

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA23 | Balsall Common and Hampton-in-Arden

November 2013

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Department
for Transport

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A report prepared for High Speed Two (HS2) Limited:

ARUP

ATKINS

CAPITA



ineco



PARSONS
BRINCKERHOFF



URS

High Speed Two (HS2) Limited,
Eland House,
Bressenden Place,
London SW1E 5DU

Details of how to obtain further copies are available from HS2 Ltd.

Telephone: 020 7944 4908

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.hs2.org.uk

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Structure of the HS2 Phase One Environmental Statement

The Environmental Statement (ES) documentation comprises:

- Non-technical summary (NTS) – which provides a summary in non-technical language of the Proposed Scheme, the likely significant environmental effects of the Proposed Scheme, both beneficial and adverse, and the means to avoid or reduce the adverse effects;
- Volume 1: Introduction to the ES and the Proposed Scheme. This describes High Speed Two (HS2), and the environmental impact assessment process, the approach to consultation and engagement, details of the permanent features and generic construction techniques as well as a summary of main strategic and route-wide alternatives and local alternatives (prior to 2012) considered;
- Volume 2: Community forum area reports and map books – 26 reports and associated map books providing an assessment of local environmental effects;
- 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.

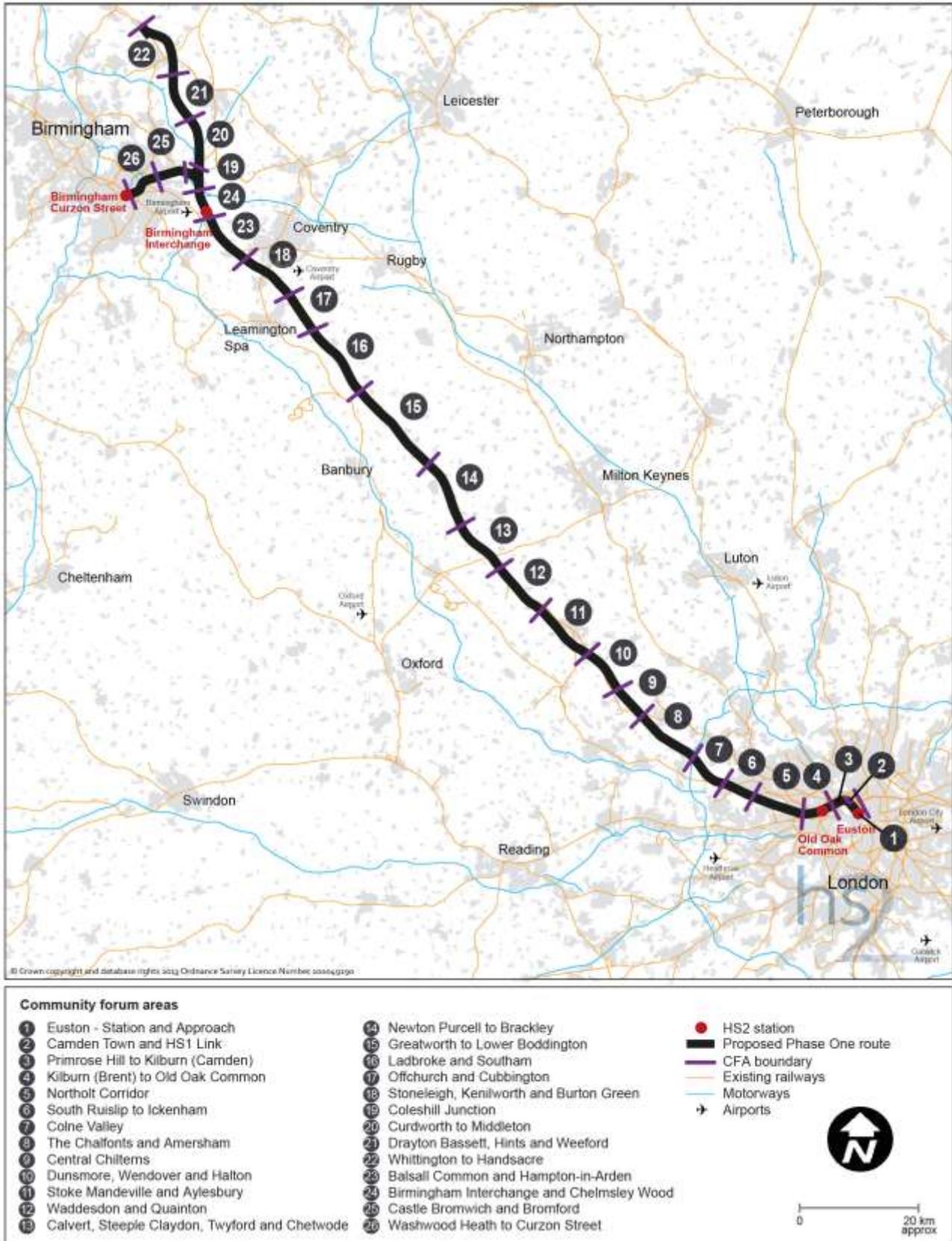
1 Introduction

- 1.1.1 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 2023/2024, and planned to be operational by 2033.
- 1.1.5 Section 4 of Volume 1 describes the anticipated operational characteristics of HS2, including the anticipated frequency of train services. As Volume 1 shows, the frequency of trains is expected to increase over time and to increase further upon opening of Phase Two. In assessing the environmental effects of the Proposed Scheme the anticipated Phase 2 operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Balsall Common and Hampton-in-Arden area (CFA23), see Section 2.4.
- 1.1.6 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish its final report on recommended options for maintaining the country's status as an international aviation hub.
- 1.1.7 For consultation and environmental assessment purposes, the proposed Phase One route has been divided into 26 community forum areas (CFA), as shown in Figure 1. This has enabled wider public engagement on the Proposed Scheme design and on the likely adverse and beneficial effects.

1.2 Purpose of this report

- 1.2.1 This CFA report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment within CFA23 (Balsall Common and Hampton-in-Arden). 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 CFA23.

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 (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 Proposed Scheme described in this report is that shown on the Map Series CT-05 (construction) (Volume 2, CFA23 Map Book) and CT-06 (operation) (Volume 2, CFA23 Map Book). There is some flexibility during detailed design to alter the horizontal and vertical alignments and other details within the limits shown on the plans and sections

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

- 1.3.6 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 Balsall Common and Hampton-in-Arden CFA covers approximately a 7.8km section of the Proposed Scheme in the borough of Solihull. It extends from Berkswell (north-west of the B4101 Waste Lane) at its southern boundary to Hampton-in-Arden (south-east of the A45 Coventry Road) at its northern boundary. The area includes land within the parishes of Berkswell, Balsall Common, Hampton-in-Arden and Great Packington.

2.1.2 Stoneleigh, Kenilworth and Burton Green CFA (CFA18) lies to the south and Birmingham Interchange and Chelmsley Wood CFA (CFA24) lies to the north as shown in Figure 2.

Settlement, land use and topography

2.1.3 The area is predominantly rural in character, with agriculture being the main land use, interspersed with small villages and a scattering of isolated dwellings and farmsteads (see Volume 2: Maps CT-06-100b to CT-06-105b). The residential areas mainly relate to Balsall Common and Hampton-in-Arden, the latter of which is designated as a conservation area, in a largely undeveloped area of agricultural land known as the 'Meriden Gap' between Coventry and Birmingham. Within the wider rural area there are a number of historic villages, including Berkswell, Barston and Temple Balsall.

2.1.4 The floodplain of the River Blythe runs north/south between Balsall Common and Hampton-in-Arden. The floodplain lies at 85m to 90m above Ordnance Datum (AOD¹) and is extended by a number of small tributary valleys. In this area the River Blythe is a designated site of special scientific interest (SSSI). The highest ground is a ridge located between Balsall Common and the western edge of Coventry which rises to approximately 130m AOD and extends westwards at a slightly lower level to the south of Balsall Common. From this higher ground, Bayleys Brook, a tributary of the River Blythe, runs north-west between Balsall Common and Berkswell through gently sloping terrain mainly below 100m AOD. This and other small tributaries join the main floodplain of the River Blythe in the vicinity of Hampton-in-Arden. To the north of Hampton-in-Arden, the land rises to approximately 95m AOD to the west of Mouldings

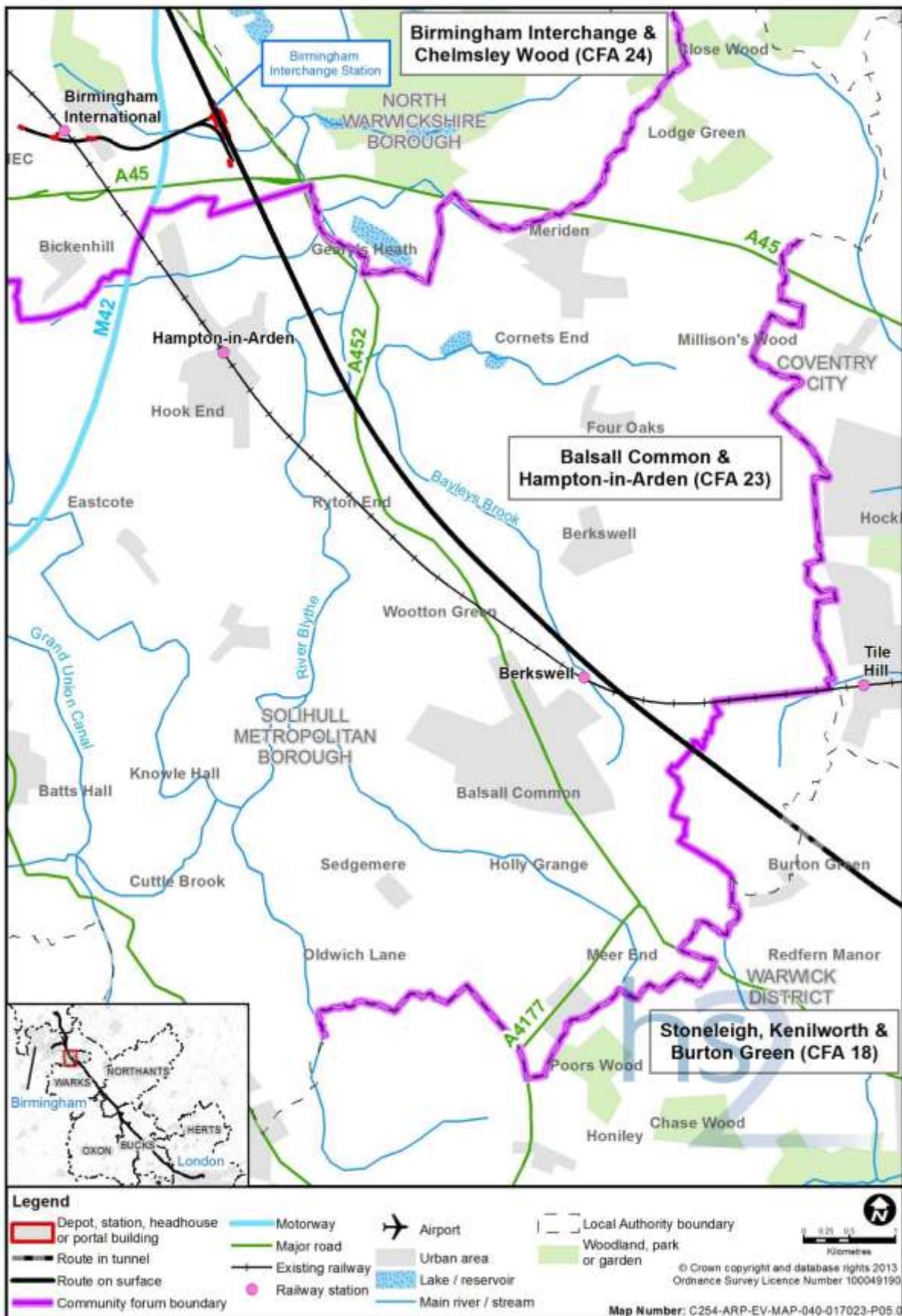
¹ Above Ordnance Datum (AOD) – Ordnance Datum is the mean sea level calculation taken from Newlyn, Cornwall and is used as a reference point for calculating height in Great Britain.

Green Farm, and again to approximately 100m AOD at Diddington Hill. These two areas of higher ground are separated by the valley of the Shadow Brook.

- 2.1.5 Berkswell Estate is a medieval deer park that is clearly discernible in the landscape by the woodland boundary and the extent of the bank forming the historic park pale². The edge of the Berkswell Estate comprises extensive woodland areas known as the Marlowes and the Roughs. These woodlands consist of smaller areas of woodland known as the Bogs, Coronation Spinney and Sixteen Acre Wood. Bayleys Brook flows through the Berkswell Marsh SSSI which comprises wet meadow with associated elements of semi-natural and plantation woodland forming part of Sixteen Acre Wood.

² A park pale was an historic palisade used to enclose deer within a defined area.

Figure 2: Area context map



Key transport infrastructure

- 2.1.6 The existing Rugby to Birmingham line runs through this area to Berkswell station, continuing in a north-west direction through Hampton-in-Arden and into Birmingham International station. The route will cross the Rugby to Birmingham line approximately 350m south-east of Berkswell station. Principal highways within this area include the A452 Kenilworth Road, the A45 Coventry Road and the M42. The route will cross beneath the A452 Kenilworth Road approximately 500m north-west of Marsh Farm.
- 2.1.7 Within the area there are a number of footpaths and local access roads which provide important links between scattered rural dwellings and villages throughout the area.

Socio-economic profile

- 2.1.8 To provide a socio-economic context for the area, data is presented for the demographic character areas (DCA) of Balsall Common and Berkswell, and Hampton-in-Arden³. The population of Balsall Common and Berkswell is approximately 3,490. The population of Hampton-in-Arden is lower at approximately 1,975 which highlights the rural nature of this area. The Balsall Common and Berkswell DCA labour market outperforms England's as a whole; unemployment at 4% is significantly lower than the national level of 7%, while 71% of the working age population is economically active compared to the national figure of 70%. This trend is also apparent in Hampton-in-Arden DCA, although not to the same levels, where unemployment is lower than the national level at 4% but the economically active percentage is lower than the national level at 69%⁴.

Notable community facilities

- 2.1.9 A number of community facilities exist in the villages of Balsall Common and Hampton-in-Arden with a smaller number of facilities within the village of Berkswell. Solihull town centre, Coventry city centre and Birmingham city centre are all in close proximity and provide a larger range of shops, services and community facilities.
- 2.1.10 Balsall Common is a large commuter village, located approximately 12km from Solihull town centre, 10km from Coventry city centre and 30km from Birmingham city centre. It provides a local centre that straddles the A452 Kenilworth Road, with a good range of convenience shops, services and

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

⁴ All data comes from the 2011 Population Census.

recreational facilities including: banks; a post office; pharmacy; hairdressers; public houses and cafes; restaurants; and a library. Heart of England School and Balsall Common Primary School are located within the village.

2.1.11 Hampton-in-Arden, a smaller village, is located approximately 7km north of Balsall Common. The village centre provides community facilities including: two churches; George Fentham Endowed School; local village shops; and a public house.

2.1.12 Berkswell is located approximately 3km north-east of Balsall Common. Berkswell provides a range of limited community facilities including: St John Baptist Church; a village store and tea rooms; the Berkswell Church of England Primary School; a public house; and a village green. There are two bus stops within the village providing access to Balsall Common and Solihull where there are a wider range of community facilities and services.

Recreation, leisure and open space

2.1.13 The area is predominantly rural with large areas of open space and woodland. Within the wider countryside there are a range of recreational facilities, which reflect the rural environment and agricultural diversification including: shooting clubs; fisheries; nature reserves; golf clubs; and riding schools. There are a number of public open spaces in the area, mostly in and around Balsall Common and Hampton-in-Arden. These comprise a mix of public recreation grounds, play areas and allotments. Kenilworth Greenway is designated as an area of open space, recognising the importance to the community of this linear route.

2.1.14 There are several public rights of way (PRoW)⁵ that run through the area. A number of these connect the surrounding villages in the area and provide a recreational facility for walkers, horse riders and cyclists. Notable PRoW include the Heart of England Way (Footpath M214) and the Millennium Way. The Kenilworth Greenway is a notable permissive bridleway.

Policy and planning context

Planning framework

2.1.15 Given that HS2 is being developed on a national basis and to meet a national need it is not included or referred to in many local plans. Nevertheless, in seeking to consider the Proposed Scheme in the local context, relevant local plan documents and policies have been taken into account in relation to environmental topics.

⁵ Public rights of way (PRoW) are footpaths, bridleways, roads or byways that the public have the right to use.

2.1.16 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:

- Solihull Unitary Development Plan (2006)⁶ is the current adopted development plan for the SMBC administrative area;
- Solihull Draft Local Plan (2012)⁷ has reached submission stage and is currently subject to examination by the Secretary of State. Once this plan has been adopted, the policies within it will replace those within the Solihull Unitary Development Plan;
- North Warwickshire Local Plan (2006) is the current adopted development plan for the NWBC administrative area. This will be replaced by the emerging Core Strategy⁸ which has reached submission stage and the examination by the Secretary of State is due to commence in January 2014;
- Minerals Local Plan for Warwickshire County Council (1995)⁹ is the current Minerals Plan for the WCC administrative area. This will be replaced by the emerging Minerals Core strategy which is currently pre-examination at draft stage; and
- Warwickshire Waste Core Strategy (2013)¹⁰ is the current adopted waste development plan for the WCC administrative area.

2.1.17 There are a number of key planning designations in the area which include: areas of green belt; conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens, areas of ancient woodland, mineral safeguarding areas (MSA) and two SSSIs.

Committed development

2.1.18 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown in Volume 5: Maps CT-13-050b to CT-13-052-R1 and listed in Volume 5: Appendix CT-004-000. Except where noted otherwise in Volume 5: Appendix CT-004-000. It has been assumed that these developments will have been completed by 2017. These are termed 'committed developments' and have been taken into account for the purpose of assessing the likely significant environmental effects

⁶ Solihull Metropolitan Borough Council (SMBC), (2006), *Solihull Unitary Development Plan (SUDP) 2006*.

⁷ Solihull Metropolitan Borough Council (SMBC), (2012), *Solihull Draft Local Plan (SDLP) 2012*.

⁸ North Warwickshire Borough Council (NWBC) (pre-submission), *North Warwickshire Core Strategy*. NWBC.

⁹ Warwickshire County Council, (1995), *Minerals Local Plan for Warwickshire*.

¹⁰ Warwickshire County Council, (2013) *Warwickshire Waste Core Strategy*.

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:

- reference 2003/1480 – Full planning permission for an extension to the Berkswell Quarry for sand and gravel extraction and landfilling; and
- reference: 2012/2064 – Extension of time limit on a full planning permission for sand and gravel extraction, inert waste disposal, restoration to agriculture and nature conservation.

2.1.19 However, where a committed development lies wholly or partly within the land required for the Proposed Scheme, it is assumed that these will not be commenced or completed in their proposed form. Such developments are noted in Volume 5: Appendix CT-004-000 and referred to in the relevant topic sections.

2.1.20 No developments have been identified which are likely to have cumulative effects, when considered together with the Proposed Scheme.

2.1.21 Planning applications yet to be determined and sites that are proposed allocations in development plans that have yet to be adopted, on or close to the Proposed Scheme, are termed 'proposed developments'. These are listed in Volume 5: Appendix CT-004-000. They are not included in the assessment¹¹. The progress of these proposals is being monitored by HS2 Ltd.

2.1.22 The currently adopted Solihull Unitary Development Plan will be superseded by the start of construction and replaced with the Solihull Draft Local Plan, but only adopted plans have been included in this assessment.

2.2 Description of the Proposed Scheme

2.2.1 The following section describes the main features of the Proposed Scheme in the Balsall Common and Hampton-in-Arden 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-06-100b to CT-06-105a.

¹¹ 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.

2.2.3 In general, features are described from south to north along the route (and east to west 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:

- removal of the proposed link road midway between Diddington Lane and the B4102 Meriden Road. The B4102 Meriden Road will remain open, Diddington Lane will remain closed with local access to agricultural land retained with height restrictions;
- the staggered priority junction between the A452 Kenilworth Road and Marsh Lane and Mercote Hall Lane respectively has been amended following comments received from the Road Safety Auditor. The two central reserve openings have been removed along the A452 Kenilworth Road realignment, thus removing all right turn movements across the dual carriageway to Marsh Lane and Mercote Hall Lane respectively. Both junctions will be left in/left out from/to the A452 Kenilworth Road;
- reduction in the length of the Balsall Common and River Blythe viaducts and the consequential extension of embankments;
- changing the River Blythe Bypass viaduct to a culvert; and
- changing the Shadow Brook viaduct to an underbridge with a segregated private means of access and a new bridleway.

Overview

2.2.5 The route of the Proposed Scheme through the Balsall Common and Hampton-in-Arden area will be approximately 7.8km in length, commencing north-west of B4101 Waste Lane (see Volume 2: Map CT-06-100b, E6), adjacent to the Kenilworth Greenway and then proceeding towards the existing Rugby to Birmingham line, crossing it south-east of Berkswell station.

2.2.6 Continuing north-west the route will cross Truggist Lane, Bayleys Brook, Lavender Hall Lane and several PRow including the Millennium Way and the Heart of England Way (Footpath M214).

2.2.7 The route will then continue broadly parallel to the A452 Kenilworth Road which it will cross in close proximity to Marsh Lane Nature Reserve. It will then cross over the B4102 Meriden Road, the River Blythe and Diddington Lane and leave this area south-east of the A45 Coventry Road, near to Pasture Farm.

Beechwood embankment and Carol Green Rail underbridge

2.2.8 The route will enter the Balsall Common and Hampton-in-Arden area north-west of B4101 Waste Lane, adjacent to the Kenilworth Greenway, on an embankment (known as Beechwood embankment) varying between

approximately 4m and 11m above ground level before reaching the Balsall Common viaduct north of Berkswell station.

2.2.9 Key permanent features of this section which is approximately 1.30km in length will include (see Volume 2: Maps CT-06-100b to CT-06-101):

- the Beechwood embankment of approximately 1.25km in length from the start of this area to Truggist Lane (see Volume 2: Map CT-06-100b, E6 to Map CT-06-101, F6). The embankment will incorporate a bund¹², approximately 820m in length on the north-east side, of which approximately 400m, from Beechwood Farm accommodation underpass to Footpath M191 underpass, will mitigate noise impacts on the residents of Beechwood Farm. A noise fence barrier will extend from this section of the bund for approximately 530m to Truggist Lane. This barrier will mitigate noise impacts on residents off Truggist Lane. The bund will vary in height between 9m and 15m above ground level, with the crest of the bund approximately 5m above rail level. A section of the bund west of Beechwood Farm will have slopes graded out to integrate the Proposed Scheme into the surrounding landscape. The gradient of this section will be suitable for a return to agricultural use. A second landscaped bund approximately 1.5m above rail level, south-east of Truggist Lane will provide landscape integration and visual screening to properties on Truggist Lane (see Volume 2: Map CT-06-101, G6 to F6);
- a noise fence barrier will be provided for the full length of this section on the south-west side of the route to mitigate the noise impacts on properties within Balsall Common (see Volume 2: Maps CT-06-100b and CT-06-101);
- diversion of an oil pipeline north-east of the route for approximately 1.2km (see Volume 2: Map CT-06-100b, E7 to Map CT-06-101, G6). This diversion is a continuation from the Stoneleigh, Kenilworth and Burton Green area (CFA18);
- areas of native broad-leaved woodland, shrub and scrub planting will be provided on the south-west side and in places, to the north-east of the route. Native broad-leaved woodland planting parallel to Kenilworth Greenway will provide screening to users of the Kenilworth Greenway and the section west of Beechwood Farm will also provide visual screening (see Volume 2: Map CT-06-100b and CT-06-101);

¹² A bund is an earthworks structure designed to provide either visual screening or noise attenuation to receptors in close proximity.

- three balancing ponds¹³ and associated access roads along the route of the Kenilworth Greenway, south-west of the route for drainage (see Volume 2: Map CT-06-100b, D7 and B7, and CT-06-101, F7);
- hedgerow replacement parallel to Kenilworth Greenway (see Volume 2: Map CT-06-100b, E7 to A7);
- two ecological mitigation ponds; the first located approximately 150m north-east of Beechwood Farm Accommodation underpass (see Volume 2: Map CT-06-100b, C6-C5), and the second located on the south-west side of Carol Green underbridge (see Volume 2: Map CT-06-100b, G7);
- Beechwood Farm accommodation underpass will provide access to agricultural fields either side of the route. This underpass will provide a headroom clearance of approximately 4.25m (see Volume 2: Map CT-06-100b, C6);
- a minor diversion of an unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) around the balancing pond at the commencement of this section (see Volume 2: Map CT-06-100b, E7-D7);
- a culvert will be provided approximately 50m north-west of Beechwood Farm accommodation underpass to convey an unnamed water course under the route (see Volume 2: Map CT-06-100b, C6);
- a culvert will be provided to convey an unnamed water course under the route (see Volume 2: Map CT-06-101, H6);
- an underpass will provide a diversion for Footpath M191. This underpass will provide headroom clearance of approximately 2.6m (see Volume 2: Map CT-06-101, H6);
- Carol Green Rail underbridge will enable the Rugby to Birmingham line to pass under the route. This underbridge will be approximately 10m above ground level and comprise of precast concrete beams and a concrete slab carrying two rail tracks for the route of the Proposed Scheme (see Volume 2: Map CT-06-101, G6);
- a culvert will be provided approximately 50m north-west of Carol Green Rail underbridge to convey an unnamed water course under the route (see Volume 2: Map CT-06-101, G6);
- Footpath M192 will be diverted along the base of the Beechwood embankment and will connect back with its current route north-east of Carol Green underbridge (see Volume 2: Map CT-06-101, G6); and

¹³ A balancing pond is part of a drainage system that is used for temporarily storing flood waters.

- a maintenance access point will be provided off Truggist Lane (see Volume 2: Map CT-06-101, F7).

Balsall Common viaduct, Lavender Hall Lane overbridge and associated earthworks

2.2.10 The route will continue in a north-west direction on viaduct (known as Balsall Common viaduct) for approximately 250m. This viaduct will be approximately 10m above ground level and will pass over Truggist Lane, Bayleys Brook and the associated floodplain. The route will then continue on partially retained embankment for approximately 170m and then embankment for approximately 260m towards Lavender Hall Lane overbridge, which it will reach in a shallow cutting approximately 120m in length, and 1.5m in depth. The height of the embankment will be up to 9m as the route leaves Balsall Common viaduct.

2.2.11 Key features of this section which is approximately 825m in length will include (see Volume 2: Map CT-06-101):

- noise fence barriers along the Balsall Common viaduct on the north-east and south-west side of the route. The barriers will be a continuation from the previous section and will be approximately 550m in length. On the south-west side of the route the noise fence barrier will be 4m high and continue into a noise bund (see Volume 2: Map CT-06-101, F7 to C6). This barrier/bund will mitigate noise impacts on residents of Riddings Hill (Balsall Common), Lavender Hall Lane and properties north of Truggist Lane. The bund, approximately 5m above rail level, will include a false cutting with graded out slopes for landscape integration along the remainder of this section up to Lavender Hall Lane;
- native broad-leaved woodland, on either side of the route, to provide visual screening to Cherry Tree Cottage (see Volume 2: Map CT-06-101, E6);
- an underground diversion of two existing Western Power overhead power lines, one north-west of Truggist Lane underneath the Balsall Common viaduct of length approximately 180m, and the other underneath an embankment (known as Lavender Hall embankment) in close proximity to Footpath M196 (see Volume 2: Map CT-06-101, E6 to E7 and D6 to C7);
- diversion of Bayleys Brook for approximately 100m under the Balsall Common viaduct (see Volume 2: Map CT-06-101, E7 to D6);
- two floodplain replacement storage areas. The first area will be in close proximity to Footpath M191, M196, and M197, south-west of the route (see Volume 2: Map CT-06-101, D7). This area will be excavated to a maximum depth of approximately 1.7m below existing ground level. The second area will be to the north-east of Lavender Hall Lane

overbridge and will be excavated to a maximum depth of approximately 2.5m below existing ground level (see Volume 2: Map CT-06-101, B4). Following excavation both areas will be re-graded back to tie into existing ground level;

- replacement hedgerow south-west of the route from the north end of Balsall Common viaduct through to Lavender Hall Lane (see Volume 2: Map CT-06-101, D7 to B7);
- Footpath M191 and Footpath M197 will be diverted via Footpath M191 accommodation underpass, north-east of Lavender Hall Fisheries (see Volume 2: Map CT-06-101, D6);
- diversion of two water mains, for approximately 440m, crossing perpendicular to the route and under a private means of access off Lavender Hall lane and under Bayleys Brook (see Volume 2: Map CT-06-101, C7 to B4);
- combined field access and diversion of Footpath M196 from its junction with Lavender Hall Lane, for approximately 80m, due to the diversion of Lavender Hall Lane (see Volume 2: Map CT-06-101, B7);
- Lavender Hall Lane will cross the route on an overbridge approximately 9m above rail level. The embankment will be up to 11m in height above ground level and will be permanently diverted to the south-east of the existing road alignment for a length of approximately 550m (see Volume 2: Map CT-06-101, B6);
- Diversion a 250mm (10”) medium pressure gas main routed through the Lavender Hall Lane overbridge, and along the realigned Lavender Hall Lane (see Volume 2: Map CT-06-102, J8-I4);
- two private means of access to the north-east of the route will be provided off Lavender Hall Lane, with one providing access to three fields (see Volume 2: Map CT-06-101, C6, B6, B5 and A4);
- flood alleviation culverts for Bayleys Brook will be provided at the point the diverted Lavender Hall Lane crosses Bayleys Brook. Culverts will be approximately 50m in length (see Volume 2: Map CT-06-101, B5 to A5);
- diversion of an unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) for approximately 80m along the south-east side of the proposed Lavender Hall Lane earthworks (see Volume 2: Map CT-06-101, B4);
- a culvert under Lavender Hall Lane will be constructed to convey water from an agricultural ditch (see Volume 2: Map CT-06-101, A7); and
- native broad-leaved woodland and shrub planting will be provided on the embankment slopes of the diverted Lavender Hall Lane (see Volume 2: Map CT-06-101, A4, A5, B4, B5).

Park Lane cutting and Sixteen Acre Wood embankment

- 2.2.12 The route will continue from Lavender Hall Lane overbridge, north-east of the A452 Kenilworth Road, in cutting (known as Park Lane cutting) of up to 12m in depth, for approximately 2km. The route will then continue on embankment (known as Sixteen Acre Wood embankment) of up to 5m above ground level, for approximately 600m, before reaching a viaduct (known as Marsh Farm viaduct), 50m north of Marsh Farm.
- 2.2.13 Key features of this section, which is approximately 2.6km in length, will include (see Volume 2: Maps CT-06-102 to CT-06-103):
- Park Lane will be permanently diverted off its existing alignment along the south-west side of the route for approximately 700m (see Volume 2: Map CT-06-102, J7 to G7) to a new junction with Lavender Hall Lane (see Volume 2: Map CT-06-102, J7). Along the south-west side of Park Lane a replacement hedgerow will be provided. Access to agricultural land and a maintenance lay-by will be provided off Park Lane (see Volume 2: Map CT-06-102, I7 and J7). The current Park Lane will be closed to vehicular traffic, with the existing section between Lavender Hall Lane and the route retained as a private means of access;
 - a new agricultural ditch will be provided parallel with the realigned Park Lane (see Volume 2: Map CT-06-102, J7-G7);
 - a noise fence barrier, approximately 470m in length, on the south-west side of the route from Lavender Hall Lane to Park Lane to mitigate noise impacts on residents of Lavender Hall Lane (see Volume 2: Map CT-06-102, J7 to G7);
 - Footpath M214 overbridge (Heart of England Way) will cross over the route at ground level, with the route in Park Lane cutting at this point. The overbridge will reinstate Footpath M214 on its original alignment (see Volume 2: Map CT-06-102, G6). Further detail regarding this overbridge is presented under Other mitigation measures in Section 7 Ecology;
 - native broad-leaved woodland planting in several areas to the north-east and south-west of the route to provide habitat replacement and to integrate the Proposed Scheme into the existing landscape(see Volume 2: Maps CT-06-102, Volume 2: Map CT-06-103);
 - diversion of an unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) commencing at a point approximately 280m south-east of Footpath M215 overbridge for approximately 1.4km along the south-west side of the route (see Volume 2: Map CT-06-102, D7 to Map CT-06-103, E7);

- diversion of a gas main for approximately 1.8km running along the south-west side of the route and crossing the route approximately 200m north-west of the Bradnock auto-transformer station (see Volume 2: Map CT-06-102, D8 to CT-06-103, D6);
- false cutting approximately 650m in length, along the north-east side of the route, with the back slope graded out to integrate the Proposed Scheme into the landscape (see Volume 2: Map CT-06-102, D6 to A6);
- Footpath M215 overbridge will provide a combined diversion of Footpath M215 and M216 and an accommodation access¹⁴ over the route (see Volume 2: Map CT-06-102, C7). Further detail regarding this overbridge is presented under Other mitigation measures in Section 7 Ecology;
- Bradnock auto-transformer station will be located at the interface between Park Lane cutting and Sixteen Acre Wood embankment approximately 550m south-east of Marsh Farm viaduct (see Volume 2: Map CT-06-103, H7). The auto-transformer will be accessed from the existing A452 Kenilworth Road/Bradnocks Marsh Lane roundabout via a new access track (see Volume 2: Map CT-06-103, G9, H8, H7, G7). Planting will be implemented around the auto-transformer station to provide visual screening for users of Footpath M216 (see Volume 2: Map CT-06-103, H7-G7);
- neutral grassland planting to the north-east of the route near Berkswell Marsh SSSI will be provided to mitigate neutral grassland lost during construction of the Proposed Scheme in this area (see Volume 2: Map CT-06-103, G6 to E7); and
- a replacement hedgerow along the south-west side of the route at the base of the Sixteen Acre Wood embankment (see Volume 2: Map CT-06-103, G7 to E7).

Marsh Farm viaduct to Mercote Hall Lane (Bridleway M218) accommodation overbridge

- 2.2.14 The route will continue on a viaduct (known as Marsh Farm viaduct) which will be an approximately 145m long concrete structure with a maximum height of approximately 5m above ground level (see Volume 2: Map CT-06-103, E7 to D7). This viaduct will span over Bayleys Brook and its associated floodplain, and the diverted Footpath M217. From Marsh Farm viaduct the route will continue north-west on embankment (known as Mercote Mill embankment), of up to 5m above ground level for approximately 100m, to Mercote Hall Lane (Bridleway

¹⁴ An accommodation access is a road or track that serves a piece of land or residential property and not considered a public highway.

M218) accommodation overbridge (see Volume 2: Map CT-06-103, D7), where the route will pass underneath Mercote Hall Lane.

2.2.15 Key features of this section which is approximately 220m in length will include (see Volume 2: Map CT-06-103):

- one balancing pond and associated access road, south of Marsh Farm viaduct, will be provided for drainage (see Volume 2: Map CT-06-103, E8);
- provision of a floodplain replacement storage area under Marsh Farm viaduct. This area will be excavated to a maximum depth of approximately 3.2m below existing ground level. Following excavation the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-103, D7);
- access to the route for maintenance will be provided from Mercote Hall Lane (see Volume 2: Map CT-06-103, C6-C7);
- diversion of a gas main continuing from the previous section (see Volume 2: Maps CT-06-102, D8 to CT-06-103, D6);
- Mercote Hall Lane (Bridleway M218) accommodation overbridge will be approximately 9m above rail level. This overbridge will provide a route for Bridleway M218 and a private means of access (see Volume 2: Map CT-06-103, D7). Two lay-bys will be provided along the accommodation access track to allow vehicles to pass (see Volume 2: Map CT-06-103, D6 and D8); and
- Planting to the south of the balancing pond and west of Marsh Farm will provide visual screening to Mercote Cottages and Marsh Farm (see Volume 2: Map CT-06-103, E7, E8 and D8).

A452 Kenilworth Road overbridge to B4102 Meriden Road underbridge

2.2.16 On leaving Mercote Hall Lane (Bridleway M218) accommodation overbridge, the route will continue in shallow cutting (known as the Horn Brook cutting) of up to 1m in depth for approximately 320m and will pass under the diverted A452 Kenilworth Road. The route will then continue on embankment (known as Blythe Bypass embankment), up to 6m in height above ground level, for approximately 300m, to the River Blythe Bypass culvert. The route will cross over the River Blythe Bypass culvert and continue on the Blythe Bypass embankment for approximately 100m up to 6m above ground level. Continuing north-west, the route will be in a shallow cutting (known as Patrick cutting) of up to 1m in depth, for approximately 240m, before continuing on the Patrick embankment of up to 10.5m in height above ground level for approximately 205m until it reaches the B4102 Meriden Road underbridge.

2.2.17 Key design features in this section which is approximately 1.20km in length will include (see Volume 2: Maps CT-06-103 to CT-06-104):

- the A452 Kenilworth Road will be realigned over a distance of 1.7km and with a deviation of approximately 100m east of the existing alignment, the road will be raised up to 13.5m in height above ground level and cross the route via the A452 Kenilworth Road overbridge, which will be approximately 10m above rail level (see Volume 2: Map CT-06-103, E9 to CT-06-104, F1). The stopped up section of the A452 Kenilworth Road will be closed to vehicular traffic and will be partially landscaped with part of the existing carriageway retained to provide access to a balancing pond. An existing high voltage Western Power underground power line and telecommunications underground cables will be diverted along the realigned highway and through the new road bridge (see Volume 2: Map CT-06-103). A replacement lay-by will be provided off the A452 Kenilworth Road (see Volume 2: Map CT-06-104, G2);
- areas of native broad-leaved woodland, shrub and grassland planting are proposed along the embankments of the diverted A452 Kenilworth Road, providing visual screening to residential properties along Marsh Lane and users of Footpath M230A. The embankment along the north-west side of the diverted highway will be graded out to integrate with the existing landscape (see Volume 2: Map CT-06-103, D8 to Map CT-06-104, H3);
- extension of Marsh Lane onto the realigned A452 Kenilworth Road will be provided for vehicles turning in left off the northbound carriageway only and then exiting left out on to the northbound carriageway only (see Volume 2: Map CT-06-103, C8);
- Bayleys Brook will be diverted through a new culvert under the A452 Kenilworth Road and the existing culvert under the stopped up section of carriageway will be removed and replaced with an open channel (see Volume 2: Map CT-06-103, D8);
- one balancing pond and associated access road north-east of the route for drainage. The access road will utilise part of the stopped up A452 Kenilworth Road north bound carriageway (see Volume 2: Map CT-06-104, I6);
- neutral grassland planting around the balancing pond and to the north of the River Blythe Bypass channel to provide mitigation for neutral grassland lost to the Proposed Scheme (see Volume 2: Map CT-06-104, I6, H5);
- a 45m long pre-cast concrete box culvert to convey the River Blythe Bypass channel. The proposed River Blythe Bypass Culvert will be 4.5m wide and 2.5m deep (see Volume 2: Map CT-06-104, H6);

- a noise fence barrier will be provided on the south-west side of the route, from 40m south-east of the River Blythe Bypass Channel to the end of this section, to mitigate the noise impacts on residential properties off the B4102 Meriden Road and Diddington Lane (see Volume 2: Map CT-06-104, I6 to Map CT-06-105, G6);
- diversion of Horn Brook and an unnamed tributary along the east side of the A452 Kenilworth Road and then culvert under the A452 Kenilworth Road realignment (see Volume 2: Map CT-06-104, G2,H2,H3);
- creation of a landscaped bund, including a false cutting, to integrate the route into the existing landform (see Volume 2: Map CT-06-104, H7 and G7). The bund, south-west of the route, will be 3m above rail level;
- one balancing pond and associated access road south-west of the route for drainage (Volume 2: Map CT-06-104, G7); and
- diversion of Footpath M230a along the south-west side of Patrick embankment for approximately 320m before connecting to the B4102 Meriden Road (see Volume 2: Map CT-06-104, F7). The footpath will be combined with a private means of access and access to a balancing pond (see Volume 2: Map CT-06-104, G7-F7).

B4102 Meriden Road underbridge to River Blythe viaduct

2.2.18 The route will cross over the B4102 Meriden Road via the B4102 Meriden Road underbridge (see Volume 2: Map CT-06-104, F6) and will provide 5.3m clearance at its centre. The route will continue on the Patrick embankment for approximately 260m before crossing the River Blythe and associated floodplain on a viaduct (known as the River Blythe viaduct). The River Blythe viaduct will be approximately 150m in length and approximately 10.5m in height above ground level (see Volume 2: Map CT-06-104, D6).

2.2.19 Key features of this section which is approximately 470m in length will include (see Volume 2: Map CT-06-104):

- realigned access off the B4102 Meriden road to Patrick Farm (see Volume 2: Map CT-06-104, F6);
- provision of a floodplain replacement storage area adjacent to the River Blythe. This area will be excavated to a maximum depth of approximately 2.3m below existing ground level. Following excavation the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-104, D8);
- native broad-leaved woodland will be provided on both sides of the Patrick embankment to provide screening for Patrick Farm and to replace woodland lost to the Proposed Scheme (see Volume 2: Map CT-06-104, F6-D6);

- provision of marshy grassland in the floodplain of the River Blythe to provide mitigation for marshy grassland lost to the Proposed Scheme (see Volume 2: Map CT-06-104, D8);
- a noise fence barrier will continue from the previous section on the south-west side of the route for the entire length of this section to mitigate noise impacts on the residents of Diddington Lane (see Volume 2: Maps CT-06-104 to CT-06-105a);
- diversion of a Western Power overhead power line underground, beneath the River Blythe viaduct (see Volume 2: Map CT-06-104, D6-D7);
- a private means of access will be provided beneath the viaduct on either side of the River Blythe with a minimum of clearance of 5.3m from ground level to underside of the structure (see Volume 2: CT-06-104, D6 and C6); and
- diversion of a water main for approximately 500m running beneath the River Blythe viaduct and then north of the route parallel to the River Blythe (see Volume 2: Map CT-05-104, C5-C7 and B8).

Diddington Lane embankment to Shadow Brook underbridge

2.2.20 On leaving the River Blythe viaduct the route will continue on embankment (known as the Diddington Lane embankment), up to 8m in height above ground level, for the full extent of this section to Shadow Brook underbridge. Shadow Brook underbridge will enable Shadow Brook to pass under the route and provide a segregated private means of access and a new bridleway created to connect up the stopped up ends of Diddington Lane, which will be closed. The bridleway will predominantly use the line of the abandoned road before passing underneath the Shadow Brook underbridge, which will provide 2.7m of clearance between ground level and the underside of the underbridge. The underbridge will also have provision for a track along its north-east side to provide access to a maintenance access point situated adjacent to the route and south-east of Shadow Brook (see Volume 2: Map CT-06-105a, H6). The route will change from a two track rail to four track rail on its approach to Birmingham Interchange station (located in Birmingham Interchange and Chelmsley Wood (CFA24), approximately 100m north of the River Blythe viaduct and Shadow Brook underbridge will support four tracks.

2.2.21 Key features of this section which is approximately 660m long will include (see Volume 2: Maps CT-06-104 to Map CT-06-105a):

- the continuation of a water main diversion from the previous section (see Volume 2: Map CT-06-104);
- a noise fence barrier will continue from the previous section on the south-west side of the route for the entire length of this section to

mitigate noise impacts on the residents of Diddington Lane (see Volume 2: Maps CT-06-104 to Map CT-06-105a);

- a noise fence barrier will also be provided along the north-east side of the route over a distance of approximately 700m from approximately 270m south-east of the River Blythe viaduct through to 320m north-west of Shadow Brook underbridge. The barrier will mitigate noise impacts to the Island Project School (see Volume 2: Map CT-06-105a, J6-F6);
- native broad-leaved woodland will be provided on either side of the route to provide visual screening (see Volume 2: Map CT-06-104);
- a maintenance access point will be provided on the south-west side of the route and will be accessed via a new access track off Diddington Lane. An Auxiliary Substation will be located close to the maintenance access point and will be accessed using the same access track as the maintenance access point. A hedgerow will be provided along the access track to provide screening for properties along Diddington Lane (see Volume 2: Map CT-06-104, B6-A7);
- one balancing pond south-west of the route adjacent to Diddington Lane for drainage (Volume 2: Map CT-06-105a, I7); and
- Diddington Lane will be closed to vehicular traffic at its southern extent and retained as a private access (with reduced height clearance underneath Shadow Brook underbridge) and access to a balancing pond and maintenance access points (see Volume 2: Map CT-06-104, B9 to Map CT-06-105a, F5). The closed section of Diddington Lane will be re-designated as a bridleway.

Shadow Brook underbridge to Pasture Farm accommodation overbridge

2.2.22 The route will continue on embankment (known as Diddington Lane embankment) on leaving the Shadow Brook underbridge. The embankment will be up to 8m above ground level for approximately 190m. Through this section the route will be a four track layout. Continuing north-west the remainder of this section will be in cutting (known as Diddington cutting), up to 9m in depth, before passing under the Pasture Farm accommodation overbridge and entering Birmingham Interchange and Chelmsley Wood (CFA24).

2.2.23 Key features of this section which will be approximately 590m in length will include (see Volume 2: Map CT-06-105a):

- a noise fence barrier continuing from the previous section on the south-west side of the route for approximately 130m (see Volume 2: Map CT-06-105a) to mitigate noise impacts on the residents of Diddington Lane;

- a noise fence barrier continuing from the previous section on the north-east side of the route (see Volume 2: Map CT-06-105a) to mitigate noise impacts to the Island Project School;
- a floodplain replacement storage area to the north-west of Shadow Brook. This area will be excavated to a maximum depth of approximately 0.8m below existing ground level. Following excavation the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-105a, G7);
- one balancing pond and associated access track north-east of the Proposed Scheme for drainage (see Volume 2: Map CT-06-105a, G6);
- Diddington Lane will be closed to vehicular traffic at its northern extent (as detailed in the previous section for the southern extent) and retained as a private access (with reduced height clearance underneath Shadow Brook underbridge) and access to a balancing pond and maintenance access points (see Volume 2: Map CT-06-105a, G6). The closed section of Diddington Lane will be re-designated as a bridleway;
- hedgerow replacement north-east of Shadow Brook (see Volume 2: Map CT-06-105a, H6-G6);
- native broad-leaved woodland planting on the embankment either side of the route north of Shadow Brook, for habitat replacement, landscape integration and visual screening of Pasture Farm(see Volume 2: Map CT-06-105a, G6 and F7);
- Pasture Farm accommodation overbridge which will provide a diverted access to Pasture Farm. The height of the overbridge will be up to 10m above the track level and up to 2m above ground level (see Volume 2: Map CT-06-105a, E6);
- the underground diversion of two existing Western Power overhead power lines for approximately 800m partly incorporated into the Pasture Farm accommodation overbridge;
- the permanent diversion of 125mm (5") water main, for approximately 210m, beneath the Shadow Brook underbridge (see Volume 2: CT-06-105a, H7-G6);
- realigned access track to Pasture Farm from the A45 Service Road which is located within Birmingham Interchange and Chelmsley Wood (CFA24); and
- provision of a cut off ditch to intercept surface water flows from the adjacent land to the west of the Proposed Scheme.

2.3 Construction of the Proposed Scheme

- 2.3.1 This section sets out the strategy for the construction of the Proposed Scheme in the Balsall Common and Hampton-in-Arden 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).
- 2.3.2 The assessment presented in this ES is based on the construction arrangements as in this section.
- 2.3.3 In addition to the land that will be required permanently by the Proposed Scheme (see Section 2.2), land will be required on a temporary basis for construction. Key temporary construction features are illustrated on the construction map series CT-05 (Volume 2 map book). Following construction works, land required temporarily will be prepared for its eventual end use, which will include being returned to its pre-construction use wherever appropriate.
- 2.3.4 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; site restoration;
- railway installation works including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; and 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 CoCP (see Volume 5: Appendix CT-003-000) including:

- the approach to environmental management during construction and the role of the Code of Construction Practice (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 environmental surveys;
- advance mitigation works including, where appropriate, contamination remediation, temporary habitat creation and translocation, and archaeological field evaluation;
- 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 of 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 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 Balsall Common and Hampton-in-Arden area there will be one main compound and ten civil engineering satellite compounds and three railway installation satellite compounds (all of which will continue to use compounds previously established for the civil engineering works). One compound, the A45/A45 Service Road overbridges satellite compound, is located in the Birmingham Interchange and Chelmsley Wood area (CFA24) but will undertake works in this area. The B4101 Waste Lane and the A45 (Stonebridge Island) satellite compounds are located on the border, in adjacent CFAs (CFA18 and CFA 24 respectively), but no works are undertaken in this area.
- 2.3.11 Figure 3 shows the management relationship for civil engineering works compounds and Figure 4 for the railway installation works compounds. Details about 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 as listed below. 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 and loading and unloading of bulk earthworks materials which are moved to and from the site on public highways; and
- living accommodation for the construction workforce.

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, and codes of worker behaviour are set out in Volume 1, Section 6.3, 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. The likely road routes to access compounds are described in subsequent sections below.

2.3.18 Movement between the construction compounds and the work sites will be on designated haul roads within the site, often along the line of the Proposed Scheme or running parallel to it.

Figure 3: Schematic of construction compounds for civil engineering works

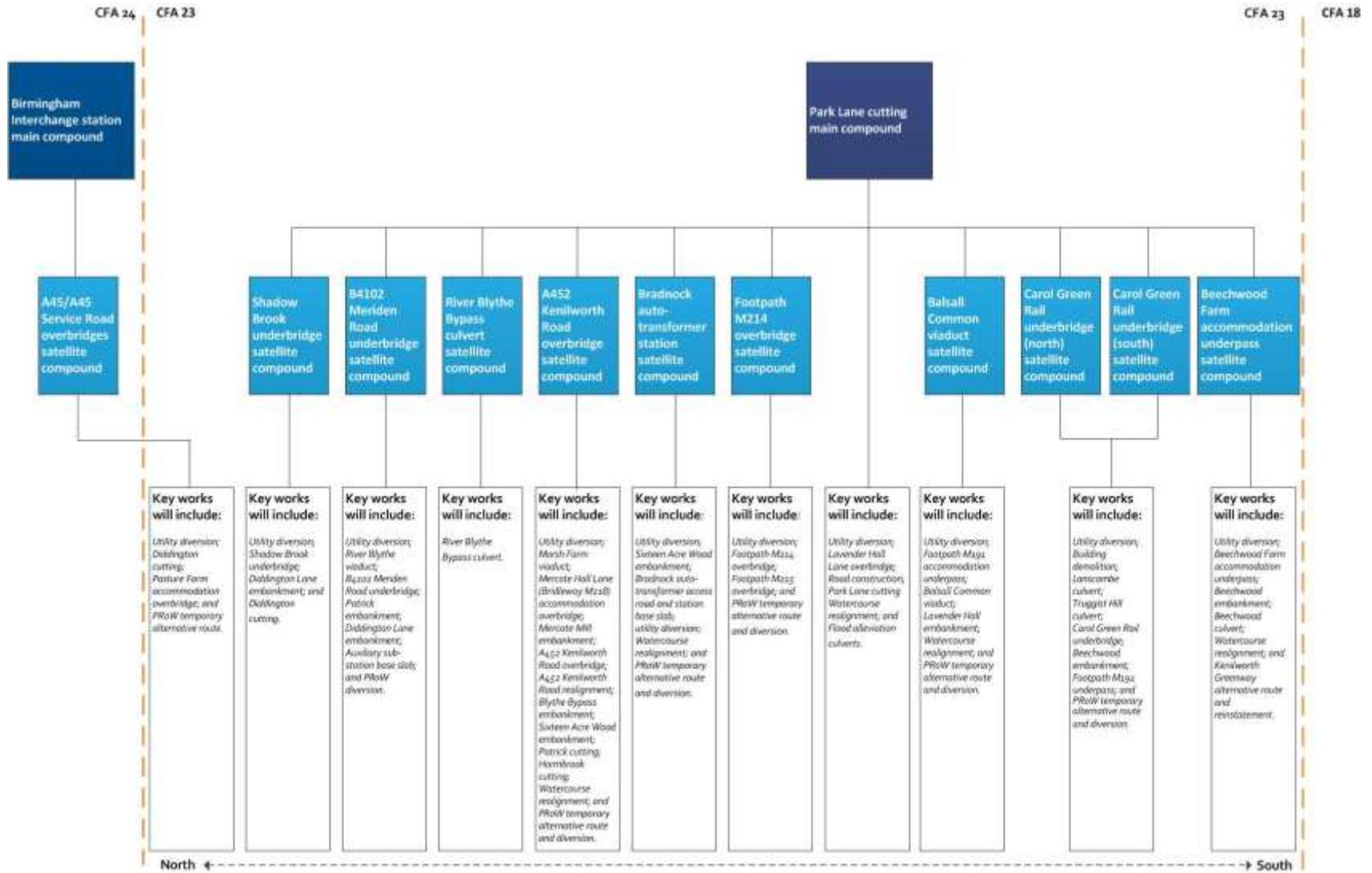
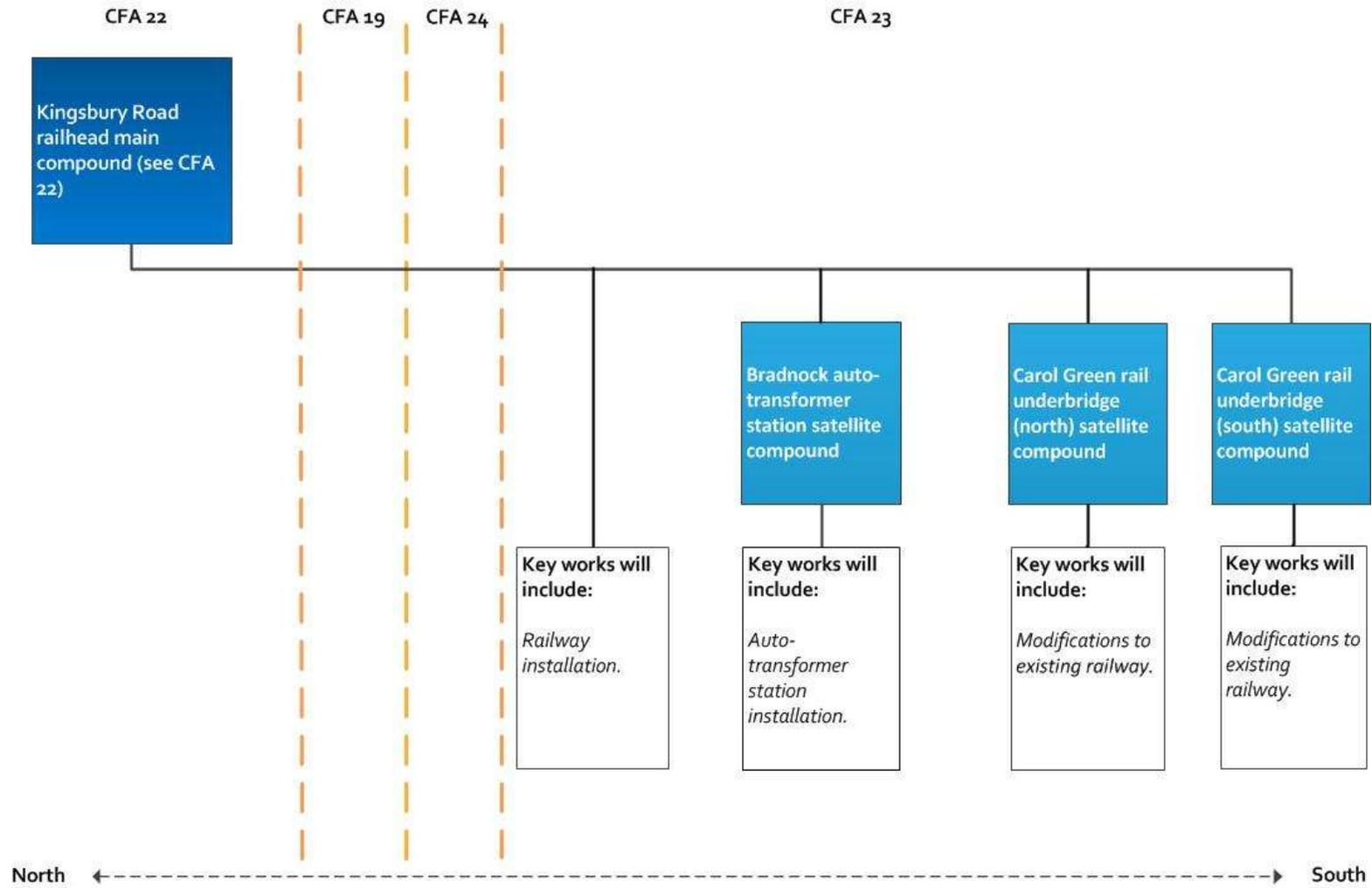


Figure 4: Schematic of construction compounds for railway installation works



Beechwood Farm accommodation underpass satellite compound

- 2.3.19 This compound (see Volume 2: Map CT-05-100b, D7) will provide for civil engineering works predominantly for the construction of the Beechwood Farm accommodation underpass and Beechwood embankment earthworks. The compound will:
- be operational for approximately four years and three months, commencing in 2017;
 - support approximately 15 workers each day throughout this period;
 - not provide worker accommodation;
 - be accessed from B4101 Waste Lane. A haul road will run parallel to the route along the south-west side. Pedestrian crossing locations will be restricted to B4101 Waste Lane and Truggist Lane;
 - provide four temporary material stockpile areas (see Volume 2: Maps CT-05-100b, D7, C7, B8 and B7); and
 - be managed from the Park Lane cutting main compound.
- 2.3.20 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - utility diversions;
 - provision of a temporary alternative route for the Kenilworth Greenway;
 - earthworks;
 - construction of the Beechwood Farm accommodation underpass;
 - construction of the Beechwood embankment;
 - excavation of two balancing ponds and construction of a maintenance access track and turning heads for the ponds;
 - watercourse realignment;
 - construction of the Beechwood culvert;
 - excavation of one ecological mitigation pond;
 - reinstatement of the Kenilworth Greenway; and
 - finalisation works including site reinstatement, fencing, planting and landscaping.
- 2.3.21 The compound will be used primarily to manage the construction of Beechwood Farm accommodation underpass, which will take approximately six months to complete and the Beechwood embankment which will take approximately two years and nine months to complete. The bridges and cuttings and embankments techniques in Volume 1, Sections 6.17 and 6.8 will generally be adopted.

- 2.3.22 The material for the Beechwood embankment (see Volume 2: CT-05-100b, E6 to CT-05-101, F6) will be deposited in layers to form profiled earthwork slopes and compacted with heavy vibratory plant. Slopes will be covered with topsoil to a predetermined depth and then trimmed to the prescribed profile. The gradient of a section of the embankment will be suitable for a return to agricultural use. Material for the Beechwood embankment will be received from locally within the Balsall Common and Hampton-in-Arden area and neighbouring CFAs.
- 2.3.23 No demolitions will be required.
- 2.3.24 No diversions of roads will be required.
- 2.3.25 An 850m temporary alternative route will be required for the Kenilworth Greenway for approximately four years and three months, south-west of the existing alignment (see Volume 2: Map CT-05-100b, E7-A8). The temporary route is a continuation from the Stoneleigh, Kenilworth and Burton Green area (CFA18). During construction the existing Kenilworth Greenway will be used as a haul road transporting materials and waste arising. The Kenilworth Greenway will be reinstated along its original route in this area following construction. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted.
- 2.3.26 A diversion of a 254mm (10") oil pipeline north-east of the route will be required to facilitate the construction of the Beechwood embankment. The diversion of approximately 1.2km will take approximately one year to complete. The diversion is a continuation from the Stoneleigh, Kenilworth and Burton Green area (CFA18) (see Volume 2: CT-05-100b, E7 to CT-05-101, G6). The utilities construction technique in Volume 1, Section 6.4 will generally be adopted.
- 2.3.27 Beechwood culvert containing an unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) will be constructed, approximately 150m south-west of Beechwood Farm (see Volume 2: CT-05-100b, C6-C7). The culvert will take approximately three months to complete. A temporary diversion a minor watercourse will be required to facilitate construction of the permanent culvert as well as the excavation of a balancing pond at the beginning of this section. The drainage and watercourse realignment construction technique in Volume 1, Section 6.9 will generally be adopted.
- 2.3.28 The excavation of two balancing ponds south-west of the route will be required (see Volume 2: CT-05-101, D7 and B7) which will take approximately three months to complete. Access tracks for the maintenance of balancing ponds will be constructed as part of these works.
- 2.3.29 The excavation of one ecological mitigation pond located approximately 150m north-east of Beechwood Farm accommodation underpass (see Volume 2: Map CT-05-100b, C6-C5).

- 2.3.30 Finalisation works will include site reinstatement of the construction area and the Kenilworth Greenway landscaping, and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

Carol Green Rail underbridge north and south satellite compounds

- 2.3.31 These two compounds (see Volume 2: Maps CT-05-101, H7-G7 and G6) will be used predominantly to manage the civil engineering and railway installation works for the construction of the Carol Green Rail underbridge, which will enable the Rugby to Birmingham line to pass under the route (see Volume 2: CT-05-101, G6). During the civil engineering works both satellite compounds will also be used to manage the rail installations work to modify the overhead line equipment and signals on the Rugby to Birmingham line to facilitate the construction of the Carol Green Rail underbridge. The compounds will:

- be operational for approximately four years, commencing in 2017;
- each support an average of approximately 15 to 20 workers each day throughout the civil engineering works period;
- not provide worker accommodation;
- be accessed from B4101 Waste Lane and Truggist Lane. The north satellite compound will be accessed directly off Truggist Lane. The south compound will be accessed via a haul road from B4101 Waste Lane. The haul road, connected to the north compound, will cross the line of the route and will run parallel to the route on the south-west side, crossing Truggist Lane at a controlled crossing point. Pedestrian crossing locations across the haul road will be restricted to B4101 Waste Lane and Truggist Lane; and
- The compounds will be managed from the Park Lane cutting main compound for civil engineering works and from Kingsbury Road main compound (see Whittington to Handsacre (CFA22)) for rail installation works.

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

- site clearance and enabling works;
- provision of temporary alternative routes and permanent diversions for PRow;
- utility diversions;
- building demolition;
- earthworks;
- excavation of one balancing pond and construction of a maintenance access track and turning heads for the ponds;
- excavation of one ecological mitigation pond;

- construction of the Lanscombe and Truggist Hill culverts including the temporary diversion of two minor watercourses;
- construction of the Beechwood embankment;
- construction of Carol Green Rail underbridge;
- construction of Footpath M191 underpass; and
- finalisation works including site reinstatement, fencing, planting and landscaping.

- 2.3.33 The compound will be used primarily to manage the construction of Carol Green Rail underbridge, including retaining walls adjacent to the structure, which will take approximately one year and six months to complete. The compound will also be used to support the construction of Footpath M191 underpass (see Volume 2: CT-05-101, H6-H7) which will take six months to complete. The bridges construction technique in Volume 1, Section 6.17 will generally be adopted.
- 2.3.34 The majority of the works at Carol Green Rail underbridge will be undertaken during core working hours; however there may be a number of activities where this is not possible due to the interface with the operation of the Rugby to Birmingham line and these will be undertaken outside of the core hours. Longer disruptive or abnormal possessions will generally occur over pre-arranged weekend and bank holiday periods.
- 2.3.35 Demolition of one building will be required, a single storey, steel framed warehouse at a property accessed off Truggist Lane, adjacent to the Rugby to Birmingham line (see Volume 2: Map CT-05-101, I6).
- 2.3.36 No diversions of roads will be required.
- 2.3.37 Temporary alternative routes and permanent diversions for two PRow will be required. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted:
- a temporary alternative route for Footpath M191, north-west of the current alignment via Truggist Lane, for a distance of approximately 1.3km, adding an additional 730m to the footpath (see Volume 2: Map CT-05-101). Following completion of the construction of Footpath M191 underpass, Footpath M191 will be permanently diverted through the underpass close to its original route, adding an additional 10m; and
 - a temporary alternative route for Footpath M192, north-east of the current alignment via Truggist Lane for a distance of approximately 1.1km, adding an additional 380m to the footpath (see Volume 2: Map CT-05-101). Following completion of the Beechwood embankment and reinstatement of the land used for the north compound, Footpath M192 will be permanently diverted 145m along the base of the Beechwood embankment and will connect back with its current route north-east of Carol Green underbridge, resulting in a decrease in length of 80m.

- 2.3.38 Two unnamed watercourses/agricultural ditches (tributary of Bayleys Brook), approximately 50m and 70m in length, to the south-east and north-west of the Carol Green Rail underbridge, will be temporarily diverted to allow construction of Truggist Hill culvert (see Volume 2: Map CT-05-101, H6-H7) and Lanscombe culvert (see Volume 2: Map CT-05-101, G6-G7) to enable the watercourses to pass under the route. The works will take between three to six months each to complete. The drainage and watercourse realignment construction technique in Volume 1, Section 6.9 will generally be adopted.
- 2.3.39 The excavation of one balancing pond will be required north-west of Carol Green Rail underbridge (see Volume 2: Map CT-05-101, F7) which will take approximately three months to construct. Access tracks will additionally be constructed during this time.
- 2.3.40 The excavation of one ecological mitigation pond located on the south-west side of Carol Green underbridge (see Volume 2: Map CT-05-101, G7).
- 2.3.41 The following works described under Beechwood Farm accommodation underbridge satellite compound will continue through this section and will also be supported from this satellite compound:
- a continuation of the alternative route for the Kenilworth Greenway;
 - a continuation of the diversion of the 254mm (10") oil pipeline north-east of the route; and
 - construction of a section of the Beechwood embankment.
- 2.3.42 Finalisation works will include reinstatement of the construction area, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.
- 2.3.43 Key railway systems installation works in this section of the route will take approximately 9 months to complete and will include modification of the existing rail overhead line equipment to achieve a lower contact wire height, to accommodate the construction of the Carol Green Rail underbridge over the Rugby to Birmingham line.

Balsall Common viaduct satellite compound

- 2.3.44 This compound (see Volume 2: Map CT-05-101, B6) will be used predominantly to manage the civil engineering works for the construction of the Balsall Common viaduct. The compound will:
- be operational for approximately two years and nine months, commencing in 2017;
 - support an average of approximately 20 workers each day throughout this period;
 - not provide worker accommodation;

- be accessed from a haul road from Park Lane via the A452 Kenilworth Road. The haul road will run parallel to the route along the north-east side. The haul road will cross Lavender Hall Lane at a controlled crossing point. Pedestrian crossing locations will be restricted to Truggist Lane and Park Lane;
- provide two temporary material stockpile areas (see Volume 2: Map CT-05-101, C5 and Map CT-05-102, I6); and
- be managed from the Park Lane cutting main compound.

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

- site clearance and enabling works;
- utility diversions;
- earthworks;
- provision of temporary alternative routes and permanent diversions for PRow;
- watercourse realignment;
- excavation of two floodplain replacement storage areas;
- construction of the Lavender Hall embankment, including a retaining wall;
- construction of Footpath M191 accommodation underpass;
- construction of Balsall Common viaduct; and
- finalisation works including site reinstatement, fencing planting and landscaping.

2.3.46 The compound will primarily be used to manage the construction of Balsall Common viaduct. The construction of the viaduct will take approximately one year and six months to complete. The viaducts construction technique in Volume 1, Section 6.16 will generally be adopted.

2.3.47 No demolitions will be required.

2.3.48 Temporary closure of one road will be required. Construction of the south-east section of the Balsall Common viaduct will require discrete lane restrictions and possibly night and weekend closures of Truggist Lane over a short period to enable delivery and installation of pre-cast concrete beams and bridge deck works. During periods of temporary closure alternative routes will be advised.

2.3.49 Temporary alternative routes and permanent diversions for three PRow will be required. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted:

- a temporary alternative route for Footpath M191, north-east of Balsall Common viaduct, for a distance of approximately 1.1km. The existing footpath will be closed between the junction with Footpath M197 and Footpath M196,

and re-routed via Truggist Lane and Footpath M196, adding an additional 600m to the footpath (see Volume 2: Map CT-05-101). Following completion of Footpath M191 accommodation underpass, Footpath M191 will be combined with Footpath M197 and permanently diverted by 100m through the new Footpath M191 accommodation underpass, adding an additional 80m to the footpath;

- a temporary alternative route for Footpath M197, north-east of Balsall Common viaduct for a distance of approximately 1.1km. The existing footpath will be closed between the junction with Footpath M191 and Footpath M196, and re-routed via Truggist Lane and Footpath M196, adding an additional 960m to the footpath (see Volume 2: Map CT-05-101). Following completion of Footpath M191 accommodation underpass Footpath M197 will be diverted through the new Footpath M191 accommodation underpass along its original alignment resulting in no change in distance; and
- a temporary alternative route for Footpath M196, north-east of Lavender Hall Farm for a distance of approximately 450m, adding an additional 330m to the footpath (see Volume 2: Map CT-05-101). Following completion of Lavender Hall Lane overbridge Footpath M196 will be reinstated along its original alignment via a new access north of Lavender Hall Farm resulting in no change in distance.

2.3.50 Diversion of two known utilities will be required, taking approximately one year and three months to complete. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted:

- two sections of existing Western Power overhead power lines, north-west of Truggist Lane. One section will be diverted underneath the Balsall Common viaduct for approximately 180m, and the other underneath Lavender Hall embankment, will be diverted underground, for 180m and for 350m (see Volume 2: Map CT-05-101, E6-E7 and C6-C7); and
- two water mains, 914mm (36 inches) and 686mm (27 inches), running through the agricultural land to the north-east and north-west of the route and passing beneath the proposed Lavender Hall embankment will be realigned for approximately 440m, crossing perpendicular to the route and under a private means of access off Lavender Hall lane and under Bayleys Brook (see Volume 2: Map CT-05-101, B4-B8).

2.3.51 A realignment of the Bayleys Brook will be required to enable the construction of the Balsall Common viaduct piers. Bayleys Brook will be diverted by approximately 100m beneath the viaduct (see Volume 2: Map CT-05-101, D7-E6), taking approximately three months to complete. The drainage and watercourse realignment construction technique in Volume 1, Section 6.8 will generally be adopted.

2.3.52 Two floodplain replacement storage areas will be excavated prior to significant works within the flood plain commencing. The first area will be in close proximity to Footpath M191, M196, and M197, south-west of the route and the second area will be

to the north-east of Lavender Hall Farm (see Volume 2: Maps CT-05-101, D7 and B4)
The excavation will take approximately three months to complete. Suitable excavated material will be reused within the works.

- 2.3.53 The material for Lavender Hall embankment, extending from the Balsall Common viaduct to Lavender Hall Lane (see Volume 2: C Map CT-05-101, D6-D7 to B6) will be deposited in layers to form profiled earthwork slopes and compacted with heavy vibratory plant. Slopes will be covered with topsoil to a predetermined depth and then trimmed to the prescribed profile. This section of the embankment will take approximately three months to complete. The cuttings and embankments technique in Volume 1, Section 6.8 will generally be adopted. Material for the Lavender Hall embankment will be received from locally within the Balsall Common and Hampton-in-Arden area and neighbouring CFAs.
- 2.3.54 Finalisation works will include site reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

Park Lane cutting main compound

- 2.3.55 This compound (see Volume 2: Map CT-05-102, H8) will be used predominantly to manage the civil engineering works for the construction of the Lavender Hall Lane overbridge and Park Lane cutting. The compound will:

- be operational for approximately four years and three months, commencing in 2017;
- support an average of approximately 75 workers each day throughout this period;
- provide worker accommodation and welfare facilities for approximately 45 workers for an estimated period of four years and three months (see Volume 2: Map CT-05-102, I8 to H8);
- provide administrative and facilities support to ten civil engineering satellite compounds, as illustrated in Figure 3, located within this section of the route;
- provide three temporary material stockpile areas (see Volume 2: Maps CT-05-102, I7-I8, G8, and F8);
- provide an area for plant maintenance; and
- be accessed via the A452 Kenilworth Road at Park Lane.

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

- site clearance and enabling works;
- utility diversion;
- earthworks;

- watercourse realignment and construction of a new agricultural ditch;
- installation of flood alleviation culverts;
- construction of Lavender Hall Lane overbridge;
- construction of Park Lane cutting;
- highway works including the construction of a temporary roundabout, realignment of Lavender Hall Lane, diversion of Park Lane; and
- finalisation works including site reinstatement, fencing, planting and landscaping.

- 2.3.57 The compound will primarily be used to manage the construction of Lavender Hall Lane overbridge, realignment of Lavender Hall Lane and the Park Lane cutting; extending from Lavender Hall Lane to the Bradnock auto-transformer station (see Volume 2: Map CT-05-102, J6-J7 to Map CT-05-103, H7). Lavender Hall Lane overbridge will take approximately nine months to complete and the section of the Park Lane cutting will take approximately one year and three months to complete. The bridges and cuttings and embankments construction techniques in Volume 1, Section 6.17 and 6.8 will generally be adopted. Material arising from the cutting will be used for embankments and earthworks in this area.
- 2.3.58 Lavender Hall Lane will be temporarily closed immediately north-east of Lavender Hall Farm to Park Lane for a distance of 240m for a duration of one year and six months. Access to all properties will be maintained. An alternative access will be available northwards on the A452 Kenilworth Road, crossing the Rugby to Birmingham line and then east via Park Lane.
- 2.3.59 The Park Lane permanent road diversion (see Volume 2: Map CT-05-102, J7 to G7), will be built off line and local traffic management will be used to construct the “tie-in” works at Lavender Hall Lane and the existing Park Lane. A temporary roundabout (see Volume 2: Map CT-05-102, F9-E9) will be constructed at the intersection of the A452 Kenilworth Road and Park Lane during the enabling works period for ease of movement of construction traffic. Traffic management comprising traffic lights, lane width and speed restrictions will be used during the roundabout construction works. The current Park Lane will be closed to vehicular traffic, with the existing section between Lavender hall Lane and the route retained as a private means of access. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted.
- 2.3.60 No demolitions will be required.
- 2.3.61 No temporary alternative routes or diversions of PRoW will be required.
- 2.3.62 Diversion of one known utility will be required. A temporary diversion of a 250mm (10”) medium pressure gas main to facilitate the construction of the Lavender Hall Lane overbridge will be required, taking approximately six months to complete. On

completion of the overbridge, the gas main will be permanently diverted along the realigned Lavender Hall Lane and through Lavender Hall Lane overbridge, which will take an additional three months to complete. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted.

- 2.3.63 An unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) will be realigned approximately 80m around the proposed Lavender Hall Lane earthworks and three flood alleviation culverts constructed at the location that Lavender Hall Lane crosses Bayleys Brook (see Volume 2: Maps CT-05-102, J5). The drainage and watercourse diversion construction technique, in Volume Section 6.9 will generally be adopted.
- 2.3.64 A new agricultural ditch will be provided parallel with the realigned Park Lane (see Volume 2: Map CT-06-102, J7-G7). The drainage and watercourse diversion construction technique, in Volume Section 6.9 will generally be adopted.
- 2.3.65 Finalisation works will include site reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

Footpath M214 overbridge satellite compound

- 2.3.66 This compound (see Volume 2: Map CT-05-102, F7) will be used predominantly to manage the civil engineering works for the construction of Footpath M214 overbridge and Footpath M215 overbridge. The compound will:
- be operational for approximately one year, commencing in 2017;
 - support an average of approximately 15 workers each day throughout this period;
 - not provide worker accommodation;
 - provide one temporary material stockpile area (see Volume 2: Maps CT-05-102, D6);
 - be accessed via a haul road at Park Lane. The haul road will run parallel to the Proposed Scheme on the south-west side. Pedestrian crossing locations will be restricted to Park Lane for this section of the works; and
 - be managed from the Park Lane cutting main compound.
- 2.3.67 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - provision of temporary alternative routes and permanent diversions for PRow;
 - earthworks;
 - construction of Footpath M214 overbridge;

- construction of Footpath M215 overbridge; and
- finalisation works including site reinstatement, fencing, planting and landscaping.

2.3.68 The compound will be used to manage the construction of Footpath M214 overbridge, and Footpath M215 overbridge. Footpath M214 overbridge and Footpath M215 overbridge will take approximately six months to complete. The bridges construction technique in Volume 1, Section 6.17 will generally be adopted.

2.3.69 No demolitions will be required.

2.3.70 No diversions of roads will be required.

2.3.71 Temporary alternative routes and permanent diversions for two footpaths will be required. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted:

- a temporary alternative route for the Heart of England Way (Footpath M214), approximately 40m south of the existing alignment for a distance of approximately 485m, adding an additional 280m to the footpath (see Volume 2: Map CT-05-102). Footpath M214 will be permanently diverted via the Footpath M214 overbridge which closely follows the line of the existing PRow, resulting in no change in distance; and
- a temporary alternative route for Footpath M215, of approximately 100m north of the existing alignment for a distance of approximately 2.4km to allow construction of the overbridge, adding an additional 1.57km to the footpath (see Volume 2: Map CT-05-102). Footpath M215 will be permanently diverted via Footpath M215 overbridge which closely follows the line of the existing alignment, resulting in no change in distance.

2.3.72 Culverts under Footpath M214 and Footpath M215 will be constructed. The drainage and watercourse realignment construction technique in Volume 1, Section 6.9 will generally be adopted.

2.3.73 The construction of Park Lane cutting previously described within the Park Lane main compound will be supported from this compound.

2.3.74 Finalisation works will include reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

Bradnock auto-transformer station satellite compound

2.3.75 This compound (see Volume 2: Map CT-05-103, H7) will support the civil engineering works predominantly for the construction of the Bradnock auto-transformer station base slab and Sixteen Acre Wood embankment earthworks and railway installation works for the auto-transformer station and auxiliary substation off Diddington Lane. The compounds will:

- be operational for approximately two years and three months for the civil engineering works, commencing in 2017, and approximately one year and six months commencing in approximately 2022 for railway installation works;
- support an average of approximately 20 workers each day throughout the civil engineering works period and support approximately 25 workers each day throughout the rail systems installations works period;
- not provide worker accommodation;
- be accessed from the adjacent A452 Kenilworth Road/Bradnocks Marsh Lane roundabout. The haul road will run parallel to the route on the south-west side. Pedestrian crossing locations will be restricted to adjacent to Marsh Farm and close to Footpath M215;
- provide four temporary material stockpiles areas (see Volume 2: Map CT-05-103, H7, H8, G8, H9); and
- be managed from the Park Lane cutting main compound for civil engineering and from Kingsbury Road main compound (see Whittington to Handsacre, CFA22) for rail installation works.

2.3.76 Works in this section of the route will be carried out in the following broad phases:

- site clearance and enabling works;
- utility diversion;
- provision of temporary alternative routes and permanent diversions for PRow;
- earthworks;
- construction of the Bradnock auto-transformer station access road;
- construction of the Sixteen Acre Wood embankment;
- construction of Park lane cutting;
- watercourse realignment;
- construction of the Bradnock auto-transformer station base slab; and
- finalisation works including site reinstatement, fencing, planting and landscaping.

2.3.77 The compound will be used to manage the construction of the Bradnock auto-transformer station base slab and building (see Volume 2: Map CT-05-103, H7).

2.3.78 No demolitions will be required.

2.3.79 No diversions of roads will be required.

2.3.80 A new access road will be provided from the A452 Kenilworth Road/Bradnocks Marsh Lane roundabout to the Bradnock auto-transformer station which will take approximately three months to complete. Initially the access road will be used to

access the satellite compound, haul road and for the construction of the auto-transformer station base slab. During operation, the road will provide access to the auto-transformer station for intermittent maintenance. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted.

- 2.3.81 A 1.8km diversion of a 914mm (36") high pressure gas main running along the south-west side of the route and crossing the route approximately 200m north-west of the Bradnock auto-transformer station, which will take nine months to complete (see Volume 2: Map CT-05-102, D8 to Map CT-05-103, D6). The utilities construction technique in Volume 1, Section 6.4 will generally be adopted.
- 2.3.82 Temporary alternative routes and permanent diversions for two PRowS will be required. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted.
- a temporary alternative route for Footpath M216, will be provided south-east of the route for a distance of approximately 2.3km via Park Lane and A452 Kenilworth Road, adding an additional 770m to the footpath (see Volume 2: Map CT-05-103). Following completion of the Bradnock auto-transformer station, Footpath M216 will be permanently diverted 630m from its junction with the new access road to Footpath M215, adding an additional 110m to the footpath (see Volume 2: Map CT-05-103); and
 - temporary alternative route for Footpath M217, will be provided north of the existing alignment for a distance of approximately 820m, adding an additional 170m to the footpath (see Volume 2: Map CT-05-103). The footpath will be permanently diverted north-west of the current alignment under the Marsh Farm viaduct, adding an additional 250m to the footpath (see Volume 2: Map CT-05-103).
- 2.3.83 Realignment of an unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) for approximately 1.4km south-west of the route, connecting back into Bayleys Brook further downstream will be required (see Volume 2: Map CT-05-102, D7 to Map CT-05-103, E7). The drainage and watercourse realignment construction technique in Volume 1, Section 6.9 will generally be adopted.
- 2.3.84 A small section of the construction of Sixteen Acre Wood embankment will be supported from this compound. The majority of the construction will be supported from the A452 Kenilworth Road overbridge satellite compound and so is described in detail in that section.
- 2.3.85 The construction of Park Lane cutting previously described within the Park Lane main compound will be supported from this compound, this will include the construction of a false cutting to the north-east of the route (see Volume 2: Map CT-05-102, D6 to Map CT-05-103, I6).

- 2.3.86 Finalisation works will include site reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.
- 2.3.87 Key railway systems installation works in this section of the Proposed Scheme include the installation of auto-transformer station and auxiliary sub-station, located in close proximity to Diddington Lane. See Volume 1, Section 5.18 for description of typical power supply features.

A452 Kenilworth Road overbridge satellite compound

- 2.3.88 This compound (see Volume 2: Map CT-05-103, C6) will primarily support the civil engineering works for the construction of the Marsh Farm viaduct, Mercote Hall Lane (Bridleway M218) accommodation overbridge, the re-alignment of the A452 Kenilworth Road and various sections of earthworks. The compound will:
- be operational for approximately two years and nine months, commencing in 2017;
 - support an average of approximately 60 workers each day throughout this period;
 - provide worker accommodation and welfare facilities for approximately 30 workers for an estimated period of four years and three months. The accommodation will be to the north-east of the compound site (see Volume 2: Map CT-05-103, C5 and C6);
 - be accessed from a haul road via the diverted Mercote Hall Lane access and the A452 Kenilworth Road overbridge. The haul road will run parallel to the route to the west and the A452 Kenilworth Road to the east. Pedestrian crossing locations of the haul road will be restricted to the diverted Mercote Hall Lane and the A452 Kenilworth Road;
 - provide roadheads either side of the A452 Kenilworth Road (see Volume 2: Map CT-05-103, B5-B6 and A5-A6) for the storage and loading and unloading of bulk earthworks materials which will be moved to and from the site on public highways;
 - provide a temporary materials stockpile area (see Volume 2: Map CT-05-103, D4-D5 and C4-C5); and
 - be managed from the Park Lane cutting main compound.
- 2.3.89 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - utility diversions;
 - provision of temporary alternative routes and permanent diversions for PRoW;
 - watercourse realignment;

- construction of A452 Kenilworth Road overbridge, Marsh Farm viaduct and Mercote Hall Lane (Bridleway M214) accommodation overbridge;
- A452 Kenilworth Road realignment;
- construction of the Sixteen Acre Wood, Mercote Mill and Blythe Bypass embankments, earthworks associated with the Mercote Hall Lane (Bridleway M218) accommodation overbridge and the A452 Kenilworth Road realignment, and Horn Brook and Patrick cuttings;
- excavation of a floodplain replacement storage area and three balancing ponds; and
- finalisation works including site reinstatement, fencing planting and landscaping.

2.3.90 The compound will primarily be used to manage the construction of Marsh Farm viaduct, Mercote Hall Lane (Bridleway M218) accommodation overbridge, and the A452 Kenilworth Road overbridge and A452 Kenilworth Road realignment. The viaduct and bridges construction techniques in Volume 1, Section 6.16 and 6.17 will generally be adopted.

2.3.91 The compound will also support the construction of a number of areas of earthworks including:

- Sixteen Acre Wood embankment (see Volume 2: Map CT-05-103, H7-E7);
- Mercote Mill embankment (see Volume 2: Map CT-05-103, D7);
- embankments associated with the Mercote Hall Lane (Bridleway M218) accommodation overbridge (see Volume 2: Map CT-05-103, D6-D8) and the A452 Kenilworth Road realignment (see Volume 2: Map CT-05-103, E9 to Map CT-05-104, F1);
- Blythe Bypass embankment (see Volume 2: Map CT-05-104, J6-H6);
- the Horn Brook cutting (see Volume 2: Map CT-05-103, D7-B6); and
- Patrick cutting (see Volume 2: Map CT-05-104, H6-G6).

2.3.92 These earthworks will each take between approximately three months to one year to complete. For the embankments material will be deposited in layers to earthworks slopes and compacted. Slopes will be covered with topsoil to a predetermined depth and then trimmed to form the prescribed profile. The cuttings and embankments construction technique in Volume 1, Section 6.8 will generally be adopted. Where possible materials arising from the cuttings will be used to form the embankments. Where there is a deficit, material will be received from locally within the Balsall Common and Hampton-in-Arden area and neighbouring CFAs. There will be no demolitions required.

2.3.93 No demolitions will be required.

- 2.3.94 Diversion of one road will be required. The proposed A452 Kenilworth Road realignment will be built off line and local traffic management will be used to construct the “tie in” works with the existing A452 Kenilworth Road (see Volume 2: Map CT-05-103, E9 to Map CT-05-104, F1). The works will include the construction of the A452 Kenilworth Road overbridge and embankments, as identified previously, to raise the highway traffic over the route. The construction of the overbridge will take approximately one year to complete. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted.
- 2.3.95 A temporary alternative route and permanent diversion for one bridleway and one footpath will be required. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted:
- a temporary alternative route for Bridleway M218, 60m north-east of the current alignment for a distance of approximately 605m will be provided, to allow the construction of the Mercote Hall Lane (Bridleway M218) overbridge, adding an additional 90m to the footpath (see Volume 2: Map CT-05-103). The bridleway will be permanently diverted 435m over the new overbridge which closely follows the existing alignment of the footpath; and
 - a temporary alternative route for Footpath M230A will be provided on both sides of the route. A temporary alternative route, west of the current alignment for a distance of approximately 140m will be provided (see Volume 2: Map CT-05-104). An alternative route will also be provided to the north-west for a distance of approximately 490m via the B4102 Meriden Road to allow the construction of the Patrick embankment (see Volume 2: Map CT-05-104). Following completion, Footpath M230A will be permanently diverted 320m along its original alignment to join the B4102 Meriden Road (see Volume 2: Maps CT-05-104, G7-F7). The subsequent work will be managed from the B4102 Meriden Road underbridge satellite compound.
- 2.3.96 Diversion of three known utilities will be required as part of the A452 Kenilworth Road realignment works. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted. The diversions are:
- an approximate 1.7km diversion of telecommunications cabling and an approximate 1.7km diversion of existing underground high voltage power lines will be diverted; and
 - an approximate 920m diversion of a 102mm (4 inch) diameter water main adjacent to Marsh Lane and the A452 Kenilworth Road realignment.
- 2.3.97 Bayleys Brook will be realigned through a new culvert under the A452 Kenilworth Road. The existing culvert, which conveys Bayleys Brook under the A452 Kenilworth Road, under the stopped up section of carriageway will be removed and replaced with an open channel (see Volume 2: Map CT-05-103, D8). The drainage and watercourse realignment construction technique in Volume 1, Section 6.9 will generally be adopted.

- 2.3.98 The Horn Brook will be realigned through a new culvert under the A452 Kenilworth Road. The existing culvert will be retained under the stopped up section of carriageway (see Volume 2: Map CT-05-104, H3). The drainage and watercourse diversion construction technique in Volume 1, Section 6.9 will generally be adopted.
- 2.3.99 A floodplain replacement storage area beneath Marsh Farm viaduct will be excavated prior to significant works within the flood plain commencing (see Volume 2: Map CT-05-103, D7). Suitable excavated material will be reused in the works.
- 2.3.100 The excavation of three balancing ponds and construction of a maintenance access track and turning heads for the ponds will be required:
- south of Marsh Farm viaduct (see Volume 2: Map CT-05-103, E8);
 - north-east of the route (see Volume 2: Map CT-05-104, I6); and
 - south-west of the route (Volume 2: Map CT-05-104, G7).
- 2.3.101 Each balancing pond will take approximately three months to complete. Access tracks will additionally be constructed during this time.
- 2.3.102 A permanent diversion of a 914mm (36”) high pressure gas main parallel to the west of the route, described in previous the Bradnock auto-transformer station satellite compound will continue through this section. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted.
- 2.3.103 Finalisation works will include site reinstatement, landscaping, planting and restoration of the existing A452 Kenilworth Road. Restoration works will be carried out by making holes through the existing road construction to allow drainage and covering with soil to the specified depth. The work will be programmed to be undertaken towards the end of construction as the existing road may be used as a storage area for traffic management equipment and materials. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

River Blythe Bypass culvert satellite compound

- 2.3.104 This compound (see Volume 2: Map CT-05-104, H6) will support the civil engineering works predominantly for the construction of the River Blythe Bypass culvert. The compound will:
- be operational for approximately one year and nine months, commencing in 2017;
 - support an average of approximately 20 workers each day throughout this period;
 - not provide worker accommodation;
 - be accessed from a haul road via the A452 Kenilworth Road and B4102 Meriden Road. The haul road will run parallel to the route predominantly on

the south-west side, however there will be a short section crossing the route to connect the satellite compound with the haul road. Temporary structures will be constructed across the River Blythe Bypass channel to enable continuation of the haul road and access to the satellite compound. Pedestrian crossing locations of the haul road will be restricted to the B4102 Meriden Road underbridge and the A452 Kenilworth Road;

- provide one temporary material stockpile area (see Volume 2: Map CT-05-104, G5-F5) and one roadhead (see Volume 2: Map CT-05-104, H5-H6) for the storage, loading and unloading of bulk earthworks materials which will be moved to and from the site on public highways; and
- be managed from the Park Lane cutting main compound.

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

- site clearance and enabling works;
- construction of the River Blythe Bypass culvert; and
- finalisation works including site reinstatement, fencing, planting and landscaping.

2.3.106 The compound will be used to manage the construction of the concrete box culvert to convey the River Blythe Bypass channel, which will take approximately nine months to complete. A temporary realignment of the River Blythe Bypass channel will be required to facilitate construction of the permanent culvert (see Volume 2: Map CT-05-104, H6). The bridges and drainage and watercourse realignment construction technique in Volume 1, Sections 6.17 and 6.9 will generally be adopted.

2.3.107 No demolitions will be required.

2.3.108 No diversions of roads will be required.

2.3.109 No temporary alternative routes or permanent diversion of PRow will be required.

2.3.110 No diversions of utilities will be required.

2.3.111 Finalisation works will include site reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

B4102 Meriden Road underbridge satellite compound

2.3.112 This compound (see Volume 2: Map CT-05-104, E7-D7) will support the civil engineering works predominantly for the construction of the B4102 Meriden Road underbridge, River Blythe viaduct and associated earthworks. The compound will:

- be operational for approximately two years, commencing in 2017;
- support an average of approximately 40 workers each day throughout this period;

- not provide worker accommodation;
- be accessed from a haul road via the A452 Kenilworth Road, B4102 Meriden Road and the A45 Coventry Road. The haul road will run parallel to the route predominantly on the south-west side. A temporary structure will be constructed across the River Blythe to enable continuation of the haul road. Pedestrian crossing locations will be restricted to the B4102 Meriden Road underbridge and A452 Kenilworth Road;
- provide six temporary material stockpile areas (see Volume 2: Map CT-05-104, C7-C8 and C6-B6 to Map: CT-05-105a, I5-I6 and H5, H6); and
- be managed from the Park Lane cutting main compound.

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

- site clearance and enabling works;
- utility diversion;
- earthworks;
- excavation of a floodplain replacement storage area, one balancing pond and construction of a maintenance access track and turning heads for the ponds;
- provision of permanent diversions for PRoW;
- construction of the B4102 Meriden Road underbridge;
- construction of the River Blythe viaduct;
- construction of the Patrick embankment and Diddington Lane embankment;
- an auxiliary sub-station base slab; and
- finalisation works including site reinstatement, fencing planting and landscaping.

2.3.114 The compound will primarily be used to manage the construction of the B4102 Meriden Road underbridge and the River Blythe viaduct (see Volume 2: Map CT-05-104, F6 and D6). The construction of both elements will take approximately one year and three months to complete. The bridges and viaducts construction techniques in Volume 1, Section 6.17 and 6.16 will generally be adopted.

2.3.115 The compound will additionally be used to manage the construction of the Patrick embankment (see Volume 2: C Map CT-05-104, G6-D6) and Diddington Lane embankment to the north-west (see Volume 2: Map CT-05-104, C6 to Map CT-05-105a, G6) which will take approximately three months to complete. The material for the embankments will be deposited in layers to form profiled earthwork slopes and compacted with heavy vibratory plant. Slopes will be covered with topsoil to a predetermined depth and then trimmed to the prescribed profile. The cuttings and embankments construction technique in Section 6.8 will generally be adopted.

Material for the embankments will be received locally within the Balsall Common and Hampton-in-Arden area and from neighbouring CFAs.

2.3.116 No demolitions will be required.

2.3.117 Temporary closure of one road and the permanent closure of another will be required:

- construction of the B4102 Meriden Road underbridge will require discrete lane restrictions and possible night and weekend temporary closures of the B4102 Meriden Road over a short period to enable construction of the underbridge. During periods of temporary closure, Diddington Lane will be used as the diversion route; and
- permanent closure of the private access to Marsh Lane Nature Reserve will be required. Alternative access will be provided via a track diversion along the route of Footpath M230A.

2.3.118 Footpath M230A will be permanently diverted under the Meriden Road underbridge (see Volume 2: C Map CT-05-104). During construction the works will be phased to maintain pedestrian access. The initial work will be managed from the A452 Kenilworth Road overbridge satellite compound.

2.3.119 Diversion of two known utilities will be required. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted. The diversions are:

- An approximate 500m diversion of a 1200mm (47") diameter water main, running beneath the River Blythe viaduct then north of the route parallel to the River Blythe (see Volume 2: Map CT-05-105, C5-B8); and
- diversion of a Western Power overhead power line to underground, beneath the River Blythe viaduct (see Volume 2: Map CT-05-104, D6-D7).

2.3.120 No watercourse realignments will be required.

2.3.121 A floodplain replacement storage area approximately 250m south-west of the River Blythe viaduct will be excavated prior to works within the floodplain commencing (see Volume 2: Map CT-05-104, D8-D9). Suitable excavated material will be reused in the works.

2.3.122 Two turning heads will be constructed at the southern end of Diddington Lane, in close proximity to the residential properties, to facilitate the closure of Diddington Lane to vehicles (see Volume 2: Map CT-05-105a, J9). An additional turning head will be provided to serve as a maintenance access for a balancing pond approximately 100m south of Shadow Brook underbridge (see Volume 2: Map CT-05-105a, H7).

2.3.123 The compound will manage the construction of the base slab for an auxiliary sub-station which will be located in close proximity to Diddington Lane. The installation of the auxiliary sub-station building will be managed from the Bradnock auto-transformer station satellite compound.

- 2.3.124 Finalisation works will include site reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

Shadow Brook underbridge satellite compound

- 2.3.125 This compound (see Volume 2: CT-05-105a, H8) will support the civil engineering works predominantly for the construction of the Shadow Brook underbridge and associated earthworks. The compound will:

- be operational for approximately three years, commencing in 2017;
- support an average of approximately 20 workers each day throughout this period;
- not provide worker accommodation;
- be accessed from a haul road via the A452 Kenilworth Road, B4102 Meriden Road, the A45 Coventry Road and from Diddington Lane north and south. The haul road will run parallel to the route generally south-west of the route. Pedestrian crossing locations of the haul road will be restricted to B4102 Meriden Road underbridge, A452 Kenilworth Road and Diddington Lane;
- provide temporary material stockpile areas (see Volume 2: Maps CT-05-105a, H8, G7, F7, G6, G5-H5 and H6); and
- be managed from the Park Lane cutting main compound.

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

- site clearance and enabling works;
- Diddington Lane closure;
- utility diversion;
- excavation of one balancing ponds and a floodplain replacement storage area;
- construction of Diddington Lane embankment;
- construction of Diddington cutting;
- construction of Shadow Brook underbridge; and
- reinstatement, fencing, planting and landscaping.

- 2.3.127 The compound will primarily be used to manage the construction of Shadow Brook underbridge (see Volume 2: Map CT-05-105a, H6), which will take one year and three months to complete. The bridges construction technique in Volume 6.17 will generally be adopted. A temporary realignment of Shadow Brook for approximately 50m will be required to facilitate construction of the Shadow Brook underbridge. The drainage and watercourse realignment construction technique in Volume 1, Section 6.9 will generally be adopted.

- 2.3.128 The compound will additionally be used to manage construction of Diddington cutting which will take one year and three months to complete. The cuttings and embankments technique in Volume 1, Section 6.8 will generally be adopted.
- 2.3.129 The construction of Diddington Lane embankment described under the B4102 Meriden Road satellite compound will be supported from this compound. Material for the Diddington Lane embankment will be received from Diddington cutting, neighbouring CFAs and locally within the Balsall Common and Hampton-in-Arden area.
- 2.3.130 No demolitions will be required.
- 2.3.131 The permanent closure of Diddington Lane will be required.
- 2.3.132 A turning head will be constructed at the northern end of Diddington Lane, in close proximity to the access to Diddington Farm, to facilitate the closure of Diddington Lane to vehicles. This turning head will also serve as a permanent access for one balancing pond (see Volume 2: Map CT-05-105a, F5).
- 2.3.133 Maintenance access roads will be constructed adjacent to both sides of the route.
- 2.3.134 A new footpath/bridleway will be provided along Diddington Lane, from the intersection of Footpath M115 south-west of the route, under Shadow Brook underbridge, to the turning head close to the entrance to Diddington Farm.
- 2.3.135 Diversion of two known utilities will be required. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted. The diversions are:
- the permanent underground diversion of an existing overhead power line for approximately 800m in the vicinity of Diddington Lane (see Volume 2: CT-05-105a, G5-F7); and
 - the permanent diversion of 125mm (5") water main, for approximately 210m, beneath the Shadow Brook underbridge (see Volume 2: CT-05-105a, H7-G6).
- 2.3.136 One balancing pond, north-east of the route (see Volume 2: Map CT-05-105a, G6), and a floodplain replacement storage area adjacent to Shadow Brook underbridge will be excavated prior to significant works within the floodplain commencing (see Volume 2: Map CT-05-105a, G6 and G7). An Access track will be constructed for the balancing pond. Suitable excavated material will be reused in the works.
- 2.3.137 Finalisation works will include reinstatement, landscaping and planting. The site restoration and landscape treatment construction technique in Volume 1, Section 6.21 will generally be adopted.

A45/A45 Service Road overbridges satellite compound

- 2.3.138 This satellite compound (see Volume 2: Map CT-05-105a, E5) is located within the Birmingham Interchange and Chelmsley Wood area (CFA24). The compound will be used to manage the construction of Pasture Farm accommodation overbridge which

is located within the Balsall Common and Hampton-in-Arden area. The overbridge will take approximately nine months to complete. The bridges construction technique in Volume 6.17 will generally be adopted.

- 2.3.139 Access to Pasture Farm will be permanently diverted east of the route via the overbridge to allow the local diversion of the A45 Service Road (located within Birmingham Interchange and Chelmsley Wood (CFA24)).
- 2.3.140 A temporary alternative route of Footpath M114 will be provided via Diddington Lane and Pasture Farm private access. The highways and public rights of way construction technique in Volume 1, Section 6.10 will generally be adopted.
- 2.3.141 Diversion of two known utilities will be required for Pasture Farm private access. The utilities construction technique in Volume 1, Section 6.4 will generally be adopted. The diversions are:
- approximate 300m permanent underground diversion of telecommunications lines; and
 - approximate 300m permanent underground diversion of an existing Western Power overhead power line.
- 2.3.142 The construction of Diddington cutting previously described within the Shadow Brook underbridge satellite compound will be supported from this compound for the section of cutting within the Birmingham Interchange and Chelmsley Wood area (CFA24).

Construction waste and material resources

- 2.3.143 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 Balsall Common and Hampton-in-Arden area have been prepared and are presented in Volume 5: Appendix WM-001-000.
- 2.3.144 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.
- 2.3.145 Based on the mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Balsall Common and Hampton-in-Arden area will be managed with the aim of contributing to an overall balance of excavated material on a route-wide basis. The overall balance of excavated material is presented in Volume 3, Section 14.
- 2.3.146 The quantity of surplus excavated material originating from the Balsall Common and Hampton-in-Arden area that will require off-site disposal to landfill as excavation waste is shown in Table 1. 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 Balsall Common and Hampton-in-Arden 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.

2.3.147 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%.

2.3.148 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 1.

Table 1: 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	2,328,455	1,593
Demolition	4,345	435
Construction	31,007	3,101
Worker accommodation site	87	44
TOTAL	2,363,894	5,173

2.3.149 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

2.3.150 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

2.3.151 A construction programme that illustrates indicative periods for each core construction activity in this area is provided in Figure 5.

Construction activity	2017				2018				2019				2020				2021				2022				2023				2024				2025			
	quarters				quarters				quarters				quarters				quarters				quarters				quarters				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	1	2	3	4
Diddington Lane embankment																																				
Diddington cutting																																				
A45/A45 Service Road overbridges satellite compound (CFA24)																																				
Pasture Farm accommodation overbridge																																				
Rail infrastructure and systems works																																				
Rail systems installation																																				
Bradnock auto-transformer station satellite compound																																				
Bradnock auto-transformer station installation																																				
Commissioning																																				
Commissioning (until end 2026)																																				
Key																																				



Construction works



Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

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

HS2 services

- 2.4.2 It is anticipated that initially there would be 11 trains per hour each way passing through the Balsall Common and Hampton-in-Arden area in the morning and evening peak hours, and fewer during other times. The first passenger trains of the day would leave the terminus stations no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last would arrive no later than midnight.
- 2.4.3 The frequency of services could rise to 14 trains per hour each way during peak hours, and with Phase Two in place the frequency could rise to 18 trains per hour each way during peak hours. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two.
- 2.4.4 In this area, trains will run at speeds up to 360kph (225mph). The trains will be either single 200m long trains or two 200m long trains coupled together, depending on demand and time of day.

Operational waste and material resources

- 2.4.5 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.
- 2.4.6 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.
- 2.4.7 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.
- 2.4.8 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.
- 2.4.9 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%.

2.4.10 On this basis, approximately 116 tonnes of operational waste will be reused, recycled and recovered during each year of operation of the Proposed Scheme in the Balsall Common and Hampton-in-Arden area. Approximately 23 tonnes will require disposal to landfill (see Table 2).

Table 2: 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	0	0
Rolling stock maintenance	0	0
Track maintenance	128	19
Ancillary infrastructure	11	4
TOTAL	139	23

2.4.11 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 community forum area is summarised below. A series of community forum meetings, parish council meetings and discussions with individual landowners, organisations and action groups were undertaken. Community forum meetings were held on:

- 28 March 2012 at Balsall Common Village Hall, Balsall Common;
- 21 June 2012 at Balsall Common Village Hall, Balsall Common;
- 13 September 2012 at Balsall Common Village Hall, Balsall Common;
- 27 November 2012 at Balsall Common Methodist Church, Balsall Common;
- 4 March 2013 at Fentham Hall, Hampton-in-Arden; and
- 25 September 2013 at Balsall Common Methodist Church, Balsall Common.

2.5.3 Parish council meetings were held on:

- 26 July 2012 at the Parish Office, Fentham Hall, Hampton-in-Arden (Hampton-in-Arden Parish Council);
- 11 January 2013 at the Parish Office, Fentham Hall, Hampton-in-Arden (Hampton-in-Arden Parish Council);
- 07 May 2013 at the Royal British Legion, Balsall Common (Berkswell Parish Council); and
- 13 June 2013 at the Parish Office, Fentham Hall, Hampton-in-Arden (Hampton-in-Arden Parish Council).

2.5.4 In addition to HS2 Ltd representatives, attendees at these community forum meetings typically included local residents, residents groups, public representatives, representatives of local authorities and parish and district councils, action groups, affected landowners and other interested stakeholders.

2.5.5 The main themes to emerge from these meetings were:

- routing of construction traffic within Balsall Common, Hampton-in-Arden and Berkswell and potential noise and air quality impacts;
- visual impact of the Proposed Scheme and in particular the visual impact of the River Blythe viaduct and the new link road associated with the B4102 Meriden Road/Diddington Lane realignment;
- provision of access to severed agricultural land;
- requests for provision of a tunnel through Balsall Common and Berkswell;
- requests for retention or realignment of PRow within Balsall Common and Berkswell;
- the temporary and permanent diversion of Kenilworth Greenway and associated amenity impacts; and
- noise emitted from the operation of the Proposed Scheme and the impact on Balsall Common, Hampton-in-Arden and Berkswell.

2.5.6 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 8 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 Proposed Scheme. Details of the local consultation events were provided on the HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the Proposed Scheme. In the Balsall Common and Hampton-in-Arden area, consultations on the draft Environmental Statement were held on 5 June 2013 at Fentham Hall, Hampton-in-Arden.

- 2.5.7 HS2 Ltd staff attended the event, including engineers and environmental specialists, for members of the public to speak to.
- 2.5.8 Responses from the draft Environmental Statement consultation have been analysed and an overview of those received and how the Environmental Statement has taken account of responses is contained in the Draft Environmental Statement Consultation Summary Report (see Volume 5: Appendix CT-08-000).

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-002-000. The main local alternatives considered for the Proposed Scheme within the local area are set out within 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 right balance between engineering requirements, cost and potential environmental impacts.

A452 Kenilworth Road

- 2.6.3 As part of the design development process since the announcement of the scheme in January 2012, a realignment of the A452 Kenilworth Road has been considered where the route intersects the existing A452 Kenilworth Road, north of its junction with Marsh Lane. The Proposed Scheme would be on shallow embankment, approximately 2m above existing road level and would include a permanent offline realignment of the A452 Kenilworth Road to the south-east at an elevation of approximately 10m. The following options were considered:
- Option 1 (the January 2012 announced scheme): The horizontal alignment would remain broadly as the existing alignment with the vertical alignment elevated by approximately 10m to pass over the route. A temporary realignment to the south would be constructed in advance of works to the A452 Kenilworth Road;
 - Option 2: Permanent offline realignment of the A452 Kenilworth Road to the north-west at an elevation of approximately 10m; and
 - Option 3: The Proposed Scheme.
- 2.6.4 The Proposed Scheme has a number of benefits when compared to the other options considered. The Proposed Scheme and Option 2 avoid constructing a lengthy temporary realignment prior to the main A452 Kenilworth Road works starting and the associated cost and programme implications, as would be the case with Option 1. When compared to the Proposed Scheme, Option 2 would involve a greater loss of vegetation, including hedgerows, and disruption and severance to agricultural land.

Areas to the north-west of the existing alignment are identified for mineral working which would be disturbed with the construction of Option 2. The Proposed Scheme would pass closer to two Grade II listed buildings, potentially impacting upon their setting. The Proposed Scheme provides an opportunity to naturalise the proposed Bayleys Brook diversion; provide replacement ecological habitat; and moves the road alignment further away from Marsh Lane Nature Reserve and surrounding residential properties.

2.6.5 For these reasons it was decided to adopt Option 3 in the Proposed Scheme.

B4102 Meriden Road/Diddington Lane realignment

2.6.6 At the meeting held on 13 June 2013 at Parish Office, Fentham Hall, Hampton-in-Arden, Hampton-in-Arden Parish Council requested that further consideration be given to where the route intersects the existing B4102 Meriden Road and Diddington Lane. Hampton-in-Arden Parish Council raised concerns regarding the potential visual intrusion on residents of Hampton-in-Arden associated with the new link road proposed. The raising of the vertical alignment in order for the B4102 Meriden Road to remain open has been evaluated alongside the scheme assessed in the draft ES and consulted on in June 2013. The evaluation has determined that when compared to the proposed link road, raising the alignment of the route, such that the B4102 Meriden Road remains open to vehicular traffic, would reduce the visual intrusion on residents of Hampton-in-Arden and additionally the Island Project School. With this option Diddington Lane would remain closed with local access to agricultural land retained, albeit with height restriction. Raising the alignment of HS2 such that the B4102 Meriden Road remains open has been taken forward as the Proposed Scheme. The following options were considered¹⁵:

- Option 1: (the scheme as assessed in the draft ES and consulted on in June 2013): A new link road midway between the B4102 Meriden Road and Diddington Lane. Two new roundabouts would be constructed to tie the new link road into the existing B4102 Meriden Road and the A452 Kenilworth Road. Local access to agricultural land would be retained, albeit with height restriction; and
- Option 2: the Proposed Scheme.

2.6.7 In addition to minimising the visual intrusion on residents of Hampton-in-Arden and the Island School Project there are a number of further environmental benefits associated with raising the alignment. Avoiding the need to construct a new link road reduces the scale of construction within the area and the associated impacts of noise,

¹⁵ A number of alignment options were considered for the proposed B4102 Meriden Road/Diddington Lane link road. The option reported in this section was that selected option as a outcome of the evaluation undertaken. Other options considered were reported in the Balsall Common and Hampton-in-Arden CFA (CFA23) Draft Environmental Statement.

dust and construction traffic on the surrounding area. Construction within the flood plain of the River Blythe is reduced and so therefore is the need to provide replacement flood storage. The new link road and flood storage areas previously resulted in the loss and severance of agricultural land which is reduced with the Proposed Scheme. The Proposed Scheme does create a small increase to the flooding level on the B4102 Meriden Road. As a consequence of the closure of Diddington Lane, should the B4102 Meriden Road be inundated during a flood event, as is the case in the current situation, there would be an increased journey time and length for vehicular users wanting to use the A452 Kenilworth Road and the A45 Coventry Road.

2.6.8 The Proposed Scheme and the link road both require the closure of Diddington Lane which has the potential to reduce traffic noise and dust impacts upon neighbouring residential properties. The Proposed Scheme would also minimise the extensive import of fill required to construct the embankments of the link road.

2.6.9 For these reasons it was decided to adopt Option 2 in the Proposed Scheme.

Carol Green Rail underbridge

2.6.10 As part of the design development process since the announcement of the scheme in January 2012, consideration has been given to where the route crosses above the Rugby to Birmingham line close to Carol Green, approximately 400m from Berkswell station and where a bridge structure would be required. The Proposed Scheme would cross over the Rugby to Birmingham line on a single span bridge structure orientated in line with the Rugby to Birmingham line. The following alignment options were considered:

- Option 1: Single-span truss¹⁶ on the line of the Proposed Scheme;
- Option 2: Three-span concrete beam and deck on the line of the Proposed Scheme;
- Option 3: Three-span steel girder and deck on the line of the Proposed Scheme; and
- Option 4: The Proposed Scheme.

2.6.11 The span of the Proposed Scheme is approximately 15m, the shortest of all the options considered. The short span enables the route to be lowered which reduces the visual impact of the underbridge on neighbouring residential properties. This is limited with the alternative options, particularly Option 2 which is considered the most visually intrusive. To further reduce the visual impact, embankments would be landscaped which would assist in integrating the underbridge in to the existing

¹⁶ A truss is a structure comprising one or more triangular units constructed with straight members whose ends are connected at joints referred to as nodes.

landscape character. A single short span structure, such as the Proposed Scheme, would potentially reduce existing visual impacts and noise levels on residential properties from the Rugby to Birmingham line. This would additionally reduce amenity impacts on users of the realigned PROW, which pass through a separate structure through the embankment to the railway.

2.6.12 For these reasons it was decided to adopt Option 4 in the Proposed Scheme.

Balsall Common, River Blythe, Marsh Farm, River Blythe Bypass and Shadow Brook viaducts

2.6.13 As part of the design development process since the announcement of the scheme in January 2012 consideration has been given to viaduct design. The Proposed Scheme requires the construction of three viaducts in this area, the lengthier ones being Balsall Common viaduct and River Blythe viaduct. The other viaducts are Marsh Farm viaduct, River Blythe Bypass viaduct and Shadow Brook viaduct. The Proposed Scheme viaducts would consist of low height multi span viaducts comprising a deck supported by beams spanning short distances between column supports.

2.6.14 The sensitivity of the residential areas of Balsall Common and Hampton-in-Arden, in terms of visual impacts and noise as well as the sensitivity of the River Blythe, has been an instrumental factor in considering the design of the viaducts within the area. Multiple short spans have been adopted to reduce the structural depth of the deck and mitigate visual impact further. They are designed to be simple and non-intrusive.

2.6.15 Four structural forms were considered at an option selection review:

- Option 1: Concrete trough deck;
- Option 2: Half trough steel box beams;
- Option 3: Below track steel composite box beams; and
- Option 4: The Proposed Scheme, concrete beams.

2.6.16 A concrete structure minimises noise and assists in reducing the vertical alignment as the structural depth below rail is lower when compared to steel structures.

2.6.17 Whilst the Proposed Scheme would result in a marginally greater visual impact when compared to Option 2, it is currently considered technically more appropriate for high-speed rail. Pre-cast concrete construction minimises the construction duration therefore reducing construction amenity impacts, including traffic related impacts, on Balsall Common and Hampton-in-Arden. Concrete structures inherently cause less noise than steel structures unless dampers are used.

2.6.18 For these reasons it was decided to adopt Option 4 in the Proposed Scheme.

2.6.19 Following the publication of the draft ES, further design development has been undertaken on the Balsall Common, Blythe Valley, River Blythe Bypass and Shadow

Brook viaducts. The design intent at draft ES stage was that the viaduct length had been determined on the basis that embankment construction within the Environment Agency Flood Zone 3 would be avoided. This approach ensured that the construction of the Proposed Scheme would minimise the built development footprint in the floodplain.

- 2.6.20 Hydraulic modelling of each watercourse has since been undertaken to better define the Flood Zone and the impact of the Proposed Scheme has concluded that reductions in viaduct length can be achieved within the floodplain.

Shortening Balsall Common and Blythe Valley viaducts

- 2.6.21 Following the publication of the draft ES, further design development has taken place which has reduced the length of Balsall Common viaduct from 450m to 250m and River Blythe viaduct from 400m to 150m, with the consequential increase in embankment length either side of the respective viaducts.
- 2.6.22 At Balsall Common, there is a small increase in flood levels on agricultural land. At the River Blythe, the reduced viaduct length results in a small increase in flood levels on agricultural land and on the B4102 Meriden Road. The increase in flood levels on the B4102 Meriden Road is minor and results in no change in flood hazard on the road.
- 2.6.23 When compared with the viaducts reported in the draft ES the shorter viaduct solutions will reduce the cost of the Proposed Scheme and will reduce programme and construction risk.

River Blythe Bypass culvert

- 2.6.24 Following publication of the draft ES, further design development has taken place which has changed the form of structure required at the crossing of the River Blythe Bypass channel from a 77m long viaduct to a 4.5m wide and 2.5m deep box culvert with the consequential increase in embankment length either side of the culvert.
- 2.6.25 When compared with the viaduct reported in the draft ES the culvert and embankment combination will not allow access for agricultural vehicles and livestock, however the viaduct solution only provided limited clearance of 2.8m between ground level and underside of the viaduct. The culvert/embankment solution provides an opportunity to re-use surplus excavated material from elsewhere along the route of Proposed Scheme and will also reduce the cost, and reduce programme and construction risk.

Shadow Brook underbridge

- 2.6.26 Following publication of the draft ES, further assessment of the operational characteristics for the Proposed Scheme has taken place and determined that additional rail crossovers near Birmingham Interchange Station are required. These additional crossovers are to be used only during times of disrupted service operations and will allow trains to turn back to the direction from which they have

come, i.e. allows trains travelling up from the south to terminate at Birmingham Interchange Station and then return to the south.

- 2.6.27 The following four options, at three separate locations along the route for the rail crossovers were identified, analysed and impact assessed:
- Option 1 – The Proposed Scheme, Shadow Brook (4 crossovers);
 - Option 2 – Park Lane cutting (between Lavender Hall Overbridge and Footpath M214 Overbridge);
 - Option 3 – Shadow Brook (2 crossovers & shorter 4-track section); and
 - Option 4 – South of Waste Lane (Burton Green Retaining Structure).
- 2.6.28 Option 2 was rejected as it would require changing the curved vertical alignment to a constant gradient which would then affect other features along the route. It is generally recommended that rail crossovers are installed where there is a constant horizontal and vertical alignment.
- 2.6.29 Option 3 was rejected due to the impacts on the normal operational capacity of the railway. The shorter 4-track section causes greater conflict between stopping and through trains.
- 2.6.30 Option 4 was rejected as the operational capacity of the crossovers at this location would be inferior to options 1-3 due to the distance from the station.
- 2.6.31 Option 1, the Proposed Scheme provides the most benefits. Shadow Brook is the ideal location to place the rail crossovers, as it provides a straight section with constant gradient on the immediate approach to Birmingham Interchange Station. Four crossovers will be required at this location as the railway will be widened out to four tracks on the approach to the station.
- 2.6.32 Following selection of Option 1, a review was undertaken of the viaduct structure over Shadow Brook and a new bridleway linking Diddington Lane. The review was undertaken to determine whether the viaduct was the most suitable form of structure to carry the crossovers. It was concluded that an alternative form of structure would be required to achieve a uniform stiffness of track formation as the railway passes over the structure and adjacent sections of embankment. This review was carried out in conjunction with more detailed hydraulic modelling of Shadow Brook and resulted in changing the form of structure from a 145m long viaduct to a 44.8m wide buried two cell box structure. The proposed underbridge structure has a span of 13.5m over Shadow Brook and span of 5.5m over the bridleway. The new bridleway will connect up the stopped up ends of Diddington Lane, which is closed as part of the Proposed Scheme, and will predominantly follow the line of the stopped up road. The combination of this form of structure and crossover at Shadow Brook will provide the most operationally efficient inspection and maintenance regime.

Berkswell/Balsall Common tunnel

- 2.6.33 At the meeting held on the 21 June 2012 at Balsall Common Village Hall, Balsall Common, the community forum requested that a design review of the vertical alignment of the Proposed Scheme was undertaken and requested that a deep bore tunnel be considered between a point north-west of B4101 Waste Lane to a location in close proximity to Berkswell Marsh SSSI. Three deep bore tunnel options were evaluated alongside the scheme announced in January 2012. The evaluation of the options determined that the ground level solution was to be taken forward as the Proposed Scheme. The three deep bore tunnel options considered were as follows:
- Option 1: Short tunnel – online: 2.5km tunnel with the entry portal in close proximity to Beechwood Farm, linking the cut and cover tunnel proposed at Burton Green, and the exit portal at the southern edge of Marlowes Wood. The tunnel would follow the same alignment as the ground level alignment;
 - Option 2: Mid length tunnel – online: 4.8km tunnel with the entry portal within the Stoneleigh, Kenilworth and Burton Green area (CFA18), at the southern edge of Black Waste Wood and the exit portal at the southern edge of Marlowes Wood. This option would replace the cut and cover tunnel proposed at Burton Green. A tunnel shaft would be located at a midway point between the two portals. The tunnel would follow the same alignment as the ground level alignment; and
 - Option 3: Long tunnel – offline: 6.5km tunnel with the entry portal within the Stoneleigh, Kenilworth and Burton Green area (CFA18), at the western edge of the Black Waste Wood and the exit portal at Cornets End Lane in close proximity to Mercote Mill Farm. The tunnel would follow a route north-west, beneath Cromwell Lane, Hodgett’s Lane, the Rugby to Birmingham line, Truggist Lane, Baulk Lane, and Lavender Hall Lane. This option would move the horizontal alignment further away from Hampton-in-Arden. Two tunnel shafts would be required at equal distance along the alignment.
- 2.6.34 All three alternative tunnel options would have benefits in comparison to the Proposed Scheme including reducing the loss of agricultural land, reduced disruption to field patterns, reduced archaeological impacts and fewer amenity impacts on neighbouring residential properties and users of PRow. However the alternative tunnelling options would have potentially greater adverse impacts on the groundwater regime and indirectly on Berkswell Marsh SSSI. The tunnel portals would require access and hard standing areas, with the access track to the exit portal located within Berkswell Marsh SSSI. In addition, the tunnel options would be likely to result in increased greenhouse gas emissions and generate more waste material and waste water during construction and cause greater air quality, noise and vibration and traffic impacts during movement of excavated material (including tunnel arisings). Permanent pumping facilities might need to be constructed where passive drainage of water was not possible.

- 2.6.35 The three alternative tunnel options would be substantially more expensive than the Proposed Scheme, with the extra cost of Option 3 being more than three times that of Option 1. Whilst the alternatives were considered to have environmental and community benefits, they would present other environmental effects. Whilst the magnitude of the benefits would increase with tunnel length, these were not considered to be substantial enough to justify the increased cost and construction programme.

3 Agriculture, forestry and soils

3.1 Introduction

- 3.1.1 This section provides a description of the current baseline for agriculture, forestry and soils and an assessment of the likely impacts and significant effects as a result of the construction and operation of the Proposed Scheme. Consideration is given to the extent and quality of the soil and land resources underpinning the primary land use activities of farming and forestry, and the physical and operational characteristics of enterprises engaged in these activities. Consideration is also given to diversification associated with the primary land uses, and to related land-based enterprises, notably equestrian activities.
- 3.1.2 The quality of agricultural land in England and Wales is assessed according to the Agricultural Land Classification (ALC) system, which classifies agricultural land into five grades from excellent quality Grade 1 land to very poor quality Grade 5 land. Grade 3 is subdivided into Subgrades 3a and 3b. The main issue in the assessment of the impacts on agricultural land is the extent to which land of best and most versatile (BMV) agricultural quality (Grades 1, 2 and 3a) is affected by the Proposed Scheme.
- 3.1.3 Forestry is considered as a land use feature and the impacts have been calculated quantitatively. The qualitative effects on forestry land and woodland are addressed principally in the ecology and landscape and visual assessments (see Sections 7 and 9).
- 3.1.4 Soil attributes other than those relating to agricultural and forestry use are identified in this section but assessed in terms of their primary attributes in other sections, notably Cultural heritage, Ecology and Landscape and visual (see Sections 6, 7 and 9).
- 3.1.5 The main issue for farm holdings is the disruption by the Proposed Scheme of the physical structure of agricultural holdings and the operations taking place upon them, during both its construction and operational phases. Key engagement has been undertaken with farmers and landowners affected by the Proposed Scheme to obtain factual information on the scale and nature of the farm and forestry operations and related farm-based uses.
- 3.1.6 Details of published and publically available information used in the assessment, and the results of surveys undertaken within this area, are contained in Volume 5: Appendix AG-001-023.

3.2 Scope, assumptions and limitations

- 3.2.1 The assessment scope, key assumptions and limitations for the agriculture, forestry and soils 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.

- 3.2.2 Common assumptions that have been applied to the Proposed Scheme, such as the restoration of agricultural land to pre-existing quality, the handing back of land used temporarily to the original landowner and the non-replacement of capital items demolished, are set out in Volume 1.
- 3.2.3 Various recreational uses are affected by the Proposed Scheme, including the Heart of England Aeromodellers site and the Berkswell Clay Pigeon Shooting club. With the exception of the Berkswell Clay Pigeon Shooting Club, these are assumed to be farm diversification and significant effects upon them are included in the assessment for the relevant individual holdings. The form the land used by the Heart of England Aeromodellers site and the Berkswell Clay Pigeon Shooting club will take when reinstated after construction is not known, but it is possible they could be used for agriculture.
- 3.2.4 There are no other assumptions or limitations that are specific to the assessment in this area.

3.3 Environmental baseline

Existing baseline

- 3.3.1 This section sets out the main baseline features that influence the agricultural and forestry use of land within this area. These include the underlying soil resources which are used for food and biomass production, as well as providing other services and functions for society, and the associated pattern of agricultural and other rural land uses.

Soils and land resources

Topography and drainage

- 3.3.2 The main topographical features within the study area are described in detail in the landscape and visual assessment (Section 9). The arterial drainage¹⁷ in this area is provided by the River Blythe and its associated tributaries. The floodplain of the River Blythe runs north/south through the gap between Balsall Common and Hampton-in-Arden, and lies at 85m to 90m above Ordnance Datum (AOD). It is extended by a number of small tributary valleys which join from the east, notably Bayleys Brook, and from the west, notably Shadow Brook. These create a number of small hills and intervening rises.
- 3.3.3 The highest ground is found in a ridge located between Balsall Common and Benton Green which rises to approximately 130m AOD. This extends westwards at a slightly lower level to the south of Balsall Common. From this higher ground Bayleys Brook

¹⁷ Arterial drainage is a drainage system where a number of watercourses flow collectively into one main channel.

runs north-west between Balsall Common and Berkswell through gently sloping terrain mainly below 100m AOD.

- 3.3.4 To the north of Hampton-in-Arden, the land rises to approximately 95m AOD to the west of Mouldings Green Farm, and approximately 100m AOD at Diddington Hill. These two areas of higher ground are separated by the valley of Shadow Brook.

Geology and soil parent materials

- 3.3.5 The main geological features are described in detail in Land quality (see Section 8). The predominant underlying geology mapped by the British Geological Survey (BGS)¹⁸ is Triassic mudstones (Mercia Mudstone Group) with occasional occurrences of sandstone and siltstone. To the east and south-west of the River Blythe, this bedrock is largely overlain with glacial and fluvioglacial deposits (till, sand and gravel). The river valley itself and its tributaries are occupied by alluvial deposits and have adjoining areas of river terrace sand and gravel deposits, particularly in the vicinity of Bradnocks Marsh.

Description and distribution of soil types

- 3.3.6 The characteristics of the soils are described by the Soil Survey of England and Wales¹⁹ and shown on the National Soil Map²⁰. The soils are grouped into associations of a range of soil types. They are described in more detail in Volume 5 and their distribution is shown on Volume 5: Map AG-02-023. The Soil Survey of England and Wales maps ten associations within the study area, of which the seven main associations relevant to the Proposed Scheme are; Fladbury 1, Arrow, Brockhurst 1, Salop, Rufford, Flint and Whimple 2²¹.
- 3.3.7 The floodplain of the River Blythe and its tributaries supports alluvial soils (Fladbury 1 association). These comprise medium or heavy clay loam topsoils overlying slowly permeable, clay subsoils derived from alluvial deposits. They are subject to groundwater waterlogging associated with fluctuating river levels and perennial flooding and fall within Wetness Class (WC) IV²².
- 3.3.8 To the east of the River Blythe, medium to coarse, sandy loamy soils of the Arrow association are associated with occurrences of fluvioglacial and river terrace sands and gravels. These more freely draining soils fall within WC II or III depending on depth to the water table.

¹⁸ British Geological Survey; <http://mapapps.bgs.ac.uk/geologyofbritain/home/html>; Accessed: 1 August 2013.

¹⁹ Soil Survey of England and Wales, (1984), *Soils and their Use in Midland and Western England*. Harpenden: Soil Survey of England and Wales, Bulletin no.15.

²⁰ Cranfield University, (2001), *The National Soil Map of England and Wales. 1:250,000 scale*, National Soil Resources Institute, Cranfield University, UK.

²¹ Three lesser associations (Bromsgrove, Whimple 3 and Wick 1) have a limited occurrence and are remote from the Proposed Scheme. As such they are not described.

²² The Wetness Class of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six bands.

- 3.3.9 In the vicinity of Hampton-in-Arden the underlying mudstone parent materials create clayey subsoils with a clay loam topsoil (Brockhurst 1 association). Their drainage status is variable and attributed to WC II-IV.
- 3.3.10 In the vicinity of Balsall Common soil parent materials are derived from a glacial till giving rise to clay or clay loam topsoils with slowly permeable subsoils of similar texture (Salop association). These heavier textured soils fall within WC IV.
- 3.3.11 Between Balsall Common and Berkswell, there are variable occurrences of the underlying geology of shales, mudstones and sandstones and superficial till deposits support a limited distribution of generally loamy topsoils over slowly permeable clayey subsoils. Over the reddish till deposits, coarse sandy loam topsoils are recognised as Rufford association and slightly stony clay loam topsoils as Flint association. Where the underlying bedrock provides the parent material, the clay loam or sandy clay loam topsoils of the Whimple² association are present. All the soil types experience seasonal waterlogging and fall within WC III.

Soil and land use interactions

Agricultural land quality

- 3.3.12 The principal soil/land use interaction in the study area is the quality of the agricultural land resource. The ALC is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the site.
- 3.3.13 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. There are two distinct soil characteristics within the area which are those of the poorly drained soils on the River Blythe floodplain and the underlying bedrock contrasting with the better drained soils of the higher ground sited on the fluvioglacial and river terrace deposits.
- 3.3.14 Climate in the area does not in itself place any limitation upon land quality, but the interactions of climate with soil characteristics are important in determining the wetness²³ and droughtiness²⁴ limitations of land. The local climate has a moderate annual average rainfall (694mm), typical of lowland England, moderately cool temperatures and moderate moisture deficits. The resulting number of Field Capacity

²³ A soil wetness limitation exists where the soil water regime adversely affects plant growth or imposes restrictions on cultivations or grazing by livestock. The severity of the limitation is influenced by the amount and frequency of rain in relation to evapotranspiration, the duration of waterlogging and the texture of the uppermost layers of the soil.

²⁴ To achieve full yield potential a crop requires an adequate supply of soil moisture throughout the growing season. Droughtiness is likely to be a limitation to crop growth in areas with relatively low rainfall or high evapotranspiration, or where the soil holds only small reserves of moisture available to plant roots.

Days²⁵ is around 162 days, which is slightly greater than the average for lowland England (150 days) and is considered to be slightly unfavourable for providing opportunities for land works.

3.3.15 Gradients and changing slopes are not limiting in the study area. Flooding and waterlogging in the floodplain of the River Blythe is considered to be a limiting factor.

3.3.16 The principal limiting factors determining agricultural land quality in this area are soil wetness and droughtiness. Under the local climatic conditions, the better drained Arrow association soils on higher ground are limited by droughtiness to Subgrade 3a and shown as such on Volume 5: Maps AG-01-050b to AG-01-052. This is also applicable to the sandy loams of the Rufford association. The heavier textured soils of the Brockhurst 1, Salop, Whimble 2 and Flint associations experience seasonal waterlogging and are subject to wetness limitations which place them in either Subgrade 3a or 3b dependent upon their specific texture. Within the floodplain, Fladbury 1 soils largely fall within Subgrade 3b due to a significant soil wetness limitation.

3.3.17 Department for Environment, Food and Rural Affairs (Defra) mapping²⁶ shows that there is generally a medium to high likelihood of encountering BMV land in the locality, which makes such land a resource of medium sensitivity in this area.

Other soil interactions

3.3.18 Soil fulfils a number of functions and services for society in addition to those of food and biomass production which are central to social, economic and environmental sustainability. These are outlined in sources such as the Soil Strategy for England²⁷ and Wales and The Natural Choice: securing the value of nature²⁸ and include:

- the storage, filtration and transformation of water, carbon and nitrogen in the biosphere;
- support of ecological habitats, biodiversity and gene pools;
- support for the landscape;
- protection of cultural heritage;
- providing raw materials; and
- providing a platform for human activities, such as construction and recreation.

²⁵ Field Capacity Day is a meteorological parameter which estimates the duration of the period when the soil moisture deficit is zero. Soils usually return to field capacity (zero deficit) during the autumn or early winter and the field capacity period, measured in days, ends in the spring when evapotranspiration exceeds rainfall and a moisture deficit begins to accumulate and opportunities for mechanised fieldwork are then possible.

²⁶ Department for Environment, Food and Rural Affairs (Defra), (2005), *Likelihood of Best and Most Versatile Agricultural Land*.

²⁷ Department for Environment, Food and Rural Affairs (Defra), (2009), *Soil Strategy for England*.

²⁸ Department for Environment, Food and Rural Affairs (Defra), (2011), *The Natural Choice: securing the value of nature*.

- 3.3.19 Forestry resources represent a potentially multifunctional source of productive timber, landscape amenity, biodiversity and carbon storage capacity. Substantial woodland areas are located between Berkswell and Hampton-in-Arden (Marlowes, The Bogs, Sixteen Acre Wood and Siden Hill Wood). The value and sensitivity of the resources are assessed in Ecology (see Section 7).
- 3.3.20 The floodplain of the River Blythe represents the functional flood environment, as set out in water resources and flood risk assessment (see Section 13). Flood Zone mapping available from the Environment Agency shows there to be a significant risk of flooding within this area. The River Blythe, and its tributary Bayleys Brook, support nature conservation interests of recognised importance. The River Blythe is designated as a Site of Special Scientific Interest (SSSI), and Bayleys Brook runs through the middle of the Berkswell Marsh SSSI. The ecological functions are identified in Ecology (see Section 7).
- 3.3.21 The presence of soil-borne cultural assets is detailed in Cultural heritage (see Section 6). The majority of the occupation of the area relates to the medieval and later periods. This is reflected in the presence of manors and extensive area of ridge and furrow cultivation features.

Land use

Land use description

- 3.3.22 Agricultural land is divided between arable and grassland uses. The floodplain of the River Blythe and its tributaries is mainly in grassland use, with the higher, more freely draining land under arable cultivation.
- 3.3.23 Woodland is primarily concentrated in the area close to the valley of Bayleys Brook and associated with land within the substantial Berkswell Estate. Generally within the area, woodland is only moderately well represented, covering about 6% of the land compared with the national average of 10%.
- 3.3.24 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone (NVZ), which is an area in which nitrate pollution is a potential problem. Statutory land management measures apply which seek to reduce nitrogen losses from agricultural sources to water. Some agricultural land is also subject to management prescriptions associated with the Environmental Stewardship Scheme which seeks either generally (the Entry Level Scheme) or specifically (the Higher Level Scheme) to retain and enhance the landscape and biodiversity qualities and features of farm land. Holdings which have land entered into an agri-environment scheme are identified in Table 3.

Number, type and size of holdings

- 3.3.25 There are 17 farms in the study area as set out in Table 3. These are a mixture of owner-occupation and tenancies. The land ownership is dominated by two large rural estates, Packington and Berkswell, which have in-hand interests in commercial nature

conservation and forestry. Several interests in the area are wholly or partially agricultural tenants of these estates. Three interests are equestrian in character and one is principally residential, but may let its open land for agricultural use. The boundaries of the holdings are shown on Volume 5: Maps AG-01-050b to 052 along with the location of the main buildings.

3.3.26 Table 3 sets out the sensitivity of individual holdings to change, which is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, and can better absorb impacts and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Smaller (less intensively used) units, such as pony paddocks associated with residential properties, have a low sensitivity.

Table 3: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA23/1 Land west of B4101 Waste Lane, part Dumble Farm, Coleshill*	Arable	Not known (assessed as at least 50)	Not known	Not known	Medium
CFA23/2 Barratts Lane Farm*	Arable and livestock	Not known (assessed as at least 50)	Not known	Not known	Medium
CFA23/3 Beechwood Farm	Equestrian (non-commercial)	11.4	None	None	Low
CFA23/4 Truggist Hill Farm	Equestrian (commercial)	15.3	Livery	None	High
CFA23/5 Berkswell House*	Residential	c. 4.5	Let for grazing/forage	Not known	Low
CFA23/6 Village Farm	Livestock (beef cattle)	65.7	None	None	Medium
CFA23/7 Ram Hall Farm*	Livestock (sheep)	Not known (assessed as at least 75)	Cheese making	Not known	Medium
CFA23/8 Land off Park Lane	Arable	224.8	Green waste recycling	None	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA23/9 New Mercote/Mercote Mill Farm	Arable	307.0	Charity clay shoot	None	Medium
CFA23/10 Berkswell Estate	Forestry, with agricultural estate	49.0	Shooting rights let	Woodland Grant Scheme	Medium
CFA23/11 Marsh Farm	Livestock (beef cattle)	33.8	None	None	Medium
CFA23/12 Horn Brook Farm	Equestrian	4.8	Wedding carriage hire (dormant)	None	Low
CFA23/13 Packington Estate (Marsh Lane Nature Reserve)	Commercial nature conservation	30.4	Nature conservation/public access	HLS ²⁹	Medium
CFA23/14 Dairy Farm	Arable and livestock (sheep and beef)	700.0	Agricultural contracting	ELS ³⁰ /HLS	Medium
CFA23/15 Mouldings Green Farm	Arable and livestock (Sheep and beef)	48.0	Part interest in commercial letting of buildings	ELS	Medium
CFA23/16 Home Farm, Hampton-in-Arden	Arable and livestock (Sheep and beef)	324.0	Farmhouse B & B	None	Medium
CFA23/17 Firs Farm*	Arable and livestock	Not known (assessed as at least 100)	Not known	Not known	Medium

* No Farm Impact Assessment interview conducted; data estimated.

Future baseline

Construction (2017)

3.3.27 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. No committed developments have been identified in this local area that will materially alter the baseline conditions in 2017 for agriculture, forestry and soils.

²⁹ Higher level stewardship (HLS).

³⁰ Entry level stewardship (ELS).

- 3.3.28 The future of agri-environment schemes is uncertain at present due to on-going reform of the Common Agricultural Policy. The majority of schemes seem likely to cease over the next two to three years and replacements are uncertain. Whilst this will remove a level of support from the agricultural industry that has been used to offset some of the costs incurred in managing land in an environmentally responsible manner, it is unlikely to materially alter the way agricultural land is managed in the future. Whilst some field margins may be cropped closer to hedgerows and stocking rates may increase in some locations, the stocking and cropping baseline set out in the previous section is unlikely to change significantly.

Operation (2026)

- 3.3.29 No additional committed developments have been identified in this local area that will materially alter the baseline conditions in 2026 for agriculture, forestry and soils.

3.4 Effects arising during construction

Avoidance and mitigation measures

- 3.4.1 During the development of the design, the following measures have been incorporated to avoid or mitigate impacts on agriculture, forestry or soils during construction:

- field access off Lavender Hall Lane to replace existing access lost permanently. This is provided for Ram Hall Farm, and Village Farm;
- agricultural overbridge (Footpath M215 overbridge) between Sixteen Acre Wood and Marlowes to provide access to severed land. This is provided for Mercote Mill Farm;
- farm access to Mercote Mill Farm from A452 Kenilworth Road to replace existing access lost to permanent works;
- field access from the B4102 Meriden Road at Patrick Farm³¹ to replace existing access permanently severed and provide continued access to severed land. This is provided for Dairy Farm;
- agricultural overbridge (Pasture Farm accommodation overbridge) and track at Pasture Farm^{31 32} to provide continued access to severed land. This is provided for Home Farm; and
- permanent diversion of PRoW and the access to the Bradnock auto-transformer station to reduce severance of agricultural fields. This is provided for Marsh Farm.

³¹ Pasture farm and Patrick farm are used as location terms only, neither is a farm holding.

³² The new access track to Pasture Farm commences in the Birmingham Interchange and Chelmsley Wood CFA (CFA24).

3.4.2 In addition, there is a need to avoid or reduce environmental impacts to soils during construction. It is an essential element of the construction process that the soil resources from the areas required temporarily and permanently are stripped and stored so that land required temporarily for construction purposes which is currently in agricultural use can be returned to that use, where agreed, and to its pre-existing agricultural condition.

3.4.3 Subject to the adoption of good practice techniques in handling, storing and reinstating soils on land where agricultural or forestry uses are to be resumed, there will be no reduction in the long term capability which would downgrade the quality of disturbed land. Some land with heavier textured soils, for example those of the Brockhurst 1 association, may require careful management during the aftercare period to ensure this outcome.

3.4.4 Compliance with the draft CoCP will avoid or reduce environmental impacts during construction. Of particular relevance to agriculture, forestry and soils are:

- the reinstatement of agricultural land which is used temporarily during construction to agriculture, where this is the agreed end use (draft CoCP, Section 6);
- the provision of a method statement for stripping, handling, storing and replacing agricultural and woodland soils to reduce risks associated with soil degradation on areas of land to be returned to agriculture and woodland following construction, based on detailed soil survey work to be undertaken prior to construction. This will include any remediation measures necessary following the completion of works (draft CoCP, Section 6);
- a requirement for contractors to monitor and manage flood risk and other extreme weather events which may affect agriculture, forestry and soil resources during construction (draft CoCP, Section 16);
- arrangements for the maintenance of farm and field accesses affected by construction, where reasonably practicable (CoCP, Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (draft CoCP, Sections 6 and 16);
- the protection of agricultural land adjacent to the construction site, including the provision and maintenance of appropriate stock-proof fencing (draft CoCP, Sections 6 and 9);
- the adoption of measures to control the deposition of dust on adjacent agricultural crops (draft CoCP, Section 7);
- the control of invasive and non-native species; and the prevention of the spread of weeds generally from the construction site to adjacent agricultural land (draft CoCP, Section 9);

- the adoption of measures to prevent, as far as reasonably practicable, the spread of soil-borne, crop and animal diseases from the construction area (draft CoCP, Sections 6 and 9); and
- liaison and advisory arrangements with affected landowners, occupiers and agents, as appropriate (draft CoCP, Sections 5 and 6).

Assessment of impacts and effects

- 3.4.5 The cessation of existing land uses will be required not only on the land on which permanent works will be sited, but also on the land required temporarily to facilitate the construction of those permanent works.
- 3.4.6 The land required for the Proposed Scheme and for its construction will, in places, sever and fragment individual fields and operational units of agricultural and forestry land. This will result in potential effects associated with the interruption of access and effective use of residual parcels of land. There may also be the loss of, or disruption to, buildings and operational infrastructure such as drainage. The Proposed Scheme design seeks, however, to minimise this structural disruption, and to incorporate inaccessible severed land as part of environmental mitigation works.
- 3.4.7 The timing and duration of various construction elements are set out in Section 2.3. Where land is restored to agricultural use it will be subject to a further period of five years of managed aftercare to ensure stabilisation of the soil structure, where appropriate.

Temporary effects during construction

Impacts on agricultural land

- 3.4.8 During the construction phase, the total area of agricultural land used will be 203.2ha as shown in Table 4. Of this total, 144.9ha will be restored and available for agricultural use following construction.

Table 4: Agricultural land required for the construction of the proposed scheme

	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Grade 1	0	0	0
Grade 2	0	0	0
Subgrade 3a	121.6	60	86.1
BMV subtotal	121.6	60	86.1
Subgrade 3b	81.6	40	58.8
Grade 4	0	0	0
Grade 5	0	0	0
Total agricultural land	203.2	100	144.9

- 3.4.9 The disturbance during construction to 121.6ha of land of BMV quality is assessed as an impact of medium magnitude, comprising between 20 and 60% of the overall agricultural land requirement, which is the relevant threshold in the assessment methodology. However, as BMV land in this local area is a receptor of medium sensitivity, the effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme, which is significant.
- 3.4.10 Following construction the land required temporarily will be primarily reinstated to its pre-existing agricultural condition. Topsoil and subsoil material arising from the Proposed Scheme and permanently displaced will be incorporated in the Proposed Scheme design either within the area or elsewhere along the route, subject to the soil movement plans that will be prepared during the detailed design stage.

Nature of the soil to be disturbed

- 3.4.11 The sensitivity of the soils is greatest in relation to those which will be disturbed by construction activity and returned to an agricultural or other rural land-based use upon completion of the Proposed Scheme. The quantum of each disturbed soil type is less important than the sensitivity of particular soils to the effects of handling during construction and reinstatement of land.
- 3.4.12 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as Defra's Code of Practice for the Sustainable Use of Soils³³. These principles will be followed throughout the construction period. The Arrow soils are well drained and relatively easily managed whereas the heavier textured Fladbury 1, Salop and Brockhurst soils are more susceptible to compaction and smearing when moved in wet conditions or by inappropriate equipment and need particularly careful handling to avoid damage to soil structure.

Impacts on holdings

- 3.4.13 Land may be required from holdings both permanently and temporarily (i.e. the latter only during the construction period). In most cases, the temporary and permanent land requirement will occur simultaneously at the start of the construction period, and it is the combined effect of both that will have the most impact on the holding. In due course some agricultural land will be restored and the impact on the individual holding will reduce, but the following assessment focuses on the combined effect during the construction phase. The residual permanent effects are discussed at the end of this section.

³³ Department for Environment, Food and Rural Affairs (Defra), (2009), *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*.

3.4.14 The effects of the Proposed Scheme on individual agricultural and related interests are summarised in Table 5. This table shows the total area of land required on a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that will be returned to the holding following the construction period. The degree of impact is based on the proportion rather than the absolute area of land required. The holding/reference name provides a unique identifier and relates to Volume 5: Maps AG-01-050b to AG-01-052 and Volume 5: Appendix AG-001-023.

3.4.15 The effects of temporary severance during construction are judged on the ease and availability of access to severed land. For the most part these will be the same during and post construction, but occasionally they will differ between the two phases. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Full details of the nature and significance of effects are set out in Volume 5: Appendix AG-001-023. Where the total sum of the land required by ALC grades differs from the total sum of the land required by holding, the difference is because some holdings are affected in more than one CFA and some holdings include non-agricultural land. The combined impact on holdings is reported once in the CFA where the main holding is located.

Table 5: Summary of temporary effects on holdings during construction

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA23/1 Land west of B4101 Waste Lane, part Dumble Farm, Coleshill*	9.5ha – 19% Medium	Negligible	Negligible	Moderate – moderate land requirement	8.0ha
CFA23/2 Barratts Lane Farm*	0.5ha; 1% Negligible	Negligible	Negligible	Negligible	0.4ha
CFA23/3 Beechwood Farm	8.4ha – 74% High	Low	Negligible	Moderate – high land requirement/ disturbance	3.8ha
CFA23/4 Truggist Hill Farm	4.5ha – 29% High	Negligible	High-loss of building	Major – high land requirement and loss of key building	2.7ha
CFA23/5 Berkswell House*	3.8ha – 84% High	Negligible	Negligible	Moderate – high land requirement	1.4ha
CFA23/6 Village Farm	2.3ha – 4% Negligible	High- loss of access for large equipment	Low	Major/Moderate – access issues	1.0ha
CFA23/7 Ram Hall Farm*	18.2ha – 18% Medium	Negligible	Negligible	Moderate – high land requirement	14.5ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA23/8 Land off Park Lane	20.4ha – 9% Low	Negligible	Negligible	Minor	18.4ha
CFA23/9 New Mercote/Mercote Mill Farm	47.1ha – 15% Medium	Medium – access available to severed land via the public highway	Medium – longer operational journeys	Moderate – severance and disruptive effects spread over a substantial length of the route	32.9ha
CFA23/10 Berkswell Estate (Forestry)	6.0ha – 12% Medium	Negligible	Low	Moderate – high land requirement and disturbance to shooting interest	1.2ha
CFA23/11 Marsh Farm	19.5ha – 58% High	Medium – access available to severed land via the public highway	Low	Major/moderate – high land requirement	11.0ha
CFA23/12 Hornbrook Farm	2.4ha -50% High	Negligible	Negligible	Moderate – high land requirement	2.0ha
CFA23/13 Packington Estate (Marsh Lane Nature Reserve)	3.8ha – 13% Medium	Negligible	Low	Moderate – high land requirement and disturbance to nature conservation activity and visitor enjoyment	1.9ha
CFA23/14 Dairy Farm	24.2ha – 4% Negligible	Low	Negligible	Minor	18.2ha
CFA23/15 Mouldings Green Farm	13.4ha – 28% High	Low	Low	Major/moderate – high land requirement and disruption to operational journeys	9.8ha
CFA23/16 Home Farm, Hampton-in-Arden	25.4ha – 8% Low (inclusive of effects in CFA24)	Medium – access available to severed land via the public highway	Medium – longer operational journeys	Moderate – severance effects and disruption to operational journeys	16.5ha
CFA23/17 Firs Farm*	5.6ha – 6% Low	Negligible	Negligible	Minor	5.1ha

* No Farm Impact Assessment interview conducted; data estimated.

3.4.16 Overall, it is considered that 13 holdings will experience moderate to major effects adverse during construction.

3.4.17 No farm enterprises which are sensitive to noise or vibration emitted during the construction phase, for example intensive poultry houses, have been identified near to the Proposed Scheme. The proximity of a building adjacent to the construction area at Truggist Lane may prejudice its use as a livestock shelter.

Cumulative effects

3.4.18 There are no known cumulative effects arising from the construction of the Proposed Scheme as a consequence of other development projects affecting agricultural land in the locality.

Permanent effects from construction

Impacts on agricultural and forestry land

3.4.19 Land used for the construction of the Proposed Scheme will fall into a number of categories when work is complete:

- part of the operational railway and kept under the control of the operator;
- returned to agricultural use (with restoration management);
- used for drainage or floodplain replacement storage which may also retain some agricultural use; or
- used for ecological and landscape mitigation.

3.4.20 Following construction and restoration, the area of agricultural land that will remain permanently required will be 58.3ha, as shown in Table 6. A further 13.1ha of forestry land will also be permanently removed. The areas refer to agricultural land of a particular grade that is required permanently for the Proposed Scheme, and its proportion of the total area of agricultural land required permanently.

Table 6: Agricultural and forestry land required permanently

	Total area required (ha)	% agricultural land
Grade 1	0	0
Grade 2	0	0
Subgrade 3a	35.5	61
BMV subtotal	35.5	61
Subgrade 3b	22.8	39
Grade 4	0	0
Grade 5	0	0
Total agricultural land	58.3	100
Forestry land	13.1	-

- 3.4.21 The permanent loss of 35.5ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall permanent agricultural land requirement. As previously stated, BMV land in this local area is a receptor of medium sensitivity so that the permanent effect on BMV land is assessed as a major/moderate adverse effect of the Proposed Scheme, which is significant.
- 3.4.22 Areas proposed for ecological and landscape mitigation which will be removed from mainstream agricultural production include severed land between the route and the Kenilworth Greenway; severed land in the vicinity of Beechwood House, Truggist Lane; land east of Cherry tree Cottage, Truggist Lane; severed land west of the route at Lavender Hall Lane; land to the west of Lavender Hall Lane, north of the junction with Park Lane; severed land parcels between the route and the junction of Park Lane and A452 Kenilworth Road; severed land in the vicinity of Sixteen Acre Wood and Marsh Farm; land west of A452 Kenilworth Road at Marsh Lane; and land adjacent to the River Blythe to the north of the B4102 Meriden Road.
- 3.4.23 Areas engineered to provide floodplain replacement storage could be subject to marginal downgrading in land quality and are located on the west side of Lavender Hall Lane and in the vicinity of Marsh Farm.
- 3.4.24 Areas of woodland within the Berkswell Estate will be permanently affected. The total amount of forestry land required to implement the Proposed Scheme will be 13.1ha, out of a total permanent land requirement of 247ha (5.3%). Although the extent of the forest cover (6%) in the study area is less than the average national woodland cover (10%) the loss of woodland will be mitigated by approximately 23ha of broadleaved woodland planting proposed as part of the Proposed Scheme. Where appropriate, soils displaced from the affected woodland will be translocated. The effect on woodland in quantitative terms is not considered to be significant. The qualitative assessment of loss of woodland is addressed in Ecology (Section 7).

Impacts on holdings

- 3.4.25 The permanent residual effects from the construction of the Proposed Scheme on individual agricultural and related interests is summarised in Table 7. The land required column refers to the area of land permanently required to operate the Proposed Scheme (in absolute terms and as a percentage of the overall area farmed). The degree of impact is based on the proportion of land required. The effects of severance are judged on the ease and availability of access to severed land once construction is completed and the impact on farm infrastructure refers mainly to the loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises. Full details of the nature and scale of effects are set out in Volume 5: Appendix AG-001-023.

Table 7: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Severance	Infrastructure	Scale of effects
CFA23/1 Land west of B4101 Waste Lane, part Dumble Farm, Coleshill	1.5ha – 3% Negligible	No effects Negligible	No effects Negligible	Negligible
CFA23/2 Barratts Lane Farm	0.1ha Negligible	No effects Negligible	No effects Negligible	Negligible
CFA23/3 Beechwood Farm	4.6ha – 40% High	Severance by diverted pipeline and watercourse Low	No effects Negligible	Moderate – high land requirement
CFA23/4 Truggist Hill Farm	1.8ha – 12% Medium	Severed land incorporated in landscape mitigation Negligible	Loss of building High	Major – loss of principal building
CFA23/5 Berkswell House	2.4ha – 53% High	No effects – severed land incorporated in landscape mitigation Negligible	No effects Negligible	Moderate – high land requirement
CFA23/6 Village Farm	1.3ha – 2% Negligible	No effects Low	Proximity of building to route Low	Minor
CFA23/7 Ram Hall Farm	3.7ha – 3.7% Negligible	Severed land incorporated in environmental mitigation or provided with alternative access Negligible	No effects Negligible	Negligible
CFA23/8 Land off Park Lane	2.0ha – 0.9% Negligible	Unit severed by route and diverted Park Lane. Access provided to residual land Medium	No effects Negligible	Moderate
CFA23/9 New Mercote/Mercote Mill Farm	14.2ha – 5% Negligible	Severance effects of route mitigated by provision of overbridge Low	No effects Negligible	Minor
CFA23/10 Berkswell Estate (forestry)	4.8ha – 10% Low	Severance of woodland mitigated by retention of existing access or provision of alternative to residual areas	No effects Negligible	Minor

Holding reference/name	Land required	Severance	Infrastructure	Scale of effects
		Negligible		
CFA23/11 Marsh Farm	8.5ha – 25% High	Severance created by new access road to trackside facility Low	No effects Negligible	Major/moderate – high land requirement
CFA23/12 Hornbrook Farm	0.4ha – 8% Low	No effects Negligible	No effects Negligible	Negligible
CFA23/13 Packington Estate (Marsh Lane Nature Reserve)	1.9ha – 6% Low	No effects Negligible	No effects Negligible	Minor
CFA23/14 Dairy Farm	6.0ha – 0.9% Negligible	No effects; access across route maintained Low	No effects Negligible	Minor
CFA23/15 Mouldings Green Farm	3.6ha – 8% Low	No effects; access across route maintained Low	No effects Negligible	Minor
CFA 23/16 Home Farm, Hampton-in-Arden	8.9ha -3% Negligible (inclusive of effects in CFA24)	Severance of fields mitigated by retention of existing access or provision of alternative access to residual areas Low	Disruptive effects to operational movements caused by closure of Diddington Lane Medium	Moderate- Permanent disruption to operational movements
CFA 23/17 Firs Farm	0.5ha -0.5% Negligible	Severance mitigated by provision of alternative access. Low	No effects Negligible	Minor

* No Farm Impact Assessment interview conducted; data estimated.

3.4.26 Overall, it is likely that five holdings will experience moderate to major permanent adverse effects from the construction of the Proposed Scheme. Although financial compensation will be available, there can be no certainty that this would be used to reduce the above adverse effects by the purchase of replacement land or construction of replacement buildings. Therefore, the above assessment should be seen as the worst-case, which could be reduced if the owner and/or occupier is able to use compensation payments to replace assets.

Cumulative effects

- 3.4.27 There are no known permanent cumulative effects arising from the construction of the Proposed Scheme as a consequence of other development projects affecting agricultural land in the locality.

Other mitigation measures

- 3.4.28 No further mitigation measures are considered necessary, with the exception of, where appropriate, soils displaced from the affected woodland will be translocated to locations proposed woodland planting.

Summary of likely significant residual effects

- 3.4.29 During construction the total area of agricultural land required is 203.2ha, of which 121.6ha is BMV. This is assessed as a major adverse residual effect which is significant.
- 3.4.30 Thirteen holdings will experience temporary major or moderate adverse residual effects which are significant.
- 3.4.31 Once the construction process is complete and land required temporarily has been restored, the residual permanent requirement for agricultural land will be 58.3ha of which 35.5ha is BMV. This is assessed as a major/moderate residual adverse effect which is significant.
- 3.4.32 A total of five holdings have been identified that will experience major or moderate permanent effects, which is significant. Of these three will be likely to remain as agricultural or rural businesses and the use of compensation payments to purchase replacement land or farm buildings could reduce the effects to not significant. Of the other two holdings, one is primarily a residential interest, and a second may not have survived the major adverse effects experienced during construction.

3.5 Effects arising from operation

Avoidance and mitigation measures

- 3.5.1 No measures are required to mitigate operational effects of the Proposed Scheme on agriculture, forestry and soils.

Assessment of impacts and effects

- 3.5.2 Potential impacts arising from the operation of the Proposed Scheme will include:
- noise emanating from moving trains and warning signals; and
 - the propensity of operational land to harbour noxious weeds.
- 3.5.3 The potential for significant effects on sensitive livestock receptors from noise has been assessed. No likely significant effects have been identified.
- 3.5.4 The propensity of linear transport infrastructure to harbour and spread noxious weeds is not only a consequence of the management of the highway and railway land, but

also of the readiness of weed spread onto such land from adjoining land, which could be exacerbated with the effects of climate change. The presence of noxious weeds, ragwort in particular, is susceptible to control through the adoption of an appropriate management regime which identifies and remedies areas of weed growth which might threaten adjoining agricultural interests.

Summary of likely significant residual effects

3.5.5 No significant residual effects on agriculture, forestry and soils have been identified for the operation of the Proposed Scheme.

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})³⁴ 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 dust emissions associated with demolition, site preparation works and the use of haul routes to and from the sites.
- 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-001-023;
 - Map AQ-01-023; and
 - Map AQ-02-023-01.
- 4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2 CFA23 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 (Appendix CT-001-000/1), the SMR Addendum (Appendix CT-001-000/2) and appendices presented in Volume 5: Appendix AQ-001-023. 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 may 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)³⁵. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on

³⁴ 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.

³⁵ Institute of Air Quality Management (IAQM), (2011), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance*.

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 '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 pollutants in the area is emissions from road traffic. Major roads in the area include the A452 Kenilworth Road, A45 Coventry Road and the M42.
- 4.3.2 Estimates for NO₂, PM₁₀ and PM_{2.5} concentrations have been obtained from background concentration maps produced nationally by the Department for Environment and Rural Affairs (Defra)³⁶.
- 4.3.3 The area of Balsall Common and Hampton-in-Arden lies within the Solihull Metropolitan Borough Council (SMBC) area. No automatic or passive air quality monitoring is undertaken by SMBC within the areas of Balsall Common, Berkswell or Hampton-in-Arden.
- 4.3.4 The data collected by SMBC in other areas of the borough show that pollutant concentrations are currently well within air quality standards and therefore no air quality management areas (AQMA) have been declared.

³⁶ Department for Environment, Food and Rural Affairs (Defra); (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 Due to the rural nature of the study area, only a small number of receptors will be in proximity of construction sites (see Volume 5: Map AQ-02-023) and roads where traffic flows will change (see Volume 5: Map AQ-01-023-01). For the construction dust assessment, these receptors are: Lavender Hall Farm, Top Lodge, Final Home, properties along Marsh Lane and Truggist Lane, Patrick Farm and Pasture Farm. For the construction/operational traffic assessments, additional receptors are: properties along A452 Kenilworth Road, Marsh Cottage, Mercote Lodge, Runnymede, Diddington Hall, 179 Fillongley Road, Redfern Farm, The Folly, 1 Kelsey Lane, Heart of England School, 198 Old Station Road, properties along Lavender Hall Lane and Diddington Lane.
- 4.3.6 Berkswell Marsh site of special scientific interest (SSSI), which lies adjacent to the route (See Volume 5: Map EC-01-051), is the only nationally designated site sensitive to the effects of dust identified within the study area. There are a number of sites of ecological interest and local wildlife sites (LWS) near to construction activities; these have been considered in the assessment of effects arising during construction.

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 route-wide implementation of the Code of Construction Practice (CoCP), where appropriate. The draft CoCP (see Volume 5: Appendix CT-003-000) includes a range of mitigation measures that are accepted by the IAQM as being suitable to reduce impacts 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 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 and exposure to NO₂ and PM₁₀, as well as ecological receptors sensitive to dust and nitrogen deposition.

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

- 4.4.5 In the Balsall Common and Hampton-in-Arden area, construction activities for the Proposed Scheme will take place adjacent to receptors at Truggist Lane and Marsh Lane as well as Top Lodge, Final Home, Lavender Hall Farm, Berkswell Marsh SSSI, Patrick Farm and Pasture Farm. Dust emissions are most likely to be associated with the demolition of one building, earthworks, construction and the use of haul routes to and from the sites.
- 4.4.6 Locally designated sites such as Berkswell Marsh Meadow LWS, Patrick Farm LWS and Mouldings Green Farm LWS have been considered in this assessment and are not likely to be significantly affected by construction activities.
- 4.4.7 Given the mitigation contained within the draft CoCP, the assessment of impacts arising from dust emissions has concluded that they will be slight adverse in magnitude at worst and that the effect will not be significant. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-023.
- 4.4.8 Construction activity can also affect local air quality through the additional traffic generated on the highway network as a result of construction traffic routes and changes to traffic patterns arising from temporary road diversions/realignments. The assessment of construction traffic emissions has been undertaken for a without the Proposed Scheme scenario and five scenarios with the Proposed Scheme which represent peak flows during the construction period. The traffic data includes the additional traffic from future committed developments.
- 4.4.9 Construction traffic in the study area data have been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in the construction period. The screening identified areas where such further assessment was required. These were mainly the main roads within the study area, such as the A45 Coventry Road, M42 junction 6, A452 Kenilworth Road as well as Park Lane.
- 4.4.10 The assessment of impacts arising from predicted changes to road traffic emissions along the local road network has concluded that the impact will be negligible at all traffic receptors. Therefore the effect on local air quality as a result of the construction of the Proposed Scheme will not be significant.

Permanent effects

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

Cumulative effects

- 4.4.12 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

- 4.4.13 Specific mitigation measures will be included in the LEMP for the area at Marsh Lane to limit the impact of dust from the movement of construction traffic along the site haul road. No other mitigation measures during construction are proposed in relation to air quality in this area.

Summary of likely significant residual effects

- 4.4.14 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.
- 4.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026; a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data includes the additional traffic from future committed developments.
- 4.5.4 Traffic data in the Balsall Common and Hampton-in-Arden area have been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026. The screening identified areas where a quantitative assessment was required. These were along the main roads within the study area, namely the A45 Coventry Road, M42 junction 6 and A452 Kenilworth Road.
- 4.5.5 The assessment of impacts arising from predicted changes to road traffic emissions along the local road network has established that the impact will be negligible at all receptors. The effect on local air quality as a result of the operation of the Proposed Scheme will not be significant. Further details regarding this assessment are provided in Volume 5: Appendix AQ-001-023.

Cumulative effects

- 4.5.6 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. The assessment has concluded that no cumulative effects are likely.

Other mitigation measures

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

Summary of likely significant residual effects

- 4.5.8 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:

- temporary and permanent impacts on a number of public rights of way (PRoW), and the regionally significant Kenilworth Greenway, due to temporary alternative routes and diversions required as part of the Proposed Scheme;
- permanent loss of the Berkswell Clay Pigeon Club and the Heart of England Aeromodellers site;
- temporary impacts to pupils at The Island Project School at Diddington Hall due to changes in accessibility between the school and Hampton-in-Arden village and amenity impacts; and
- temporary 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 PRoW surveys undertaken within the CFA are contained in Volume 5: Appendix CM-001-023.

5.1.4 Community assessment maps are provided in Maps CM-01-151b to CM-01-153, Volume 5, Map Book Community.

5.1.5 The current assessment draws on information gathered from local and regional sources including; Solihull Metropolitan Borough Council (SMBC), Warwickshire Local Access Forum, Berkswell Parish Council, Berkswell Clay Pigeon Club, The Island Project at Diddington Hall and the Heart of England Aeromodellers Club.

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 following local assumptions.

5.2.2 Worker accommodation will be located adjacent to the Park Lane cutting main compound and the A452 Kenilworth Road overbridge satellite compound. Construction worker impacts on community resources are considered at a route wide level in Appendix CM-002-000. The assessment takes into account the number of workers, the type and location of accommodation, working hours, facilities provided on construction compounds, experience from large projects (such as HS1) and the measures contained in the draft CoCP. On this basis it is concluded that there will be no significant effects associated with worker accommodation.

5.3 Environmental baseline

Existing baseline

- 5.3.1 Baseline data on community resources was collected up to 500m from the centreline of the Proposed Scheme 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 Proposed Scheme. 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 majority of community facilities serving this area such as general practice surgeries, schools and community meeting places are located within the village centres of Balsall Common, Hampton-in-Arden and Berkswell. These village centres are outside of the study area as the Proposed Scheme does not require land within the villages and there will not be amenity or isolation effects in these locations.
- 5.3.4 There are a range of recreational facilities within the study area, which are on the outskirts of Balsall Common and Hampton-in-Arden. These include sporting activities that reflect the agricultural diversification of the area and PRoW that provide access to the open countryside and between the smaller villages and farmsteads. In addition, there are a number of sparsely located residential properties on the outskirts of the villages. For the purposes of the assessment the route has been split into sections. Each section provides a more detailed account of the community resources and receptors within the study area, in accordance with key sections and features of the Proposed Scheme within CFA 23.

Start of Balsall Common and Hampton-in-Arden to Truggist Lane

- 5.3.5 This is a rural area to the north of Burton Green and the east of Balsall Common and is split by the Rugby to Birmingham line with Catchems Corner to the south and Carol Green to the north.

Residential

- 5.3.6 Old Waste Lane located to the north-west of Burton Green, is the location of approximately 15 residential properties, which are within the study area. The properties are detached and semi-detached 'new build' style family homes.
- 5.3.7 There are 15 residential properties located on Truggist Lane, including those at the junction with Baulk Lane and extending eastwards past Pandora Cottage. These

properties are predominantly large detached houses within generous plots set within attractive semi-rural surroundings. The most western properties are approximately 100m from Berkswell station and the easterly properties adjacent to Hodgett's Lane. The southern edge of the residential properties on Truggist Lane is at the boundary of land that is required to construct the Proposed Scheme.

Open space and recreational PRow

- 5.3.8 The Kenilworth Greenway, described as a linear country park and a permissive bridleway, is used by pedestrians, cyclists and horse riders. The Kenilworth Greenway runs from the A429 Coventry Road, in a north westerly direction to the outskirts of Balsall Common at the south of Truggist Lane. The Kenilworth Greenway is approximately 6.1km in total length and runs along the line of the dismantled Kenilworth to Balsall Common line and has received Sustrans investment to become part of the national cycle network. The most northern section of the Kenilworth Greenway, which runs from the north of B4101 Waste Lane at Burton Green to the south of Berkswell station, is approximately 850m in length and is within the land required for the construction of the Proposed Scheme. Further south the Kenilworth Greenway is addressed in the Stoneleigh, Kenilworth and Burton Green CFA (see Volume 2, CFA Report 18, Stoneleigh, Kenilworth and Burton Green, Section 5, Community).

Truggist Lane to Lavender Hall Lane

- 5.3.9 The route will cross Truggist Lane, where there is a cluster of community facilities on the outskirts of Balsall Common. These include the Railway Inn public house, the Balsall Common Royal British Legion and the Balsall Common Health Centre, all of which are outside of the study area. The route will then pass the eastern extent of Balsall Common that includes residential areas and open space, which also lie outside of the study area, and are bound by the existing Rugby to Birmingham line.

Community infrastructure

- 5.3.10 Lavender Hall Fisheries, to the north-west of Berkswell station and parallel to the Rugby to Birmingham line, is located immediately adjacent to the route. The site includes a collection of fishing lakes which are accessed via a track off Lavender Hall Lane. The fisheries are accessible to the public by paid entry and facilities include a café, shop and provision for disabled users.
- 5.3.11 To the north of the fisheries, adjacent to Lavender Hall Farm, is the Berkswell Clay Pigeon Shooting Club shooting ground. The site is accessed off Lavender Hall Lane via a track across Ram Hall Farm. The facility provides a hard standing parking area, a club house and a shooting ground with clay traps. The club is used on a weekly basis by members. There are approximately 44 members that collectively own the club and shooting grounds.

Lavender Hall Lane to Marsh Farm

- 5.3.12 Lavender Hall Lane provides a direct route from Berkswell village to the larger village of Balsall Common. Berkswell village provides local facilities including a primary school, a church and a public house, all of which are located outside of the study area.

Residential

- 5.3.13 There is a group of seven sparsely located residential properties on Lavender Hall Lane, Park Lane and the A452 Kenilworth Road. These include Final Home, Top Lodge and a cluster of five properties on Lavender Hall Lane including Fernbank Cottage and Lavender Hall Farm, all to the north of the Rugby to Birmingham line. These properties are mostly detached with large areas of land amongst agricultural fields and south of Sixteen Acre Wood and Park Lane Spinney.

Open space and recreational PRow

- 5.3.14 The Heart of England Way, which includes Footpath M214, is a long distance walking route, approximately 167km in total length. The route starts at Milford Common on Cannock Chase and ends at Bourton-on-the-Water in the Cotswolds. A small section of the Heart of England Way (a section of Footpath M214), to the south-west of Berkswell village centre where it approaches Park Lane is within land required permanently by the Proposed Scheme. This section of the Heart of England Way also forms part of the Millennium Way.
- 5.3.15 Millennium Way is a signed path made up of a collection of local PRow (including Footpaths M214, M 215, M216, and M217). It is approximately 161km in total length, and includes 44 signed circular walks which cover part of Millennium Way, each circular walk being between 5km and 16km in length. The Millennium Way runs from Pershore in Worcestershire to Middleton Cheney in South Northamptonshire, via Meriden. Footpaths that make up the Millennium Way are within land required for the construction and operation of the Proposed Scheme in two locations. This includes a section of the PRow at the edge of Sixteen Acre Wood (Footpath M216), and a section approximately 50m east of Marsh Farm (Footpath M217). A section of Footpath M215 is also crossed by the Proposed Scheme to the east of the Blooms Garden Centre; however this section does not form part of the Millennium Way (see Volume 5: Appendix CM-001-023).

Marsh Farm to Mercote Hall Lane (Bridleway M218) accommodation overbridge

Residential

- 5.3.16 This is a short section of the route running through agricultural land, commencing to the south-east of the A452 Kenilworth Road, approximately 50m south-east of Marsh Farm and continuing to Mercote Hall Lane. This includes residential properties along the A452 Kenilworth Road, to the north of Bradnocks Marsh Lane, and on Marsh Lane, six of which are within the study area. These include:

- Marsh Cottage, Mercotes Cottages (two properties) and Marsh Farmhouse, which are accessed via a track off the western side of the A452 Kenilworth Road; and
- Mercote Lodge and Hornbrook Cottage on Marsh Lane, to the west of the A452 Kenilworth Road.

These properties are adjacent to land required to construct and operate the Proposed Scheme.

Mercote Hall Lane (Bridleway M218) accommodation overbridge to the River Blythe Bypass culvert

- 5.3.17 The route will approach an area to the east of Hampton-in-Arden village centre, passing through open countryside and crossing the A452 Kenilworth Road. This section includes the Marsh Lane Nature Reserve.

Open space and recreational PRow

- 5.3.18 Marsh Lane Nature Reserve is located to the east of Hampton-in-Arden village and south of the B4102 Meriden Road and it includes an area of approximately 468,700m². The nature reserve is accessible to visitors by purchase of a day or year permit. There are three car parks and access is provided via a series of locked gates off Marsh Lane to the west side and off the Old Kenilworth Road (Footpath M230a), which runs south off the B4102 Meriden Road. The Old Kenilworth Road runs through the nature reserve separating it into western and eastern areas. The larger western area of the nature reserve consists of three main pools that together with the River Blythe, woodland and grassland provide habitats for a diverse range of species. In addition, the car parks, a cabin and a network of footpaths are located within the western area of the nature reserve. The eastern area contains an area of open grassland and is bound by the A452 Kenilworth Road. The nature reserve is well known for its breeding and wintering bird populations and attracts a large number of visitors, including the West Midlands Bird Club on this basis. There are limited alternative sites that provide a similar level of species diversity within the wider area. The eastern extent of the nature reserve includes an area of land required to construct and operate the Proposed Scheme.

River Blythe Bypass culvert to River Blythe viaduct

- 5.3.19 The route will cross the B4102 Meriden Road and pass the eastern outskirts of Hampton-in-Arden village. The village centre provides several local services, all of which are outside of the study area.

Residential

- 5.3.20 Diddington Lane is located on the north eastern outskirts of Hampton –in-Arden village. Approximately 25 residential properties on the eastern side of Diddington Lane are within the study area. The section of a garden of a property off Diddington Lane is within an area required for the operation of the Proposed Scheme.

Community infrastructure

- 5.3.21 The Heart of England Aeromodellers site to the south of the B4102 Meriden Road and north of Marsh Lane Nature Reserve is within an area of land required to construct and operate the Proposed Scheme. The site provides a take-off and fly zone with a small club house. The club is affiliated to the British Model Flying Association. The site is used daily by the Heart of England Aeromodellers Club, with a maximum of 80 members from across the West Midlands region. The club also host a range of events and social gatherings, particularly during the summer months.

River Blythe viaduct to Shadow Brook underbridge

- 5.3.22 This part of the Proposed Scheme passes through open countryside, north of Hampton-in-Arden village. There are no residential properties or community facilities within the study area within this section of the route.

Shadow Brook underbridge to end of Balsall Common and Hampton-in-Arden CFA

- 5.3.23 This section of the route passes through open countryside on approach to the A45 Coventry Road.

Community infrastructure

- 5.3.24 The Island Project School at Diddington Hall is an independent school that serves 26 children with Autism and Asperger's Syndrome from ages 5 to 19 years. The grounds of Diddington Hall extend primarily to the west towards Diddington Lane, east towards the A452 Kenilworth Road and south towards Hampton-in-Arden village. The grounds extend to approximately 1.6 hectares in total. The grounds provide a teaching resource used for learning and play activities and are in continual use by pupils during the school day. This includes the track to Diddington Hall, which leads on to Diddington Lane and connecting footpaths to Hampton-in-Arden village. The track off Diddington Lane forms the main pedestrian and vehicular access to the school; the front entrance point directly off the A452 Kenilworth Road is not used.

Future baseline

Construction (2017)

- 5.3.25 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for the community, or that will be significantly affected by the Proposed Scheme from a community perspective.

Operation (2026)

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

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 The following measures have been incorporated into the scheme design as part of the design development process to avoid or minimise the environmental impacts during construction:

- amending the Proposed Scheme to allow B4102 Meriden Road to remain open and as such removing the need for a new B4102 Meriden Road/Diddington Lane link and associated tie-in works and minimising impacts on the amenity of residents at Diddington Lane;
- re-locating the River Blythe Bypass culvert satellite compound northwards to avoid Marsh Lane Nature Reserve;
- re-locating a balancing pond at the eastern extent of Marsh Lane Nature Reserve, close to the existing A452 Kenilworth Road, in order to minimise land required at the nature reserve;
- provision for temporary alternative route and permanent diversions of PRoW and a temporary alternative route for the Kenilworth Greenway;
- Diddington Lane will be stopped up south of the access track to the rear of Diddington Farm and Diddington Hall and north of the residential properties, thereby retaining access to these properties; and
- re-locating the Shadow Brook underbridge satellite compound at a greater distance from The Island Project School, to reduce amenity impacts.

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 practical, maintenance of PRoW for pedestrians, cyclists and equestrians 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 practicable, the avoidance of large good vehicles operating adjacent to school 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-001-023. 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.

Start of Balsall Common and Hampton-in-Arden to Truggist Lane

Temporary effects

Residential properties

- 5.4.4 Seven residential properties to the western end of Truggist Lane and at the junction with Baulk Lane will be in close proximity to the construction of the Proposed Scheme. The works will include the Carol Green Rail underbridge and the route raised on the Beechwood embankment with landscape earthworks and planting before reaching the Balsall Common viaduct. Construction activities will include; the erection of temporary fencing approximately 2.4m high around the properties and the Carol Green Rail underbridge (north) satellite compound to the east of the properties. Truggist Lane will provide a construction traffic route, and a construction haul road will run from Truggist Lane to the satellite compound north of the existing Rugby to Birmingham line.
- 5.4.5 These works will result in significant noise effects during the daytime on all seven properties and during the night-time on two of these properties. The daytime effects are mainly due to vegetation clearance, earthworks and construction of the Balsall Common viaduct. At night-time the noise effects will be due to the installation of a railway protection barrier at the Carol Green Rail underbridge. Residents of all seven properties will experience significant adverse visual effects. For those properties at Baulk Lane this will include the construction of the Balsall Common viaduct, with prominent views of cranes. The residential properties to the south of Truggist Lane will be nearby the Carol Green Rail underbridge (north) satellite compound, with views of the construction haul road. In addition, the use of Truggist Lane as a construction traffic route will result in a significant increase in Heavy Goods Vehicles (HGVs), passing the residential properties and accessing the construction haul road to the south.
- 5.4.6 The combination of significant noise, visual and HGV effects will result in a major adverse effect on the amenity of residents at these properties for approximately four years and three months in total, and is therefore considered significant.

Open space and recreational PRow

- 5.4.7 An approximate 850m long section of the Kenilworth Greenway will be removed during the construction of the Proposed Scheme for use as a haul road. The existing

route of the Kenilworth Greenway will therefore be closed to the public for a period of approximately four years and three months. A temporary alternative route will be provided to the south-west of the existing Kenilworth Greenway which will be of an equivalent standard and approximately 100m longer in length. To the south-east, the temporary alternative route will continue into the Kenilworth, Stoneleigh and Burton Green area (CFA 18). To the north-west the temporary alternative route will join with an existing Footpath M191, which is used to access the existing Kenilworth Greenway, adjacent to Berkswell station. The original line of the Kenilworth Greenway will be reinstated once construction is complete. The temporary removal of Kenilworth Greenway will be a negligible adverse effect, as a replacement will be provided, and is therefore not considered significant.

- 5.4.8 The diverted Kenilworth Greenway will be located alongside the construction of the Proposed Scheme to the north-east. This will include the construction of the route on the Beechwood embankment which will vary between 9m and 15m high, the Beechwood Farm accommodation underpass and two balancing ponds. In addition, the location of temporary material stockpiles alongside the re-routed Kenilworth Greenway and the presence of the Beechwood Farm accommodation underpass satellite compound will be in the immediate foreground of users of the Kenilworth Greenway alternative route. The removal of trees and woodland along the existing Kenilworth Greenway and the construction of the Proposed Scheme parallel to it and centrally with in view of users of the re-routed Kenilworth Greenway will result in a significant adverse visual effect. In addition, the presence of HGV traffic along the existing Kenilworth Greenway and within prominent view will be a significant effect. The combination of significant visual and HGV effects will result in a moderate adverse effect on the amenity of those using the Kenilworth Greenway temporary alternative route for approximately four years and three months in total, and is therefore considered significant.

Permanent effects

Open space and recreational PRow

- 5.4.9 Following the construction works, the Kenilworth Greenway will be reinstated to the existing alignment in this area. The Kenilworth Greenway will be required occasionally for maintenance access to the proposed balancing ponds to the south-west. During maintenance Kenilworth Greenway will not need to close and will continue to function without any significant inconvenience to the users. This will not affect users of the Kenilworth Greenway.

Truggist Lane to Lavender Hall Lane

Temporary effects

Community infrastructure

- 5.4.10 The route will run alongside Lavender Hall Fisheries on the Balsall Common viaduct and the Lavender Hall embankment, approximately 30m from the north-eastern

boundary of the fisheries site. The construction of the route, earthworks and the Footpath M191 accommodation underpass in this location will result in significant adverse visual effects at the fisheries. This will include the erection of temporary construction fencing approximately over 2.4m high around the north-eastern boundary of the lakes, a temporary material stockpile and a haul road. In addition, the haul road, along the north-eastern boundary of the site, will result in a significant number of HGVs passing the fisheries. The combination of HGV and visual effects will result in a moderate adverse effect on the users of the fisheries for approximately two years and nine months, and is therefore considered significant.

- 5.4.11 Approximately 900m² of land at Lavender Hall Fisheries, located to the north of the lakes is required for approximately one year and three months, for the diversion of a water main. The land will be reinstated following these works. The land required is peripheral to the main uses on the site, and the fishery could continue to be used for its intended purpose without any significant inconvenience to the users. This will have a negligible adverse effect, and is therefore not considered significant.

Permanent effects

Community infrastructure

- 5.4.12 The Berkswell Clay Pigeon Shooting site will be permanently removed, including the demolition of the club house, due to the route on the Lavender Hall embankment running through the centre of the site. This will include land to the south-west of the route for landscape mitigation planting. In addition the Proposed Scheme includes the realignment of the existing Lavender Hall Lane, which will include the proposed Lavender Hall Lane overbridge and a new access road through the northern extent of the shooting site.
- 5.4.13 The club is well established and used approximately twice a month by local members. Whilst there are similar alternative facilities within North Warwickshire, this facility is owned and run by local members, and is regarded as an important local facility. The loss of the facility will result in a moderate adverse effect, and is therefore considered significant at a community level.
- 5.4.14 Approximately 340m² of land Lavender Hall Fisheries to the north of the lakes, will be required for permanent access rights, for maintenance works on an occasional basis. This will not affect the use of the fisheries.

Lavender Hall Lane to Marsh Farm

Temporary effects

Residential properties

- 5.4.15 Seven residential properties located on, the A452 Kenilworth Road (Top Lodge), Lavender Hall Lane (five properties) and Park Lane (Final Home) will experience isolation effects as a result of road closures, road traffic delays and visual barriers due to the construction works surrounding the properties. Works will be associated with

the construction of the route in the Park Lane cutting, the Lavender Hall Lane overbridge and realignment, the diversion of Park Lane and utility and watercourse diversions. Construction activities will be focused at land between Park Lane and the Rugby to Birmingham line, which is adjacent to the residential properties.

- 5.4.16 Construction works will result in significant traffic flows and delays to vehicles on the A452 Kenilworth Road and on Park Lane (see Section 12 Transport and traffic). In addition, the construction of the Lavender Hall Lane overbridge will require the temporary re-routing of Lavender Hall Lane to Park Lane, for approximately one year and six months. Following which, Park Lane will be stopped up and diverted permanently to the south, alongside the route in the Park Lane cutting. These transport effects will result in reduced accessibility from the properties to nearby local centres, including Balsall Common to the south.
- 5.4.17 Nearby construction works will also result in visual barriers surrounding the properties. This will include the erection of temporary fencing approximately 2.4m high, the Footpath M214 overbridge satellite compound, temporary material stockpiles, the Park Lane cutting main compound; workers accommodation and construction haul roads.
- 5.4.18 The combination of significant transport effects and visual barriers will result in a major adverse isolation effect on the seven properties for approximately two years and nine months, and is therefore considered significant.
- 5.4.19 Six of the properties described above, including Final Home and five properties on Lavender Hall Lane will also experience a combination of other environmental effects due to nearby construction works. A water main will be diverted along Lavender Hall Lane and an existing gas main will be diverted over the proposed Lavender Hall overbridge. These utility works, combined with site clearance and the construction of the Lavender Hall Lane overbridge will result in adverse noise effects that have been assessed as significant on the five residential properties on Lavender Hall Lane during the daytime.
- 5.4.20 The A452 Kenilworth Road, Park Lane and Lavender Hall Lane will provide construction traffic routes, in addition to a construction haul road running to the south of Park Lane. This will result in a significant increase in HGV traffic passing the properties, which may result in disturbance to residents of all six properties.
- 5.4.21 Significant adverse views due to nearby construction activities will affect all six properties. Construction works associated with the Lavender Hall Lane overbridge and diversion of Park Lane will affect properties on Lavender Hall Lane. In addition, residents at Final Home will experience views of temporary material stockpiles to the rear of the property.
- 5.4.22 The combination of noise, visual and HGV effects on five residential properties and the combination of visual and HGV effects on one residential property will result in a

major adverse effect on the amenity of residents at all six properties for approximately two years and nine months in total, and is therefore considered significant.

Open space and recreational PRow

- 5.4.23 To the north-east of Park Lane, a section of the Heart of England Way (Footpath M214) is within land required for the construction and operation of the Proposed Scheme. The land is required for Park Lane cutting and the proposed Footpath M214 overbridge, which will carry the Heart of England Way over the route. During the construction period, a temporary alternative route of approximately 482m will be provided for the Heart of England Way via Park Lane for approximately three years. The Heart of England Way will therefore continue to be available for use by pedestrians. As such this will be a negligible adverse effect, and is not considered significant.
- 5.4.24 Sections of the Millennium Way (including sections of Footpaths M215, M216 and M217) are within land required for the construction and operation of the Proposed Scheme, adjacent to Sixteen Acre Wood and to the east of Marsh Farm. This includes the construction of Park Lane cutting, Sixteen Acre Wood embankment, and the proposed Footpath M215 overbridge. Temporary alternative routes will be provided for these footpaths along the eastern and western boundaries of the land required to construct the Proposed Scheme. Access across the route, linking these routes, is provided along Park Lane on the diverted Footpath M215 to the south and via the Mercote Hall Lane (Bridleway M218) accommodation overbridge to the north.
- 5.4.25 Access to the Millennium Way will be provided throughout the construction period; however the temporary alternative routes of some sections will have a substantially increased in length. Impacts on journey times are assessed in Traffic and transport (Section 12). The Millennium Way will remain accessible. As such this will be a negligible effect, and is not considered significant.

Permanent effects

Open space and recreational PRow

- 5.4.26 A section of the Heart of England Way (Footpath M214), to the north-east of Park Lane, will be crossed by the route in the Park Lane cutting. The Proposed Scheme includes a permanent diversion of the Heart of England Way of approximately 100m, via the proposed Footpath M214 overbridge, providing access over the route and leading to Park Lane. This will be a negligible adverse effect, and is therefore not considered significant.
- 5.4.27 The Proposed Scheme includes the permanent diversion of sections of the Millennium Way. This includes Footpath M216, which is diverted to the east and west of the route, to the east of the existing A452 roundabout with Bradnocks Marsh Lane. In addition, Footpath M217 will be permanently diverted to the east of the Sixteen Acre Wood embankment, beneath the Marsh Farm viaduct and alongside Marsh Farm where it

will connect with the existing Footpath M217 to the west of the route. A section of Footpath M215, which links directly onto the Millennium Way, will be crossed by the route, in the Park Lane cutting, to the east of the Blooms Garden Centre. The Proposed Scheme includes the Footpath M215 overbridge, which will provide permanent access to the footpath over the Park Lane cutting. The footpath is then diverted to the south-west of the route and connects with the existing Footpath M216 approximately 400m south of Marsh Farm. Access to the Millennium Way will be retained. This will be a negligible effect, and is therefore not considered significant.

Marsh Farm to Mercote Hall Lane (Bridleway M218) accommodation overbridge

Temporary effects

Residential

- 5.4.28 Six residential properties located off the A452 Kenilworth Road will be in close proximity to the construction of the Sixteen Acre Wood embankment, Marsh Farm viaduct, Mercote Hall Lane (Bridleway M218) accommodation overbridge, the A452 Kenilworth Road overbridge and the realignment of the A452 Kenilworth Road. Construction activities will include a construction haul road running parallel approximately 300m east of the A452 Kenilworth Road and adjacent to Marsh Farm. The Proposed Scheme will also require utility diversion works including a water main diversion and the diversion of high and low voltage underground power lines under the A452 Kenilworth Road and Marsh Lane.
- 5.4.29 These works will result in significant noise effects during the daytime on all six properties. Residents at Mercote Lodge and Hornbrook Cottage will also experience significant vibration effects due to earthworks. In addition, all six properties will experience significant adverse visual effects. Residents at Marsh Farm, Mercote Cottage and Marsh Cottage will experience views of construction activities associated with the Sixteen Acre Wood embankment, Marsh Farm viaduct, Mercote Hall Lane (Bridleway M218) accommodation overbridge and the A452 Kenilworth Road realignment. Vehicles using the construction haul road, which crosses the panorama, will be visible in the middle ground. Residents at Mercote Lodge and Hornbrook Cottage will experience short range views dominated by construction activity associated with the A452 Kenilworth Road realignment, including the removal of the existing road in the foreground.
- 5.4.30 The combination of noise, vibration and visual effects on these properties will result in a major adverse effect on the amenity of residents at these properties for a total of approximately one year and one month, and is therefore considered significant.

Permanent effects

- 5.4.31 No permanent effects have been identified on community resources in this section arising from construction.

Mercote Hall Lane (Bridleway M218) accommodation overbridge to the River Blythe Bypass culvert

Temporary effects

Open space and recreational PRow

- 5.4.32 The route on the Blythe Bypass embankment will intercept the eastern area of Marsh Lane Nature Reserve, east of the old Kenilworth Road (Footpath M230a). In total, approximately 21,980m² of land (5% of the nature reserve) at the eastern extent of the nature reserve will be required for the construction of the Proposed Scheme. Of this, 5,540m² will be required temporarily, for construction works, whilst the remaining 16,440m² of land required will be removed permanently for the operation of the Proposed Scheme (see Section 5.4 on permanent effects to Marsh Lane Nature Reserve).
- 5.4.33 The land within the nature reserve is required for the construction of the route on the Blythe Bypass embankment. This will include a construction haul road running through the eastern extent of the nature reserve and temporary fencing around the works, approximately over 2.4m high. The construction haul road will provide access to the works and the River Blythe Bypass culvert satellite compound to the north. The temporary loss of land will make this area of the nature reserve unusable for approximately one year and nine months. The majority of the nature reserve is expected to remain open to visitors and land required during the construction period will be contained within the eastern area, whilst the key features of the nature reserve are provided within the western area. It is therefore concluded that the loss of a small area of the nature reserve will be a negligible adverse effect and is not considered significant.

Permanent effects

Open space and recreational PRow

- 5.4.34 The majority of land required at Marsh Lane Nature Reserve, will be required permanently for the Proposed Scheme, approximately 16,440m². The land is required for the route on the Blythe Bypass embankment, a balancing pond, landscaping (scrub and woodland) and a drainage channel. This area of the nature reserve (approximately 3% of the nature reserve) will be removed with no access to visitors. This is a small area of the overall site, which is located to the eastern extent of the nature reserve. This will be a negligible adverse effect, and is therefore not considered significant.

River Blythe Bypass culvert to River Blythe viaduct

Temporary effects

- 5.4.35 No temporary effects have been identified on community resources in this section arising from construction.

Permanent effects*Community infrastructure*

- 5.4.36 The Heart of England Aeromodellers site is within land required for the operation of the Proposed Scheme, and the facility will be removed permanently. The flight zone and take-off and landing area at the Heart of England Aeromodellers site will be crossed by the route on the Blythe Bypass embankment and the Patrick cutting. Landscape earthworks and mitigation planting will be located to the south-west of the route within the aeromodellers site. During construction the River Blythe Bypass culvert satellite compound and temporary material stockpiles will be located at the site.
- 5.4.37 There are alternative aeromodeller sites within the region, however these do not have comparable flying provisions and this resource provides an important local facility. The permanent loss of the Heart of England Aeromodellers site will be a major adverse effect, and therefore considered significant.

*River Blythe viaduct to Shadow Brook underbridge***Temporary effects**

- 5.4.38 The Proposed Scheme will require approximately 4802m² of land within a garden to the rear of one property on the eastern side of Diddington Lane. The majority of this land (3346m²) will be required temporarily for approximately two years during the construction period. The remaining area will be required permanently (see Permanent effects). The partial loss of a garden will be a minor adverse effect, and is therefore not considered significant at the community level.

Permanent effects

- 5.4.39 The operation of the Proposed Scheme will require approximately 1456m² of land within a garden to the rear of one property on the eastern side of Diddington Lane. The land will be required permanently as a replacement flood storage area. The partial loss of a garden will be a minor adverse effect, and is therefore not considered significant at the community level.

*Shadow Brook to the end of Balsall Common and Hampton-in-Arden CFA***Temporary effects***Community infrastructure*

- 5.4.40 Pupils of The Island Project School at Diddington Hall regularly use Diddington Lane, as a pedestrian route, to access Hampton-in-Arden village as part of life skills education. Diddington Lane will be stopped up to vehicles permanently as part of the Proposed Scheme, whilst pedestrian access will be removed temporarily during the construction period. During the construction period there will be no temporary alternative footpath provided. Pupils and staff wishing to access Hampton-in-Arden from Diddington Hall will therefore be required to use the A452 Kenilworth Road and the B4102 Meriden Road. This is not considered to be a suitable alternative route. The

relevant section of Diddington Lane will be designated as a bridleway with access provided beneath the proposed Shadow Brook underbridge following the construction period. This will be a major adverse isolation effect on the pupils for approximately three years, and is therefore considered significant.

5.4.41 Construction works within proximity to The Island Project School will include the construction of the Diddington Lane embankment, Shadow Brook underbridge, Pasture Farm accommodation overbridge and the A45 Service Road overbridge (located in the Birmingham Interchange and Chelmsley Wood area (CFA24)). These works will result in significant noise effects during the daytime. In addition, significant adverse visual effects are expected. Views of the construction works from the immediate grounds of Diddington Hall and the building itself are unlikely, although taller elements including cranes may be viewed above the height of the intervening vegetation. However, aspects of the construction of the Proposed Scheme, including the construction of the Shadow Brook underbridge and associated embankments will result in adverse views from the lane leading to Diddington Farm, which is used by pupils at the school. The combination of significant noise and visual effects will result in a major adverse effect for approximately four months in total, and is therefore considered significant.

5.4.42 HS2 Ltd will work closely with The Island Project School to identify reasonably practicable measures to mitigate the residual significant isolation and amenity effects, including discretionary measures identified in the draft CoCP.

Permanent effects

5.4.43 No permanent effects have been identified on community resources in this route section arising from construction.

Cumulative effects

5.4.44 No cumulative or community wide effects on community resources have been identified in the Balsall Common and Hampton-in-Arden area.

Other mitigation measures

5.4.45 The assessment has concluded there are significant adverse effects arising during construction in relation to community resources. No further mitigation measures have been identified at this stage.

Summary of likely significant residual effects

5.4.46 The construction of the Proposed Scheme will result in temporary effects on the amenity of residents at properties on Truggist Lane, Lavender Hall Lane, Park Lane and properties off the A452 Kenilworth Road. In addition the amenity of staff and pupils at The Island Project School at Diddington Hall, the users of the Lavender Hall Fisheries and the re-routed Kenilworth Greenway will be temporarily affected.

- 5.4.47 Berkswell Clay Pigeon Shooting Club and Heart of England Aeromodellers site will be permanently removed for the construction and operation of the Proposed Scheme.

5.5 Effects arising from operation

Avoidance and mitigation measures

- 5.5.1 The following measures have been incorporated into the Proposed Scheme design as part of the design development process to avoid or minimise environmental impacts during operation:

- landscaping alongside the Kenilworth Greenway to help screen the Kenilworth Greenway from the route;
- a noise fence barrier along the Beechwood embankment to reduce noise impacts at the Kenilworth Greenway, Lavender Hall Fisheries and nearby residential properties; and
- a noise fence barrier on Diddington Lane embankment and part of the Diddington cutting to reduce noise impacts on pupils at the Island Project School.

Assessment of impacts and effects

Start of Balsall Common and Hampton-in-Arden to Truggist Lane

Residential

- 5.5.2 A group of approximately 15 residential properties on Old Waste Lane will be located approximately 350m south of the route. This will include the route on the Beechwood embankment varying between 9m and 15m high, two balancing ponds and associated landscaping including hedgerow planting. The operation of the Proposed Scheme is predicted to result in a significant noise effect during the daytime and night-time. In addition the Proposed Scheme will result in significant adverse visual effects during the first year of operation. The Proposed Scheme will lie in the middle ground view beyond the retained hedgerow boundary. The overhead line equipment will be visible due to the removal of existing vegetation. By year 15 and beyond, planting established on the boundaries as part of the Proposed Scheme will have grown to a height of approximately 7m, making the adverse visual effect no longer significant. The combination of significant noise and significant visual effects will result in a major adverse effect on the amenity of residents in this location.
- 5.5.3 A group of 15 residential properties on Truggist Lane and at the junction with Baulk Lane will be located to the north of the Proposed Scheme. Elements of the Proposed Scheme at this location include the Beechwood embankment, Carol Green Rail underbridge and the Balsall Common viaduct along with landscape earthworks to provide visual and noise screening. The operation of the Proposed Scheme will result in significant adverse noise effects during the daytime and night-time. Residents at these properties will also experience significant visual effects. In particular those at the junction with Baulk Lane, will see the Balsall Common viaduct, approximately 20m

high (including noise fence barriers and overhead line equipment) above the existing ground level. The combination of significant noise and visual effects will result in a major adverse effect on the amenity of residents in this location.

Shadow Brook to the end of Balsall Common and Hampton-in-Arden CFA Residential

- 5.5.4 Approximately 25 residential properties on Diddington Lane will be located to the west of the route from where it passes B4012 Meriden Road on approach towards the A45 Coventry Road. This will include the route on the Patrick embankment, River Blythe viaduct and Diddington Lane embankment. The operation of the Proposed Scheme in proximity to these properties will result in significant daytime and night-time noise effects. In addition, residents at these properties will experience adverse visual effects. The Diddington Lane embankment, up to 6m high with 4m high noise fence barriers on the western side, will be visible in the centre of the view. Overhead line equipment will also be clearly visible on the skyline in the middle ground. In both cases the presence of existing trees and shrubs in gardens will have a localised and mitigating effect on views. In year one, proposed planting on the embankment will provide no visual screening effect at this stage, by year 15 of operation, proposed planting on embankments will serve to soften the engineered appearance and partially screen trains, but the effect will remain significant. The combination of significant noise and visual effects will result in a significant amenity effect on residents at this location.

Cumulative effects

- 5.5.5 No cumulative or community wide effects on community resources have been identified in the Balsall Common and Hampton-in-Arden area.

Other mitigation measures

- 5.5.6 No further mitigation is proposed at this stage.

Residual significant effects

- 5.5.7 The amenity of residents of properties on Truggist Lane, Old Waste Lane and Diddington Lane will be affected due to the operation of the Proposed Scheme.

6 Cultural heritage

6.1 Introduction

- 6.1.1 This section of the report provides a description of the current baseline for heritage assets and reports the likely impacts and significant effects resulting from the construction and operation of the Proposed Scheme. Consideration is given to the extent and heritage value (significance) of assets including archaeological and palaeo-environmental remains; historic buildings and the built environment; and historic landscapes.
- 6.1.2 With regard to heritage assets, the main issue is the extent to which designated and non-designated assets are affected by the Proposed Scheme. Impacts on assets as a result of the Proposed Scheme will occur largely through the physical removal and alteration of assets and changes to their setting.
- 6.1.3 Maps showing the location of the key environmental features can be found in the Volume 2 map book. Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5: Maps CH-01-151b to CH-01-153 and Maps CH-02-151 to CH-02-152. Detailed reports on the cultural heritage character and surveys undertaken within the CFA are contained in the Volume 5 Appendices. These are:
- Volume 5: Appendix CH-001-023 – Baseline Report;
 - Volume 5: Appendix CH-002-023 – Gazetteer of Heritage Assets;
 - Volume 5: Appendix CH-003-023 – Impact Assessment Table; and
 - Volume 5: Appendix CH-004-023 – Survey Reports.
- 6.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, BHA***, further detail on these assets can be found in the Gazetteer in Volume 5: Appendix CH-002-023.
- 6.1.5 Engagement has been undertaken with the Warwickshire County Council planning archaeologist, who also provides advice for Solihull Metropolitan Borough Council (SMBC), and the conservation officer for Solihull Metropolitan Borough Council (SMBC) with regard to the nature of the cultural heritage assets within the 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 and in the SMR (see Volume 5: Appendices CT-001-000/01) and the SMR Addendum (see Volume 5: CT-001-000/02). This report follows the standard assessment methodology.

- 6.2.2 The setting of all designated heritage assets up to 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 500m.
- 6.2.3 The cultural heritage methodology includes the consideration of the intra-project effects of a number of technical topic 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 In undertaking the assessment the following limitations were identified:
- the LiDAR³⁷ data examined did not encompass the full extent of the study area; and
 - not all areas of survey, as identified in the archaeological risk model³⁸ were available for survey.
- 6.2.5 However, a non-intrusive field survey was undertaken in a number of areas to provide data regarding the nature of sub-surface archaeological assets. Information from other sources of data, including the Historic Environment Record and local archives was utilised to provide information relating to the potential archaeological assets that may be present.

6.3 Environmental baseline

Existing baseline

- 6.3.1 In compiling this assessment documentary baseline data was collected from a variety of sources as set out in Volume 5: Appendix CH-001-023.
- 6.3.2 In addition to collation of this baseline data the following surveys were undertaken:
- walkover and site reconnaissance 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;
 - desk-top review of remote sensing data including LiDAR, aerial photographs and hyperspectral data (see Volume 5: Appendix CH-004-023); and
 - a programme of non-intrusive surveys including geophysical surveys (see Volume 5: Appendix CH-004-023).

³⁷ Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.

³⁸ The archaeological risk model is an approach that enables the identification of those areas of the Proposed Scheme where archaeological assets are known or suspected and provides a mechanism for the prioritisation of the programme of survey.

Designated assets

- 6.3.3 There are no designated heritage assets located partially or wholly within the land required temporarily or permanently for the construction of the Proposed Scheme.

Non-designated assets

- 6.3.4 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:

- the possible Iron Age hill fort (BHA150) at Hampton Lane;
- Iron Age cropmarks (BHA149) representing a field system, south of the B4102 Meriden Road, Hampton Lane;
- site of a moat (BHA132), north-east of Marsh Farm, Mercote, Berkswell Mercote;
- Berkswell Estate (BHA063), a non-designated historic park and garden including evidence of the park pale along its southern boundary;
- Diddington settlement (BHA211) surrounding Diddington Hall;
- three hedgerows meeting the archaeology and history criteria for importance as defined in the 1997 Hedgerow Regulations: two near to Pasture Farm (BHA080, BHA245) and west of Diddington Lane (BHA050); and
- cropmarks (BHA142), west of Mercote Farm.

- 6.3.5 The following identified 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 areas of ridge and furrow, including:
 - west of Lavender Hall (BHA068);
 - south-west of Mercote Hall (BHA135);
 - Mercote Farm, Berkswell (BHA121);
 - south of Park Lane (BHA107); and
 - west of Diddington Hall (BHA218).
- dismantled Kenilworth to Balsall Common line (BHA022);
- 21 features identified through LiDAR analysis, including:
 - ridge and furrow (BHA265) located south-west of Diddington Hall;
 - headland earthworks (BHA264) located south of Patrick Farm;
 - ridge and furrow (BHA262) located immediately south of Patrick Farm;

- remnants of ridge and furrow (BHA248) located north-east of Marsh Farm;
- ridge and furrow (BHA258) north of Marsh Farm;
- linear feature (BHA257) located to the east of Marsh Farm;
- ridge and furrow (BHA253) located to the east of Marsh Farm;
- ridge and furrow (BHA243) located to the north of Berkswell station;
- ridge and furrow (BHA241) located to the north-east of Berkswell station;
- ridge and furrow (BHA235) located to the south of Truggist Lane;
- ridge and furrow (BHA236) located to the west of Beechwood Farm;
- ridge and furrow (BHA234) located to the south of Beechwood Farm;
- ridge and furrow (BHA240) between Lavender Hall and Ram Hall;
- ridge and furrow (BHA259) north of Marsh Farm;
- headland earthworks (BHA261) west of Mouldings Green Farm;
- ridge and furrow (BHA252) located to the south of Diddington Hall;
- headland earthworks (BHA093) west of Diddington Lane;
- ridge and furrow (BHA172) south of Patrick Farm;
- ridge and furrow (BHA263) located to the south of Patrick Farm; and
- gardens and ridge and furrow (BHA239) associated with Berkswell House.
- eight features identified through the aerial photographic analysis:
 - medieval fields and eroded ridge and furrow (BHA103) at the Marlowes;
 - medieval fields and ridge and furrow (BHA043) around Ram Hall and Lavender Hall;
 - drains and possible water meadows (BHA166) south of the River Blythe and north of the B4102 Meriden Road;
 - medieval fields, ridge and furrow and earthworks (BHA169) located around Diddington Hall;
 - eroded ridge and furrow (BHA128) near Marsh Farm;
 - medieval fields (BHA009) including and to the east of Truggist Hill Farm;
 - medieval fields and eroded ridge and furrow south of Truggist Lane (BHA016); and
 - medieval fields and ridge and furrow (BHA062) west of Berkswell.

6.3.6 All non-designated heritage assets within 500m of the land required temporarily or permanently for the construction of the Proposed Scheme are listed in the gazetteer

at Volume 5: Appendix CH-002-023 and identified on Volume 5: Maps CH-01-151b to CH-01-153.

Cultural heritage overview

- 6.3.7 Within the study area and to the east of the Meriden Fault, the solid geology comprises the upper strata of the Carboniferous Warwickshire Group including the Tile Hill Mudstone Formation, which consists of mudstone and laminated siltstone with thin beds of sandstone and occasional conglomerate. The Bromsgrove Sandstone Formation occurs in faulted inliers associated with the western boundary fault of the Warwickshire Coalfield. It typically comprises very weak poorly cemented Sandstone, with some subordinate beds of silty and sandy Mudstone. The Mercia Mudstone Group is present (beneath superficial deposits in many places) to the west of the Meriden Fault. Within the Mercia Mudstone sequence, a thicker horizon of interbedded sandstone, siltstone and mudstone, known as the Arden Sandstone Member outcrops.
- 6.3.8 This solid geology is overlain by a continuous cover of glacial deposits and alluvial superficial deposits. Most of the glacial deposits comprise sands and gravels, which form an extensive but now dissected deposit beneath the axis of the River Blythe valley. Fluvial and alluvial deposits are present across the lower parts of the river and stream valleys. Such deposits have the potential to mask archaeological deposits and to over-lay deposits of palaeo-environmental interest.
- 6.3.9 Local areas of 'made ground' are noted within the study area, associated with surface mineral extraction and also the construction of the Rugby to Birmingham line and the A452 Kenilworth Road. Thus, providing evidence of industrial activity within the area.
- 6.3.10 The open agricultural landscape had originally been heavily wooded with current evidence suggesting few settlements and minimal land use. Small scale clearance and seasonal use of woodlands began in the prehistoric period and evidence has been noted for this activity within the study area. Within the vicinity of the ancient inventory woodland site of Siden Hill Wood, south-east of Hampton-in-Arden, a number of cropmarks (BHA142) of possible Neolithic date have been recorded.
- 6.3.11 Directly west of the North Warwickshire Golf Club, off the B4102 Meriden Road and A452 Kenilworth Road roundabout, lies an area of continued prehistoric occupation (BHA157, BHA158, BHA159, BHA12). The first evidence of this activity is a series of cropmarks (BHA152) that may be of possible Neolithic or Bronze Age date, enclosed within an approximate 18 hectare (ha) site. Evidence suggests that occupation ceased in the first half of the first century AD, and no evidence of continuity of settlement in to the Roman period has been identified.
- 6.3.12 In the Iron Age period, the study area lay at the junction of three tribal groups – the Corieltavi to the east, the Cornovii to the north-west and the Dobunni to the south-west. An Iron Age field system and possible hill fort (BHA149 and BHA150) has been

recorded in the area of Neolithic and Bronze Age cropmarks (BHA142) described above, which suggests continuity of occupation throughout the prehistoric period. This has since been partially destroyed by the construction of Packington Racecourse, at the beginning of the 19th century, North Warwickshire Golf Club and past mineral extraction activities.

- 6.3.13 In the early medieval period, the study area was part of the Hwiccan kingdom which extended over what is now Worcestershire (except its north-western extension), western Warwickshire and all of Gloucestershire (except the Forest of Dean). This tribal land then became part of the kingdom of Mercia. Place-name evidence demonstrates the occupation of the area at that time; such as Balsall meaning 'Baell(i)'s nook of land/small valley', Berkswell meaning 'Be(o)rcol's spring/stream', Hampton-in-Arden meaning 'high farm/settlement in the forest of Arden' and Meriden meaning 'pleasant valley'. Early medieval activity is also demonstrated by silver artefacts found south-west and south-east of Diddington Hall and in surviving fabric of the Church of St John the Baptist, Berkswell (BHA101).
- 6.3.14 By the time of the Domesday Survey in 1086, the study area was part of the county of Warwick that included settlements and manors such as Berkswell, Barston, Diddington and Meriden. The manor of Berkswell was established by 1325 with the park in existence by 1557. The extent of the park is suggested by a surviving earthwork known as the park pale (BHA063). The current park is characterised by open parkland, centred on the 19th century Berkswell Hall (BHA106). Hampton-in-Arden was also established by this date with the Church of St. Mary and St. Bartholomew (BHA191) retaining 12th century fabric.
- 6.3.15 Much of the remaining landscape during this period, including those areas now part of Coventry, Solihull and Birmingham, were covered by the ancient Forest of Arden. Larger scale clearance of the forest began during the medieval period giving rise to an increase in the areas of arable farming and isolated farmstead settlements. Surviving areas of forest are evidenced within elements of surviving ancient woodlands which are found throughout the study area, such as the Bogs (BHA120) and Siden Hill Wood (BHA155).
- 6.3.16 Woodland clearances were a result of deliberate moves to colonise the area with manors and moated houses, such as those at Ram Hall (BHA046) and Moat House (BHA026) in Hampton-in-Arden and at Mercote moat in Berkswell. The clearance also provided valuable building material, reflected in the high number of timber-framed buildings within the study area.
- 6.3.17 Evidence for the dominance of agriculture as the primary economic activity can be seen in the extensive areas of ridge and furrow which are present throughout the study area, and a possible hay stack stand (BAH041) located south-east of Ram Hall. Small scale rural industry is noted by a windmill (BHA141) north-east of Mercote Mill Farm and the watermills (BHA266) within the Mercote Estate. The post-medieval

rural economy is otherwise represented by small scale farms and their associated farmhouses, such as Beechwood Farm (BHA014), Mouldings Green Farm (BHA175), Barratts Lane Farmhouse (BHA023) and Pasture Farmhouse (BHA225). More elaborate farmsteads were also established, with substantial halls at Ram Hall (BHA046), Diddington Hall (BHA216) and adjacent Diddington Farmhouse (BHA222), and Lavender Hall (BHA058). All expanded in the 17th century with large barns to form farm complexes. The agricultural setting of these complexes survives largely unaltered.

- 6.3.18 More substantial settlements developed in the 16th and 17th centuries, often as an expansion of existing manors. Berkswell survives largely unaltered, while others such as Hampton-in-Arden have continued to expand. The character of Hampton-in-Arden changed significantly as a result of the work of W. E. Nesfield. Nesfield was a prominent architect of the 19th century and was employed by Sir Frederick Peel to modernise the village. This process involved the demolition of the 16th and 17th century buildings to accommodate his view of Old English architecture. A significant number of his buildings survive.
- 6.3.19 The study area avoided much of the industrialisation of the landscape initiated by the coal extraction industry in the 19th and 20th centuries; however changes did occur in the area through the arrival of the railway along the Blythe Valley. Warwickshire occupied a critical position with the railway development running through the county. This is represented by the existing Rugby to Birmingham line, part of the former London and Birmingham line of 1838. Within the study area, the Kenilworth to Berkswell branch of the London and Northwest line passes through Beechwood towards Berkswell station. This was opened to passengers in 1884, but was closed to passenger traffic in 1965.
- 6.3.20 During World War II (WWII) the nearby Birmingham Airport (previously known as Elmdon) was requisitioned by the Air Ministry. Within the study area, WWII activity is evidenced by a now demolished military and ammunition depot (BHA176) east of Hampton-in-Arden, previously located in fields to the south of B4102 Meriden Road.
- 6.3.21 There has been little change within the study area in the latter half of the 20th century.

Future baseline

Construction (2017)

- 6.3.22 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The potential for these developments to alter the current cultural heritage baseline has been reviewed as part of this assessment. None of the identified developments affect the assessment of the Proposed Scheme's likely construction impacts on heritage assets.

Operation (2026)

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

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:
- reduction in the land required to construct the Proposed Scheme in the area of Berkswell Estate (BHA063);
 - the provision of planting to minimise the impacts on the setting of the Berkswell Estate (BHA063);
 - the diversion of Park Lane to reduce impacts on the Berkswell Estate from this element of the Proposed Scheme;
 - reduction in the amount of land required to construct the Lavender Hall Lane overbridge and realigned Lavender Hall Lane to reduce the impacts on the setting of Lavender Hall (BHA058) and Lavender Barn (BHA059); and
 - profiling of landscape earthworks and incorporation of native broadleaf woodland planting to screen and reduce visual impacts on the setting of designated assets within the study area.
- 6.4.2 The draft CoCP sets out the provisions that will be adopted to control effects on cultural heritage assets. The provisions include the following (see Volume 5: Appendix CT-003-000) 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 utilities, have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required temporarily and permanently for the construction of the Proposed Scheme and assets

in the wider study area due to the visibility of plant, cranes and equipment and other construction factors.

- 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 Ram Hall (BHA046), an asset of high value, will be affected by construction activity associated with the excavation of a floodplain replacement storage area, and construction of Lavender Hall embankment, including a mitigation bund at 5m in height approximately 500m to the west. Construction activities including the presence of cranes, earthmoving plant, temporary material stockpiles and the erection of construction fencing, will impact on the significance of the asset by introducing new elements into its rural landscape setting. This will constitute a medium adverse impact and a major adverse effect. Construction activity will take place over approximately three months.
- 6.4.6 The moat (BHA045) located at Ram Hall, an asset of low value, will be affected by the use of land as a temporary material stockpile area. This will result in an impact on the ability to understand the asset within its landscape setting. This will constitute a high adverse impact and a moderate adverse effect. Construction activity will take place over approximately three months.
- 6.4.7 The Barn (BHA047) at Ram Hall, an asset of moderate value, will be affected by construction activity associated with the construction of a floodplain replacement storage area and construction of Lavender Hall embankment, including a mitigation bund at 5m in height approximately 500m to the west. Construction activities including the presence of cranes, earthmoving plant, temporary material stockpiles, approximately 100m to the west, and the erection of construction fencing, will impact on the significance of the asset by introducing new elements into its rural landscape setting. This will constitute a medium adverse impact and a moderate adverse effect. Construction activity will take place over approximately three months.
- 6.4.8 Lavender Hall Farmhouse (BHA058), an asset of high value, and its relationship with the surrounding landscape including Ram Hall (BHA046) to the east, will be impacted by construction activity associated with the construction of Lavender Hall embankment and Lavender Hall Lane overbridge and the presence of cranes, earthmoving plant, temporary material stockpiles and Park Lane cutting main compound, including temporary worker accommodation and construction fencing. The proximity of these construction elements will impact upon the relationship of the asset to its surrounding landscape setting which makes a positive contribution to its significance. This will result in a high adverse impact and a major adverse effect. Construction activity will take place intermittently over approximately one year and six months. The Park Lane cutting main compound will be present for approximately four years and three months.

- 6.4.9 The Barn at Lavender Hall Farm (BHA059), an asset of moderate value, will be affected by construction activity associated with the construction of the Lavender Hall embankment and Lavender Hall Lane overbridge and the presence of cranes, earthmoving plant, temporary material stockpiles and the Park Lane cutting main compound, including temporary worker accommodation and construction fencing. The proximity of these construction elements will affect the setting of the asset. This will constitute a high adverse impact and a major adverse effect. Construction activity will take intermittently over approximately one year and six months. The Park Lane cutting main compound will be present for approximately four years and three months.
- 6.4.10 Berkswell Conservation Area (BHA065), an asset of moderate value, will be affected by the activities associated with the construction of the Park Lane cutting and the Lavender Hall Lane overbridge, and the presence of cranes, earthmoving plant and temporary material stockpiles, approximately 200m to the south, and Balsall Common viaduct satellite compound. The rural landscape and parkland character of this asset will be affected by these construction elements. This will constitute a medium adverse impact and a moderate adverse effect. Construction activity will take place over approximately one year and three months. The Balsall Common viaduct satellite compound will be present for approximately two years and nine months.
- 6.4.11 Diddington Hall (BHA216), an asset of high value, will be affected by the activity associated with the construction of the Shadow Brook underbridge and the presence of the Shadow Brook underbridge satellite compound, approximately 320m to the west. Construction activities, including the presence of cranes, earthmoving plant and temporary materials stockpiles will affect the isolated setting of the asset which contributes to its significance. This will constitute a low adverse impact and a moderate adverse effect. Construction activity will take place over approximately one year and three months. The Shadow Brook underbridge satellite compound will be present for approximately three years.
- 6.4.12 Diddington Farmhouse (BHA222), an asset of high value, will be affected by the presence of construction activities associated with the construction of Pasture Farm overbridge and the Diddington cutting, construction of balancing ponds to the south-west and north-west, presence of the A45/A45 Service Road overbridge satellite compound (located within the Birmingham Interchange and Chelmsley Wood area (CFA24)) and the construction activities associated with the closure of Diddington Lane. Construction activities will include the presence of cranes, earthmoving plant and temporary material stockpiles located approximately 150m to the west, and the use of Diddington Lane for construction traffic. These construction elements will be visible from the asset and will change its rural setting, which makes an important contribution to its significance, but will not substantially alter its setting. This will constitute a medium adverse impact and a major adverse effect. Construction activity

will take place over approximately two years. The A45/A45 Service Road overbridge satellite compound will be present for approximately six years and six months.

- 6.4.13 Pasture Farmhouse (BHA225), an asset of moderate value, will be affected by construction activities associated with the construction of the Pasture Farm accommodation overbridge and earthworks, including the presence of cranes, earthmoving plant, temporary material stockpiles and a haul road to the east and south-east of the asset which will interrupt the rural setting of the asset. This will constitute a medium adverse impact and a moderate adverse effect. Construction activity will take place over approximately nine months.

Cumulative effects

- 6.4.14 No committed developments have been identified which will lead to any cumulative impacts from temporary impacts on heritage assets within the study area.

Permanent effects

- 6.4.15 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 the Proposed Scheme.
- 6.4.16 Two areas of ridge and furrow (BHA234, BHA236) located to the west of Beechwood Farm, each assets of low value, will be entirely removed through the construction of Beechwood embankment and Beechwood Farm accommodation underpass. This will constitute a high adverse impact and moderate adverse effect.
- 6.4.17 Medieval eroded ridge and furrow (BHA016) located to the east and south-east of Balsall Common, an asset of low value, will be partially removed through the presence of the Beechwood Farm accommodation underpass satellite compound, and the activities associated with the construction of the Beechwood embankment, Footpath M191 underpass, excavation of a balancing pond and landscape mitigation planting. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.18 An area of ridge and furrow (BHA235) located to the south of Truggist Lane, an asset of low value, will be partially removed through the construction of the Beechwood embankment, an oil pipeline diversion, Footpath M191 diversion and presence of the Carol Green Rail (north) satellite compound. This will constitute a high adverse impact and moderate adverse effect.
- 6.4.19 Gardens and ridge and furrow (BHA239), associated with Berkswell House, is an asset of low value, will be entirely removed through construction of the Balsall Common viaduct, and Beechwood embankment, excavation for a balancing pond and new ditches. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.20 An area of ridge and furrow (BHA241) located to the north-east of Berkswell station, an asset of low value will be partially removed through the construction of the Balsall Common viaduct, the diversion of an existing overhead power line, and woodland

habitat creation. This will constitute a high adverse impact and moderate adverse effect.

- 6.4.21 An area of ridge and furrow (BHA240) located between Lavender Hall and Ram Hall, an asset of low value, will be partially removed through the presence of a temporary material stockpile. This will constitute a high adverse and impact and a moderate adverse effect.
- 6.4.22 An area of ridge and furrow (BHA243) located to the north of Berkswell station, an asset of low value, will be entirely removed through the excavation of a flood plain replacement storage area and construction of the Lavender Hall embankment and Footpath M191 accommodation underpass. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.23 An area of ridge and furrow (BHA068) west of Lavender Hall Farm, an asset of low value, will be entirely removed through the presence of Park Lane cutting main compound, temporary material stockpiles and the temporary worker accommodation. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.24 The north-eastern portion an area of medieval ridge and furrow and a field system (BHA062) located to the west of Berkswell, an asset of low value, will be removed through the presence of the Park Lane cutting main compound, and activities associated with the construction of the Park Lane cutting and the Park Lane diversion. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.25 Berkswell Estate (BHA063), an asset of moderate value, will be partially removed through the construction of the Park Lane cutting and Footpath M214 overbridge through the medieval deer park at Berkswell resulting in the partial removal of the park pale. Further physical impacts will arise from the construction of the haul road, the construction of the Footpath M214 overbridge satellite compound and temporary material stockpiles. The majority of the park will remain but the Proposed Scheme will sever the historic boundary of the park resulting in a permanent loss of historic integrity and a reduction of significance. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.26 Ridge and furrow (BHA253) and a linear feature located to the east of Marsh Farm (BHA257), each assets of low value, will be entirely removed through the construction of the Sixteen Acre Wood embankment, temporary site access route and diversion of a gas main. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.27 Ridge and furrow (BHA258) to the north of Marsh Farm, an asset of low value, will be entirely removed through the construction of the Mercote Hall Lane (Bridleway M218) accommodation overbridge, Marsh Farm viaduct and floodplain storage area. This will constitute a high adverse impact and a moderate adverse effect.

- 6.4.28 An area of ridge and furrow (BHA259) north of Marsh Farm, an asset of low value, will be entirely removed by the excavation of a floodplain storage area and woodland planting. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.29 The site of a moat at Mercote (BHA132) north-east of Marsh Farm, an asset of moderate value, will be affected by the diversion of a gas main. Whilst only a portion of this asset will be permanently removed, the significance of the asset will be reduced. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.30 An area of ridge and ridge and furrow (BHA135) to the north of Marsh Cottage, and west of Mercote Hall, an asset of low value, will be entirely removed through the excavation of a balancing pond to the west of Marsh Farm and construction of the Mercote Hall Lane (Bridleway M218) accommodation overbridge, A452 Kenilworth Road realignment and associated earthworks and landscape mitigation planting. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.31 An earthwork of a headland (BHA264) located to the south of Patrick Farm, an asset of low value, will be permanently removed by the construction of the route, the construction of Patrick embankment and temporary site access route, and the construction of a mitigation bund and balancing pond. This will constitute a high adverse impact and moderate adverse effect.
- 6.4.32 Cropmarks of a possible Iron Age field system (BHA149) south of the Hampton Lane, an asset of moderate value, will be partially removed through the construction of the A452 Kenilworth Road realignment and associated earthworks and landscape mitigation planting. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.33 A possible Iron Age hill fort (BHA150) at Hampton Lane, an asset of moderate value, will be partially removed by landscape mitigation planting, introduction of woodland and the realignment of the A452 Kenilworth Road. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.34 Ridge and furrow (BHA262) located immediately south of Patrick Farm, an asset of low value, will be partially removed by the construction of Patrick cutting and an access to a balancing pond south of Patrick Farm. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.35 An area of ridge and furrow (BHA263) located approximately 400m south of Patrick Farm, an asset of low value, will be entirely removed through the construction of the Patrick cutting and the River Blythe Bypass culvert. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.36 An area of ridge and furrow (BHA265) located to the south-west of Diddington Hall, an asset of low value, will be entirely removed through the construction of the

Shadow Brook underbridge, Diddington cutting and the excavation of a balancing pond. This will constitute a high adverse impact and a moderate adverse effect.

- 6.4.37 Hedgerow (BHA050) west of Diddington Lane, an asset of moderate value, will be entirely removed through the erection of a temporary construction fence. This will constitute a high adverse impact and a major adverse effect.
- 6.4.38 The following significant effects will occur as a result of permanent impacts on the setting of heritage assets.
- 6.4.39 Ram Hall (BHA046), an asset of high value, will have its setting changed by the Proposed Scheme including the presence of the Balsall Common viaduct. These new elements will interrupt the rural setting of the asset and affect the ability to understand the significance of its relationship with the wider landscape. This will constitute a medium adverse impact and a major adverse effect.
- 6.4.40 The Barn at Ram Hall (BHA047), an asset of moderate value, will have its setting changed by the Proposed Scheme including the presence of the Balsall Common viaduct. This will constitute a medium adverse impact and a major adverse effect.
- 6.4.41 Lavender Hall Farmhouse (BHA058), an asset of high value, and its relationship with the surrounding landscape including Ram Hall (BHA046) to the east will have its setting changed by the Proposed Scheme including the presence of the Lavender Hall Lane overbridge and Lavender Hall embankment to the north-east of the asset and the Balsall Common viaduct to the south-east. This will result in a high adverse impact and a major adverse effect.
- 6.4.42 The Barn (BHA059) at Lavender Hall Farm, an asset of moderate value, will have its setting changed by the Proposed Scheme including the presence of the Lavender Hall Lane overbridge and Lavender Hall embankment to the north-east of the asset and the Balsall Common viaduct to the south-east. This will sever the relationship between the barn and the surrounding landscape and Ram Hall. This will result in a high adverse impact and a major adverse effect.
- 6.4.43 Diddington Hall (BHA216), an asset of high value, will have its rural and isolated setting changed by the Proposed Scheme including the presence of the Diddington Lane embankment, Diddington cutting and the River Blythe viaduct. This will constitute a low adverse impact and a moderate adverse effect.
- 6.4.44 Diddington Farmhouse (BHA222), an asset of high value, will have its setting changed by the Proposed Scheme including the presence of the Pasture Farm accommodation overbridge and a balancing pond to the south-west and north-east, which will be visible from the asset and interrupt the rural character of its setting. This will result in a low adverse impact and a moderate adverse effect.
- 6.4.45 Pasture Farmhouse (BHA225), an asset of moderate value, will have its setting changed by the Proposed Scheme including the presence of the Pasture Farm

accommodation overbridge. This will constitute a medium adverse impact and a moderate adverse effect.

- 6.4.46 The landscape of the study area is largely rural, and its historic character and retains a large degree of legibility due to the presence of well-defined areas of ridge and furrow. Many field boundaries are relatively modern in date, and relate to post-medieval enclosure of the medieval fields. However certain elements of medieval land division remain, in particular the former park pale of the Berkswell Estate. The study area is divided east/west by the A452 Kenilworth Road and attendant modern roadside settlement, and this, combined with existing and former rail infrastructure, has reduced the legibility of the historic landscape in this area. The Proposed Scheme will not have a significant effect on the legibility of the overall historic landscape within this area.

Cumulative effects

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

Other mitigation measures

- 6.4.48 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detailed design to reduce further the significant effects described above. These refinements will include the identification of:

- suitable locations for advance planting, to reduce impacts on the setting of assets; and
- locations where the physical impact on below ground assets can be reduced through the design of earthworks.

- 6.4.49 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the Draft CoCP will be considered during detailed design to reduce further the significant effects described above. These refinements will include the identification of:

- suitable locations for advance planting, to reduce impacts in the setting of assets; and
- locations where the physical impact on below ground assets can be reduced through the design of earthworks.

Summary of likely residual significant effects

- 6.4.50 As no mitigation beyond that described above has been identified the residual effects are the same as those reported in the permanent effects section.

- 6.4.51 The temporary effects of construction activity on the setting of heritage assets are largely reversible in nature and last for the duration of the construction works.

Residual effects will arise from the visibility of construction plant and in particular the loss of vegetation which form part of the setting of assets.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 The following design measures have been incorporated into the design of the Proposed Scheme to reduce the impacts and effects on assets:

- noise mitigation measures have been included within the Proposed Scheme design to reduce potential impacts on the setting of Lavender Hall and Barn from noise resulting from the running of trains; and
- landscape planting will increasingly reduce impacts on the setting of the assets, such as that at the Berkswell Estate, as it matures during the operational phase.

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 Significant effects will occur as a result of permanent changes to the setting of the following assets arising from the impacts of railway operation.

6.5.4 The Grade II* listed Ram Hall (BHA046), is an asset of high heritage value. During operation the presence of trains running on embankment and the Balsall Common viaduct will interrupt the rural landscape which defines the asset's setting to the north and its relationship with Lavender Hall. It will introduce a new dynamic element into the setting of the asset. This will constitute a low adverse impact and a moderate adverse effect.

6.5.5 The Barn at Ram Hall (BHA047), an asset of moderate value. During operation the presence of trains running on embankment and the Balsall Common viaduct will interrupt the rural landscape which defines the asset's setting to the north and its relationship with Lavender Hall. It will introduce a new dynamic element into the setting of the asset. This will constitute a low adverse impact and a moderate adverse effect.

6.5.6 The Grade II* listed Lavender Hall Farmhouse (BHA058) is an asset of high value. During operation the presence of trains running on embankment and the Balsall

Common viaduct will interrupt the rural landscape which defines the asset's setting to the north and its relationship with Ram Hall. This will introduce a new dynamic element into the setting of the asset and changes in the ability to understand and appreciate the resource and its historical context and setting. This will constitute a high adverse impact and a major adverse effect.

- 6.5.7 The Grade II listed Barn (BHA059) at Lavender Hall Farm is an asset of moderate value. During operation the presence of trains running on embankment and the Balsall Common viaduct will interrupt the rural landscape which defines the asset's setting to the north and its relationship with Ram Hall. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.5.8 The Grade II* listed Diddington Farmhouse (BHA222) is an asset of high value. During operation the presence of trains and associated noise of the operational scheme will introduce a new dynamic element into the rural setting of the asset. This will constitute a low adverse impact and moderate adverse effect.

Cumulative effects

- 6.5.9 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 on Volume 5: Maps CT-13-050b to CT-13-052-R1. No significant cumulative effects have been identified in relation to cultural heritage.

Other mitigation measures

- 6.5.10 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

- 6.5.11 As no mitigation beyond that described has been identified, the residual effects are the same as those reported in the assessment of impacts and effects section.

7 Ecology

7.1 Introduction

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

7.1.2 The principal ecological issues in this area are:

- loss and fragmentation of marshy grassland at Berkswell Marsh Meadow Local Wildlife Site (LWS), Patrick Farm Meadow LWS and Mouldings Green Farm LWS;
- risk of habitat severance for bats at Marlowes wood; and
- loss and fragmentation of semi-natural woodland on the Berkswell Estate; and species-rich 'Important' hedgerows near Diddington Lane.

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

- ecological baseline data (Volume 5: Appendices EC-001-004 to EC-004-004); and
- register of local/parish level effects which are not reported individually in Volume 2 are reported in 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: Environment Agency; Solihull Metropolitan Borough Council; Warwickshire Biological Records Centre; Warwickshire Wildlife Trust and the West Midland Bird Club.

7.2 Scope, assumptions and limitations

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

7.2.2 A Water Framework Directive assessment has been undertaken in conjunction with the environmental assessment. Details of this assessment are presented in Volume 5: Appendix WR-001-023.

7.2.3 The surveys that have been undertaken are recorded in Volume 5: Appendices EC-001-004 to EC-004-004.

- 7.2.4 As well as the standard range of surveys described in the SMR, radio-tracking surveys targeting several species of bat, including Daubenton's and barbastelle, were undertaken in this area. Trapping and radio-tracking surveys were undertaken alongside the River Blythe SSSI where it passes through the land required for the construction of the Proposed Scheme north of Marsh Lane nature reserve following static recorder and transect surveys undertaken in suitable habitat where scarce species were recorded or considered likely to be present.
- 7.2.5 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 key ecological receptors where access could not be gained for survey include Berkswell Estate and Berkswell Marsh SSSI. Further details are provided in Volume 5: Appendices EC-001-004 to EC-004-004.
- 7.2.6 Where data are limited, a precautionary baseline has been built up according to the guidance reported in the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This constitutes a 'reasonable worst case' basis for the subsequent assessment.
- 7.2.7 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 Map series EC-01 to EC-12 presented in Volume 5. Statutory and non-statutory designated sites are shown on Volume 5: Map EC-01-50b to EC-01-052.
- 7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists mainly of agricultural land, woodland, floodplain and farmsteads. Woodland occurs adjacent to the Proposed Scheme and is most prevalent to the west of Berkswell. Much of the Proposed Scheme in this area passes through the floodplain of the River Blythe and its tributaries.

Designated sites

- 7.3.3 There are two statutory designated sites located within 500m of the land required for the construction of the Proposed Scheme; both are of national value. They are:
- Berkswell Marsh SSSI – the SSSI is located adjacent to Sixteen Acre Wood on the Berkswell Estate, outside of the land required. It is designated because of the fen meadow and wet woodland it supports. It contains the largest area of marshy grassland in the West Midlands. The SSSI is located between Berkswell and the A452 Kenilworth Road. Bayleys Brook flows through the SSSI as well as the land required for the construction of the Proposed Scheme; and

- River Blythe SSSI – the River Blythe is designated as the SSSI and a short stretch of the river is located within land required for the construction of the Proposed Scheme north of B4102 Meriden Road. The SSSI is a fine example of a lowland river with a wide range of natural structural features such as riffles, pools, small cliffs and meanders. The habitat structure of the River Blythe is variable and its importance is increased because of the rarity of such examples in lowland England. The River Blythe supports diverse assemblages of aquatic plant and macro-invertebrate communities. It also supports the pea-shell cockle which occurs at the western edge of its range in the River Blythe SSSI.

7.3.4 Though not a designated site, Marsh Lane nature reserve is partly located within the land required for construction of the Proposed Scheme. The site is privately owned and is managed for wetland bird and other wildlife interests, which are assessed under sections on habitats and species below.

7.3.5 There are three LWS located partly within land required for the construction of the Proposed Scheme; each is of county/metropolitan value. They are:

- Berkswell Marsh Meadow LWS – designated for the species-rich marshy grassland it supports. The LWS is well connected to the adjacent Berkswell Marsh SSSI. The LWS is located near Marsh Farm to the east side of the A452 Kenilworth Road;
- Patrick Farm Meadow LWS – designated for the species-rich semi-improved and marshy grassland it supports. The LWS is located within the land required for the construction of the Proposed Scheme between Marsh Lane and the A452 Kenilworth Road; and
- Mouldings Green Farm, Hampton-in-Arden LWS – designated for its species-rich marshy grassland and ponds which support the county rare species, blue water-speedwell. The LWS is located within the land required for the construction of the Proposed Scheme, east of Hampton-in-Arden and adjacent to the north bank of the River Blythe.

Habitats

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

Watercourses

7.3.7 The River Blythe SSSI is within the land required to construct the Proposed Scheme for a short section north of the B4102 Meriden Road, though no works will take place within the river channel. Rivers are a habitat of principal importance and are a conservation priority of the Local Biodiversity Action Plan (LBAP³⁹). The River Blythe is a lowland river of high habitat quality and diversity and is of national value.

³⁹ Warwickshire Biodiversity Partnership; *Warwickshire, Coventry & Solihull Local Biodiversity Action Plan* [online]; Available at: <http://www.warwickshire.gov.uk/biodiversity>.

7.3.8 The River Blythe Bypass channel is a channel connected to the River Blythe and also acts as a land drain. The channel is of local/parish value.

7.3.9 The land required for the construction of the Proposed Scheme encompasses a number of tributaries of the River Blythe. These include: Shadow Brook, a small watercourse less than 2m in width which passes through the land required and which has embankments vegetated with tall herbs; Horn Brook, a ditch of low conservation value; and Bayleys Brook, a small watercourse of between 1-2m depth which passes through agricultural land. Shadow Brook and Bayleys Brook have natural alignments and a notable absence of invasive plant species. They are habitats of principal importance⁴⁰ and represent a local BAP habitat. They are both therefore of district/borough value. Horn Brook is of local/parish value owing to its artificial construction.

Woodland

7.3.10 Broad-leaved woodland (a Local Biodiversity Action Plan (LBAP) habitat), which includes small areas of scrub, occurs within the land required for the construction of the Proposed Scheme, and includes Marlowes Wood and Sixteen Acre Wood, both of which support oak woodland of National Vegetation Classification (NVC) community type W10 NVC communities *Quercus robur* – *Pteridium aquilinum* – *Rubus fruticosus*. W10 broad-leaved woodlands exist at the aforementioned sites as do small areas of alder dominated wet woodland of NVC type W6 *Alnus glutinosa* – *Urtica dioica*, within Berkswell Marsh SSSI. These habitats are of principal importance as identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006). These areas of W10 broadleaved woodland are of county/metropolitan value. Owing to the rarity of W6 wet woodland in Warwickshire, and its extent and quality within the SSSI, these habitats are of national value.

7.3.11 Broadleaved plantation woodland occurs within the land west of The Roughs and north of Lodge Farm, within land south of The Roughs and within Marlowes Wood south of Berkswell Marsh SSSI, all of which lie within the land required for the construction of the Proposed Scheme. These habitats are of local/parish value.

Grassland

7.3.12 Marshy grassland occurs within or in the vicinity of the land required for the construction of the Proposed Scheme, and includes mire habitat of NVC community M23 *Juncus effusus/acutiflorus* – *Galium palustre* and small extents of swamp habitat amongst the areas of tall-herb fen of NVC community S28 *Phalaris arundinacea* and swamp habitat of S7 *Carex acutiformis* at Berkswell SSSI. The marshy grassland vegetation at Berkswell Marsh SSSI is outside land required to construct the Proposed

⁴⁰ *Natural Environment and Rural Communities Act (2006)*, Chapter 16, Her Majesty's Stationery Office, London.

Scheme and represent the largest extent of this habitat type in the West Midlands. The marshy grassland is of national value.

- 7.3.13 There is also marshy grassland vegetation of NVC communities S7 swamp, MG9 *Holcus lanatus* – *Deschampsia cespitosa* and rush-pasture habitat of MG10 *Holcus lanatus* – *Juncus effusus* at Berkswell Marsh Meadow LWS, and grassland habitat of NVC community MG4 *Alopecurus pratensis* – *Sanguisorba officinalis* at Patrick Farm Meadow LWS and Mouldings Green Farm, Hampton-in-Arden LWS, including the north side of the River Blythe within land required to construct the Proposed Scheme. The marshy grasslands are habitats of principal importance. Semi-improved MG4 grassland is also included within Annex 1 of the Habitats Directive⁴¹ and is described as the Habitat Biotope H6510. This MG4 community is rare across Europe and in the UK is largely restricted to the floodplains of central and southern England. The marshy grassland at these sites includes vegetation within the land required for the construction of this section of the Proposed Scheme. Each is of county/metropolitan value.
- 7.3.14 Areas of species-rich semi-improved neutral grassland are widely distributed across the land required for the construction of the Proposed Scheme and include NVC community grassland habitat of MG6 *Lolium perenne* – *Cynosurus cristatus* at Beechwood Farm, fields adjacent to River Blythe SSSI, and Berkswell Marsh Meadow LWS. Some are likely to qualify as habitats of principal importance and as local BAP habitat. These areas of grassland are collectively considered to be of district/borough value.
- 7.3.15 Improved grassland represented by NVC community MG7 *Lolium perenne* grassland, occurs within the various locations including within the land required for the construction of the Proposed Scheme, including at Ram Hall Farm and Beechwood Farm. This habitat type is of limited ecological interest and is of local/parish value.

Hedgerows

- 7.3.16 There are approximately 17.5 km of hedgerow within the land required for construction of the Proposed Scheme. Hedgerow with at least 80% cover of native woody species is a habitat of principal importance and the majority of recorded hedgerows meet this criterion. Approximately 11.9 km of the hedgerows were recorded as species-poor and 5.6km as species rich. Approximately 7.5 km of the hedgerows are also classified as 'Important' according to the 'Wildlife and Landscape' criteria described in The Hedgerows Regulations 1997⁴² with a further 2.3km considered to be 'possible Important' (because no access was available for survey). Most native species-rich and 'Important' hedgerows occur to the west of Kenilworth

⁴¹ European Commission; *The Habitats Directive*; <http://ec.europa.eu/environment/nature/legislation/habitatsdirective/>; accessed: March 2013.

⁴² *The Hedgerows Regulations 1997* (1997 No. 1160), The Stationery Office Ltd, London.

Greenway and to the south of Lavender Hall Lane. Many include mature pedunculate oaks which are characteristic of the area. Large-leaved lime, small-leaved lime and black poplar are also present within some hedgerows. The hedgerows within this area also function as wildlife corridors and the network is evaluated as being of district/borough value.

Water bodies

- 7.3.17 Several ponds and small water bodies exist in various locations within or in the vicinity of the land required for the construction of the Proposed Scheme. Several were identified as supporting diverse assemblages of invertebrate or macrophyte species. These include the pond at Beechwood Farm, which is within the land required, and the ponds and other water bodies at Marsh Lane Nature Reserve, at Moat House Farm, at the roundabout north of Bradnocks Marsh Lane, within the land west of the A452 Kenilworth Road, and north of the B4102 Meriden Road, all of which fall outside of the land required for the construction of the Proposed Scheme.
- 7.3.18 The pond at Beechwood Farm is within land required to construct the Proposed Scheme and is of district/borough value. The remaining field ponds and ephemeral floodplain pools and other water bodies are habitats of principal importance and are local BAP habitats. Field ponds and floodplain pools are each of local/parish value.

Protected and/or notable species

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

Table 8: Protected and/or notable species

Species/ species group	Value	Receptor	Baseline and rationale for valuation
Birds	County/ metropolitan	Barn owl at Patrick Farm and surrounding grassland habitats.	A nest and breeding territory of this Annex 1, Schedule 1 and LBAP species was recorded during the surveys within land required for the construction of the Proposed Scheme. Barn owl is a scarce species in Warwickshire.
	District/borough	An assemblage of breeding birds at Marsh Lane Nature Reserve.	A total of 31 species, including three active nests of common tern, an Annex 1, Schedule 1 and Amber List species, and oystercatcher, an Amber list species ⁴³ .
	District/borough	A heronry within the Marlowes Wood, adjacent to Park Lane.	A total of 17 active heron nests were recorded within this area of woodland, during the survey period, approximately 150m away from the land required for construction of the Proposed Scheme.

⁴³ Eaton MA, Brown AF, Noble DG, Musgrove AJ, Hearn R, Aebischer NJ, Gibbons DW, Evans A and Gregory RD (2009) *Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man*, British Birds 102, pp296–341.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
	District/borough	Populations of wintering wigeon and snipe at Marsh Lane Nature Reserve and Patrick Farm.	Wigeon and snipe (which are Amber List species) were recorded during the winter survey period at this location.
	Local/parish	An assemblage of wintering birds at Diddington Lane.	A total of 47 common farmland species, including 10 Red List and 13 Amber List were recorded at low densities during the surveys.
	Local/parish	An assemblage of breeding birds at the land between A452 Kenilworth Road, Park Lane and Berkswell Marsh SSSI.	A total of 25 species were recorded during the surveys recorded, mostly at low densities, including one Red List species (song thrush), and five Amber List species.
Amphibians	Up to county/metropolitan	A metapopulation ⁴⁴ of great crested newt north-west of Lavender Hall Farm and potentially within the water bodies contained within the Berkswell Estate.	A medium metapopulation of this species of principal importance which is listed in the LBAP associated with the two ponds north-west of Lavender Hall Farm which lie adjacent to the Proposed Scheme, and potentially present within the network of ponds and water bodies on the Berkswell Estate.
	Up to district/borough	Potential metapopulations of common toad, common frog, smooth newt, palmate newt within the water bodies contained within the Berkswell Estate.	Potential large metapopulations of these species of principal importance which are listed in the LBAP associated with the network of ponds and water bodies on the Berkswell Estate.
	District/borough	A metapopulation of great crested newt south of Pasture Farm.	A small metapopulation of this species of principal importance which is listed in the LBAP associated with the two ponds to the south of Pasture Farm, outside of the land required for construction of the Proposed Scheme.
	District/borough	A population of common toad at Beechwood Farm.	A good population of this species of principal importance and a conservation priority of the LBAP was recorded at Beechwood Farm pond.
	Local/parish	Populations of common toad, common frog and smooth newt south of Pasture Farm.	Low populations of common toad, a species of principal importance and a conservation priority of the LBAP, common frog and smooth newt, both of which are LBAP species, associated with the two ponds north-west of Lavender Hall Farm which lie

⁴⁴ A metapopulation is a group of spatially separated populations which interact.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
			adjacent to the Proposed Scheme.
	Local/parish	Populations of common toad, common frog and smooth newt north-west of Lavender Hall Farm.	Low populations of common toad, a species of principal importance and a conservation priority of the LBAP, common frog and smooth newt, both of which are LBAP species, associated with the two ponds north-west of Lavender Hall Farm which lie adjacent to the Proposed Scheme.
	Local/parish	Metapopulations of common toad and common frog at Lavender Hall Fisheries.	Low populations of common frog, an LBAP species, and common toad, a species of principal importance and a conservation priority of the LBAP, were recorded within the water bodies at Lavender Hall Fisheries.
	Local/parish	Metapopulations of common frog and smooth newt to the south of Berkswell Station.	A good population of smooth newt, an LBAP species, a low population of common frog, also an LBAP species, associated with the four ponds south of Baulk Lane, within the land required for the construction of the Proposed Scheme, and a further four ponds immediately adjacent to the Proposed Scheme.
	Local/parish	Metapopulations of common frog and smooth newt to the south of Baulk Lane	Low-sized metapopulations of these LBAP species were recorded amongst the complex of 11 ponds which exist across the network of pastures to the south of Berkswell Station.
Reptiles	Up to district/borough	Potential population of grass snake within the habitat mosaic of the Berkswell Estate.	A potentially large population of this species of principal importance associated with the habitat mosaic of the Berkswell Estate.
	Local/parish	A small population of common lizard at Sixteen Acre Wood adjacent to Berkswell Marsh SSSI.	A single common lizard, a species of principal importance which is listed in the LBAP, was recorded in suitable habitat during the survey period.
Bats	Up to county/metropolitan	A population of barbastelle bats recorded in the area of land to the east of the A452 Kenilworth Road, north of Lavender Hall Lane.	A population of barbastelle bat, a rare species ⁴⁵ in England which is of principal importance, was recorded twice in two locations on the Berkswell Estate, outside of the land required but connected via woodland and wetland habitats, including Bayleys Brook. There are no known barbastelle roosts within 5km of the Proposed Scheme, though Marlowes wood and extensive habitats adjacent and to the east of the Proposed Scheme represent roosting and foraging habitats of high suitability to

⁴⁵ Bat Conservation Trust, (2012), State of the UK's Bats 2012.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
			<p>barbastelles. Woodland and wetland areas around Stonebridge Golf Centre and Packington Estate further to the north, as well as Bradnocks Marsh and associated woodland and grasslands within the River Blythe valley to the west of the A452 Kenilworth Road and the land required are also potentially suitable for this dispersive species. Potential foraging and commuting routes local to the proposed Scheme include: the corridor along Bayleys Brook to the north and south of Berkswell Estate; through the Marlowes woodland (and across the land required); and hedgerow and other habitats along the Rugby to Birmingham Rail line. These habitats may facilitate barbastelle dispersal to and from the River Blythe floodplain. Consequently, this species may be using the landscape within and to the west of the land required, in addition to the Berkswell Estate to the east.</p>
	District/borough	<p>Populations of rarer species (<i>Nyctalus sp.</i>, serotine and Leisler's) within the survey extent of this section of the Proposed scheme in the vicinity of the River Blythe SSSI, east of Marsh Lane Nature Reserve; Baulk Lane, the woodland on the north side of Park Lane; Marlowes Wood; Sixteen Acre Wood; the large pond north-west of Lavender Hall Lane; and along Bayleys Brook.</p>	<p>Moderate to high levels of commuting and foraging activity recorded across each of these areas during the survey period within the marshy grassland habitats either side of the River Blythe and to the north of Marsh Lane nature reserve identified as being of particular importance. Principal dispersal corridors were also identified along Bayleys Brook, within the Marlowes Wood and along the woodland adjacent to Park Lane.</p>
	District/borough	<p>A populations of serotine bat within the survey extent of this section of the Proposed scheme in the vicinity of: Shadow Brook; at Baulk Lane; the woodland on the north side of Park Lane; Marlowes Wood; Sixteen Acre Wood; the large pond north-west of Lavender Hall Lane; and along Bayleys Brook.</p>	<p>Low to moderate levels of commuting and foraging activity recorded in this area in the vicinity of Shadow Brook and moderate to high levels of commuting and foraging activity recorded across each of these areas he areas within and in the vicinity of the Berkswell Estate during the survey period (with the marshy grassland habitats either side of the River Blythe and to the north of Marsh Lane nature reserve identified as being of particular importance). Principle dispersal corridors were also identified along Bayleys Brook, within the Marlowes Wood and along the woodland adjacent to Park Lane.</p>
	District/borough	<p>A large common pipistrelle maternity roost at Diddington Hall.</p>	<p>A maternity roost of common pipistrelles, at Diddington Hall west of the A452 Kenilworth Road, outside of the land required for the construction of the Proposed Scheme. Approximately 94 bats were recorded during</p>

Species/ species group	Value	Receptor	Baseline and rationale for valuation
			an emergence survey at this location in 2013.
	District/borough	Populations of <i>Nyctalus sp.</i> within the survey extent of this section of the Proposed scheme in the vicinity of Shadow Brook.	Low to moderate levels of commuting and foraging activity recorded in this area.
	Local/parish	A network of small tree and building roosts of common species (common pipistrelle; soprano pipistrelle; and brown long-eared bat) at various locations within the survey extent of this section of the Proposed scheme.	12 building roosts and 11 tree roosts at various locations, within and outside of the land required, supporting between one and approximately 20 individuals, including a suspected maternity roost north of the B4102 Meriden Road and west of Patrick Farm which supports 12 common pipistrelle.
	Local/parish	Populations of common species (common pipistrelle, soprano pipistrelle, brown long-eared bat, noctule and <i>Myotis sp.</i>) within the survey extent of this section of the Proposed scheme in the vicinity of Baulk Lane, the woodland on the north side of Park Lane, Marlowes Wood, Sixteen Acre Wood, the large pond north-west of Lavender Hall Lane and along Bayleys Brook.	Moderate to high levels of commuting and foraging activity recorded across each of these areas.
	Local/Parish	A population of Daubenton's bat recorded east of Lavender Hall Farm.	Moderate levels of foraging and commuting activity at Lavender Hall Fisheries.
	Local/parish	Populations of common species (common pipistrelle; soprano pipistrelle; and noctule and <i>Myotis sp.</i>) within the survey extent of this section of the Proposed scheme in the vicinity of the River Blythe SSSI, east of Marsh Lane Nature Reserve.	Moderate to high levels of commuting and foraging activity recorded for common species: common pipistrelle; soprano pipistrelle; and noctule. Low levels of commuting and foraging activity recorded for <i>Myotis sp.</i> , in this area.
	Local/parish	Populations of common species (common pipistrelle, soprano	Moderate to high levels of commuting and foraging activity recorded for several

Species/ species group	Value	Receptor	Baseline and rationale for valuation
		pipistrelle, Daubenton's, brown long-eared bats, noctule and <i>Myotis sp.</i>) within the survey extent of this section of the Proposed Scheme in the vicinity of Shadow Brook.	common species in this area.
	Local/parish	Populations of common species (common pipistrelle, soprano pipistrelle, noctule and <i>Myotis sp.</i>) within the survey extent of this section of the Proposed Scheme in the vicinity of Kenilworth Greenway.	Moderate to high levels of commuting and foraging activity recorded for several common species in this area.
	Local/parish	A population of <i>Nyctalus sp.</i> , within the survey extent of this section of the Proposed Scheme in the vicinity of Kenilworth Greenway.	Low levels of foraging and commuting activity was recorded for this rarer species during the survey period.
Otter	District/borough	A small population of otter.	Otter occurs at low density throughout the area and signs of their presence have been recorded alongside the River Blythe and Bayleys Brook. An active artificial holt exists alongside the River Blythe at Mouldings Green Farm LWS near the land required to construct the Proposed Scheme.
Aquatic-macro invertebrates	County/ metropolitan	Metapopulations ⁴⁶ of three species of diving beetle.	Three species of diving beetle (<i>Rhantus suturalis</i> , <i>Hygroglyphus geminus</i> and <i>Helochaeres lividus</i>) which are classified as Notable ⁴⁷ , exist within water bodies on land south of Berkswell, within the River Blythe Bypass channel which flows through land west of A452 Kenilworth Road and north of B4102 Meriden Road, and within the pond at Beechwood Farm.
	District/borough	An assemblage of aquatic-macro invertebrates within the two ponds at Marsh Lane Nature Reserve.	High invertebrate diversity was recorded, with 63 taxa in one pond and 39 taxa in the other. A locally notable caddisfly (<i>Phrygaena grandis</i>) was also recorded.
Fish	District/borough	An assemblage of fish species within the River Blythe SSSI.	A diverse assemblage of fish species, including stone loach, brown trout and bullhead.
Badger	Local/parish	At least nine social groups	A common and widespread species recorded during the survey period. There are two

⁴⁶ A metapopulation is a group of spatially separated populations which interact.

⁴⁷ Chadd, R. and Extence, C, (2004), *The conservation of freshwater macro-invertebrate populations: a community based classification scheme*. Aquatic Conservation: Marine and Freshwater. Ecosystems. 14: 597-624.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
		at undisclosed locations.	badger main setts and five outlier setts located within land required for the construction of the Proposed Scheme.
Dormouse	Up to county/metropolitan	Potentially present within the Marlowes Wood and the Berkswell Estate.	A species of principal importance and LBAP species which may be present within those areas of the Berkswell Estate where suitable habitat exists but where access was not available for surveys. There are no recent records of this species occurring within the study area.

Future baseline

Construction (2017)

7.3.20 A summary of the known developments which are assumed to be mostly built and occupied prior to construction of the Proposed Scheme is provided in Volume 5: Appendix CT-004-000.

7.3.21 The extraction of sand and gravel, storage and crushing of material at Meriden Quarry, Cornets End Lane, Meriden, has potential to impact on groundwater levels and thereby affect the wetland plant communities of importance that rely upon the edaphic conditions at the adjacent Berkswell Marsh SSSI, however it is anticipated that the SSSI will continue to be of National value.

Operation (2026)

7.3.22 There are no known committed developments or changes to management in this area that will affect the operational baseline, beyond those described above in relation to the construction 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 land required to construct the Proposed Scheme has been designed to avoid the loss of marshy grassland at Berkswell Marsh SSSI and minimise loss of semi-natural woodland on the Berkswell Estate; and
- construction of the River Blythe viaduct over the River Blythe SSSI and the associated floodplain, Balsall Common viaduct over Bayleys Brook, and Marsh Farm viaduct also over Bayleys Brook, in place of embankment, will reduce impacts on dispersal routes used by birds, bats and river-based fauna and allow riparian plant habitat to remain in place. The crossings of rivers have been designed to ensure no footings will be placed in the channels themselves and to reduce the levels of shading on the watercourses concerned.

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

Assessment of impacts and effects

Designated sites

- 7.4.3 Construction of the proposed Blythe Bypass embankment, and Patrick cutting will result in the loss of 1.3ha (60%) of the marshy grassland at Patrick Farm Meadow LWS. The loss of habitats within the LWS will result in an adverse effect on site integrity that is significant at county/metropolitan level.
- 7.4.4 Construction of River Blythe viaduct and Diddington Lane embankment will result in the loss of 0.4ha (51.5%) of the marshy grassland at Mouldings Green Farm LWS. The loss of habitats within the LWS will result in an adverse effect on site integrity that is significant at county/metropolitan level.
- 7.4.5 Construction in the area of Marsh Farm viaduct and diversion of a gas main through Berkswell Marsh Meadow LWS will result in the loss of 1.9ha (39%) of the marshy grassland and 0.9ha (60%) of species-rich semi-improved grassland. The loss and fragmentation of grassland habitats within the LWS will result in an adverse effect on site integrity that is significant at county/metropolitan level.
- 7.4.6 There are no works proposed within Berkswell Marsh SSSI and works to divert the gas main adjacent to the SSSI are not anticipated to have an adverse effect on site integrity.
- 7.4.7 There are no works proposed within the River Blythe SSSI and consequently no adverse effect is anticipated on site integrity.

Habitats

- 7.4.8 Construction of the Proposed Scheme will result in the loss of 2.6ha of marshy grassland at various locations within the land required, including loss of grassland at Mouldings Green Farm, Hampton-in-Arden LWS from construction of the River Blythe viaduct and Diddington Lane embankment and at Berkswell Marsh LWS from diversion of a gas main and the construction of Marsh Farm viaduct and Sixteen Acre Wood embankment. This will result in an adverse effect on the conservations status of this habitat that is significant at the district/borough level.
- 7.4.9 Earthworks associated with the Proposed Scheme will result in the loss of 10ha of species-rich neutral grassland at Beechwood Farm from construction of Beechwood embankment; at Berkswell Marsh LWS from diversion of a gas main; and one of the fields adjacent to the River Blythe SSSI north of B4102 Meriden Road. This will result in an adverse effect on the conservation status of this habitat that is significant at the district/borough level.
- 7.4.10 Earthworks associated with the Proposed Scheme will result in the loss of 13.1ha of broadleaved woodland, including along Kenilworth Greenway, at Marlowes wood,

at Sixteen Acre Wood and at woodland adjacent to Park Lane. This will fragment the remaining areas of woodland habitat and will result in a permanent adverse effect on the conservation status of this habitat type that is significant at the district/borough level.

7.4.11 Construction of the Proposed Scheme will result in the loss of approximately 17.5km of hedgerow, including 5.6km of species-rich hedgerows and 11.9km of species-poor hedgerows. This will fragment the remaining lengths of hedgerow and will result in a permanent adverse effect on the conservation status of hedgerows that is significant at the district/borough level.

7.4.12 The realignment of Bayleys Brook at Balsall Common Viaduct will result in loss of approximately 120m of watercourse habitat. A further 80m will be lost as a result of culverting where the brook is crossed by the embankment for the Lavender Hall Lane Overbridge. Culverting of the watercourse for the A452 Kenilworth Road realignment will result in covering of 50m of watercourse though the existing culvert under the original alignment of the A452 Kenilworth Road will be removed to expose the previously covered channel. Overall this represents an adverse effect on conservation status of Bayleys Brook at local/parish level.

7.4.13 The realignment of Horn Brook will result in loss of approximately 170m of watercourse habitat. The culverting of the watercourse underneath the proposed A452 Kenilworth Road will result in the realignment of approximately 180m and covering of approximately 60m of watercourse. It is not expected that this represents an adverse effect on the conservation status of Horn Brook.

7.4.14 It is unlikely that any other effects on habitat receptors at more than the local/parish level will occur. This includes a culvert of the River Blythe Bypass channel at Blythe Bypass embankment and losses of species-poor semi-improved grassland and improved grassland vegetation.

7.4.15 Effects at the local/parish level are listed in Volume 5: Appendix EC-005-004.

Species

7.4.16 The construction of the Proposed Scheme in the vicinity of Patrick Farm, including a satellite construction compound and a number of temporary material stockpile areas, will lead to the permanent loss of grassland and field margin foraging habitat for barn owls. Barn owl is a Schedule 1 and Amber List species which is included in the LBAP and is scarce in Warwickshire. This loss of foraging habitat has potential to result in displacement of the local barn owl population, resulting in a temporary adverse effect on conservation status of this species which will be significant at the district/borough level.

7.4.17 Loss of habitats for breeding bird assemblages at Diddington Farm and on land between A452 Kenilworth Road, Park Lane and Berkswell Marsh SSSI will result in impacts on conservation status at local/parish level for both assemblages.

- 7.4.18 There will be no significant effect on the conservation status of the wintering and breeding birds at Marsh Farm Nature Reserve or the heronry at Marlowes Wood. These receptors are outside the land required to construct the Proposed Scheme and sufficient extent and quality of habitats would remain to support the species and assemblages concerned.
- 7.4.19 The permanent loss of broadleaved semi-natural woodland, marshy grassland, neutral grassland, species rich hedgerows and species-poor hedgerows, particularly as a result of the construction of Park Lane cutting at Marlowes woodland, will lead to a reduction in suitable foraging habitat, and the degradation of potential dispersal corridors for barbastelle bat on land to the east of the A452 Kenilworth Road and north of Lavender Hall Lane. Marlowes Wood and extensive habitats to the east of the Proposed Scheme provide woodland, watercourse and other wetland habitats suitable for barbastelle bat. Suitable habitat also exists outside land required to construct the Proposed Scheme to the north around Packington Estate and to the west of the Proposed Scheme at Bradnocks Marsh and the wider floodplain of the River Blythe. A precautionary approach is taken for the assessment of the effect of the proposed Park Lane Cutting, which varies between approximately 50 and 80m in width through Marlowes Wood. Habitat removal required for construction of the cutting will present a partial barrier to movement of this species across the Proposed Scheme between suitable foraging areas to the east and west, including those in the floodplain of the River Blythe.
- 7.4.20 Barbastelle bat often emerges from roosts early in the evening before dark, and is less likely to cross open spaces before darkness⁴⁸ so the potential barrier effect will not be consistent, having greater effect on bats attempting to cross in early evening and closer to sunrise. Although barbastelle records from surveys in 2013 were recorded approximately 1 hour or more after sunset or before sunrise, a barrier effect is still considered likely, though potential alternative routes to surrounding land west of the Proposed Scheme will still be available along Bayleys Brook to the north and south of the Park Lane Cutting. Overall, the potential adverse effect of habitat loss and degradation on the conservation status of this species could be significant up to district/borough level prior to the implementation of other mitigation and compensation measures.
- 7.4.21 The construction of Park Lane cutting will lead to a reduction in suitable foraging habitat, and the potential degradation of dispersal corridors used by serotine bat on land to the east of the A452 Kenilworth Road and north of Lavender Hall Lane.

⁴⁸ English Nature Research Reports: Number 657, *Advice for the management of flightlines and foraging habitats of the barbastelle bat, Barbastelle barbastellus*, Frank Greenway, 2004.

Therefore there is potential for a permanent adverse effect on the conservation status of serotine which has potential to be significant at up to local/parish level.

- 7.4.22 The permanent loss of broadleaved semi-natural woodland, marshy grassland, neutral grassland, pond, species rich hedgerows and species-poor hedgerows will lead to a reduction in suitable foraging habitat, and the potential disruption of dispersal corridors used by a number of less common bat species including *Nyctalus sp.*, and Leisler's bat in various locations within this section of the Proposed Scheme. Therefore there is potential for a permanent adverse effect on the conservation status of these species which will be likely to be significant at the local/parish level.
- 7.4.23 The common pipistrelle maternity roost at Diddington Hall is outside land required for the Proposed Scheme and no impacts on this roost are anticipated as sufficient habitat will be retained on land around the roost site.
- 7.4.24 With regard to aquatic-macro invertebrates, the permanent loss of a large pond at Beechwood Farm which is one of a network of water bodies in the locality which support metapopulations of species of Notable conservation importance (*Rhantus suturalis*, *Helophanes lividus* and *Hygroglyphus geminus*) will result in a permanent adverse effect on the conservation status of the populations concerned that is significant at district/borough level.
- 7.4.25 The permanent loss of a large pond at Beechwood Farm will result in an adverse effect on the conservation status of the common toad population that is significant at district/borough level.
- 7.4.26 Although there are great crested newt breeding ponds north of Lavender Hall Farm and at Pasture Farm within 250m of the land required for construction of the Proposed Scheme, the confirmed breeding ponds are outside the land required and those terrestrial habitats which fall within the land required for construction of the Proposed Scheme are represented by arable farmland which is cultivated annually and which is of low suitability to great crested newt. The terrestrial habitats which are of value to the local population of great crested newts in this location and the ruderal grassland habitats alongside the existing Rugby to Birmingham line will be unaffected. Consequently, it is not anticipated that there will be any significant adverse impact on the conservation status of this population. Similarly, only a small proportion of the terrestrial habitats of value to the low great crested newt population at Pasture Farm will be affected by the Proposed Scheme, the majority of which will be reinstated post construction. Consequently, again it is not anticipated that there will be any significant adverse impact on the conservation status of the great crested newt population at Pasture farm. Implementation of appropriate mitigation measures described within the draft CoCP and Ecological Principles of Mitigation set out in the SMR Addendum (see Volume 5: Appendix CT-001-000/2) will also allow for adverse impacts on the conservation status of this species to be avoided during construction.

- 7.4.27 Noise, vibration and visual disturbance by machinery and personnel during the construction of Marsh Farm viaduct, River Blythe viaduct, Shadow Brook underbridge, River Blythe Bypass culvert as well as other construction works in the vicinity of Bayleys Brook and Horn Brook will affect the use of the associated watercourses for foraging and commuting by otter, potentially resulting in a decline in population status. This will represent a temporary adverse impact on this species which will be significant at up to local/parish level and which is anticipated to have duration of between one and three years.
- 7.4.28 It is unlikely that any other 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

- 7.4.29 This section describes additional measures designed to reduce or compensate for significant ecological effects. These include habitat creation and habitat enhancement.
- 7.4.30 Approximately 3.8ha of marshy grassland will be created. This will be located to the east of Blythe Bypass embankment and Patrick cutting, Farm Meadow LWS, to the north of Marsh Lane Nature Reserve, on the western bank of the River Blythe SSSI north of B1402 Meriden Road, and to the north of Sixteen Acre Wood embankment. Areas identified for marshy grassland creation will be specifically designed to provide suitable ground conditions for establishment. Natural regeneration of locally appropriate marshy grassland species will be promoted and these works will be carried out in accordance with the ecological principles of mitigation set out in the SMR Addendum (see Volume 5: Appendix CT-001-000/2). Consequently, no residual significant effect is predicted.
- 7.4.31 Approximately 23ha of broadleaved woodland habitat will be created. This comprises substantial areas of woodland planted primarily for ecological purposes (habitat creation) as well as other landscape planting of native broadleaved woodland. The target habitat type is lowland mixed deciduous woodland habitat of principal importance. Areas of woodland creation include Pasture Farm south of Diddington cutting, Patrick embankment, on the proposed south-west facing embankment on the existing A452 Kenilworth Road alongside Marsh Lane Nature Reserve, at Marsh Farm, within the Berkswell estate at Marlowes wood and also along the Kenilworth Greenway. These new areas of woodland habitat will connect and help maintain the integrity of remaining areas of woodland, including those within and adjacent to Berkswell Estate. A temporary adverse effect is expected until these woodland areas have become established, after which there will be a minor beneficial effect. These works will be carried out in accordance with the Ecological Principles of Mitigation.
- 7.4.32 Approximately 5.8km of native species-rich hedgerow will be planted in various appropriate locations, including alongside the Kenilworth Greenway, Park Lane

cutting, and the diverted sections of Park Lane and the A452 Kenilworth Road dual carriageway. These new lengths of hedgerow will link existing sections and restore part of the hedgerow network. These works will be carried out in accordance with the ecological principles of mitigation. Consequently, no residual significant effect is predicted with regard to species rich hedgerows. However, the net loss of 11.9km of species poor hedgerow will represent a significant impact on the network of this habitat within this section of the Proposed Scheme and will therefore result in a permanent adverse effect at the district/borough level.

- 7.4.33 Approximately 10 ha of neutral grassland habitat will be created on the proposed south-west facing embankment on the existing A452 Kenilworth Road alongside Marsh Lane Nature Reserve and at Beechwood Farm embankment. These works will be carried out in accordance with the ecological principles of mitigation. Consequently, no residual effect is anticipated on the conservation status of neutral grassland.
- 7.4.34 New woodland and hedgerow planting parallel to the route and establishment of grassland will reduce the effect of habitat loss on bats, providing foraging and commuting habitat connections, replacing or providing alternative routes through the landscape. At Park Lane Cutting, woodland and hedgerow planting will be provided at the top of the cutting slopes to the north and south of the retained portion of Marlowes woodland. Dense hedgerow planting will also be provided across the cutting itself, supported by the structures of the proposed Footpath M214 overbridge and Footpath M215 overbridge. To facilitate this, Footpath M214 overbridge will be approximately 20m wide and Footpath M215 overbridge will be approximately 18m wide. Vegetation will be established in accordance with the Ecological Principles of Mitigation, including advance planting and use of artificial hedgerows where necessary to provide suitable routes prior to removal of existing habitats and construction of the cutting. The objective will be to provide habitat along and across the route which provides sufficient shelter for barbastelle bat, including during early evening or at sunrise when light levels are relatively higher.
- 7.4.35 This mitigation will provide replacement linear habitat features alongside and across the route, allowing barbastelle (and other bat species) to more easily cross the Park Lane cutting, reducing the effect of habitat loss and degradation. Retained habitats will be protected during construction, including shelter from artificial illumination where necessary.
- 7.4.36 After implementation of this mitigation, the residual effect on conservation status of barbastelle will be up to local/parish level. This represents an effect on the local population rather than the favourable conservation status of the national population.
- 7.4.37 No residual effect is anticipated on the conservation status of serotine bats.

- 7.4.38 HS2 Ltd will continue to monitor the barbastelle population in this area of the route during the period up to construction, and if it is demonstrated that any of the above measures are not required to maintain conservation status of local barbastelle and serotine populations, then the mitigation provision may be reduced accordingly.
- 7.4.39 The habitat creation measures detailed above, including the recreation of species-rich neutral grassland, marshy grassland, ponds and broadleaved semi-natural woodland, will compensate for those bat foraging habitats lost for the Proposed Scheme. The appropriate planting of hedgerows, as detailed above, as well broadleaved semi-natural woodland on the embankments of the Proposed Scheme will also help maintain existing bat dispersal corridors and promote future dispersal across the wider landscape. Following creation of these habitats no significant impacts are anticipated with regard to the more common species of bat recorded within this section of the proposed Scheme, including common pipistrelle, soprano pipistrelle and brown long-eared bats, as well as the rarer noctule and Leisler's bat.
- 7.4.40 Three ponds with a combined area of 0.05ha will be created at Beechwood Farm and to the south of Berkswell station. These will be established in accordance with the ecological principles of mitigation and will provide suitable replacement habitat for amphibians and aquatic-macro invertebrates. Translocation of species will be considered if necessary, in accordance with the ecological principles of mitigation, though it is likely that aquatic-macro invertebrates and the population of common toad at Beechwood Farm will naturally colonise the new ponds, encouraged by the placement of silt and substrate from the pond to be lost. Following creation of these new pond habitats, no residual impacts are anticipated on the conservation status of aquatic-macro invertebrates, including the three Notable diving beetle species within the network of water bodies south of Berkswell, at Beechwood Farm and elsewhere. Similarly, no significant impacts are anticipated on the conservation status of common toad at Beechwood Farm.
- 7.4.41 There will be an adverse effect on the conservation status of barn owl at district/borough level due to loss of grassland habitats within and in the vicinity of Patrick Farm. To offset the likely loss of barn owls from the vicinity of the Proposed Scheme, opportunities to provide barn owl nesting boxes in areas greater than 1.5 km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.
- 7.4.42 Mitigation measures to address the potential killing, injury and disturbance of badgers will be provided in accordance with the principles of ecological mitigation. This will include the provision of badger proof fencing and replacement setts where necessary.

Summary of likely residual significant effects

- 7.4.43 Taking into account mitigation, compensation and enhancement proposed, anticipated significant residual ecological effects during construction are the permanent adverse effect on the conservation status of species poor hedgerows.
- 7.4.44 The permanent loss of the barn owl territories on and around Patrick Farm represents a residual significant effect. However, if the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that is not significant.

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;
 - two overbridges over Park Lane Cutting, to the north and south of the Marlowes woodland, will support vegetation to reduce habitat severance impacts on local flora and fauna; and
 - all bridges and viaduct structures, including Marsh Farm Viaduct and the River Blythe Viaduct, will be constructed with clear spans to promote and maintain bat 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 Where the route of the Proposed Scheme bisects, or is located in close proximity to existing features known to be utilised regularly by foraging or commuting bats, there is an increased risk that bats could be killed or injured as a result of collisions with passing trains or associated turbulence. The significance of any such effect will be dependent on both the flight habitat of the species or species concerned and the vertical alignment of the Proposed Scheme (i.e. is the railway in cutting, on embankment, on a viaduct, or at grade) at the point the impact occurs.
- 7.5.6 The proposed viaduct structures, which are 5.4m above ground level along Bayleys Brook at Balsall Common viaduct, 2.4m along Bayleys Brook at Marsh Farm viaduct, 5.3m along the River Blythe SSSI at the River Blythe viaduct, and 2.7m above ground level along Shadow Brook at Shadow Brook underbridge, will cross key bat foraging and commuting routes. In all these locations, existing foraging and commuting routes will be maintained beneath the structures along existing key features and no impacts are anticipated on the conservation status of bat populations due to collision or turbulence effects. At Park Lane cutting, trains will be between below the level of surrounding land at Marlowes wood and no adverse effect on the conservation status of bats in this area is likely as a result of collision or turbulence effects.
- 7.5.7 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 therefore not considered to be significant.
- 7.5.8 The majority of bird species that are known to be present in the area are not considered to be particularly vulnerable to collision with trains. However, barn owls hunt low over the rough grassland habitats that are associated with railway embankments and are slow moving which make them more at risk to train strike. Evidence suggests that such mortality is likely to result in the loss of all breeding populations of barn owls within 1.5km of the Proposed Scheme.
- 7.5.9 A barn owl winter foraging territory extends across Patrick Farm. It is likely that barn owls will be vulnerable to train strike and associated turbulence. This will result in a

permanent adverse effect on the conservation status of barn owl which will be significant at county/metropolitan level.

- 7.5.10 It is 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.

Other mitigation measures

- 7.5.11 This section describes additional elements designed to reduce or compensate for significant ecological effects. These include measures (such as habitat manipulation and fencing) to discourage species from foraging close to the Proposed Scheme.

- 7.5.12 Train strike is likely to result in the loss of barn owls which nest close to the route. As part of the precautionary assessment it is assumed all territories within close proximity to the route could be lost and therefore adverse effects are likely to remain significant at county/metropolitan level. To offset these losses opportunities to provide barn owl nesting boxes in areas greater than 1.5km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

Summary of likely residual significant effects

- 7.5.13 The mitigation, compensation and enhancement measures described above reduce the residual ecological effects during operation to a level that is not significant, except for barn owl. Train strike is likely to result in the loss of barn owls that nest close to the route resulting in a residual significant effect. However, if the proposed measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that is not significant.

8 Land quality

8.1 Introduction

8.1.1 This section presents the baseline conditions that exist along the route in relation to land quality and reports the likely impacts and any significant effects resulting from 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 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 Blythe SSSI, Berkswell Marsh SSSI, Bayleys Brook, Shadow Brook and large areas of superficial sand and gravel deposits that have been widely exploited.

8.1.4 The main land quality issues in this area include:

- the presence of four landfill sites, one of which is partially operational;
- the presence of infilled historical quarries and pits within or adjacent to the location of the Proposed Scheme; and
- the presence of three preferred mineral sites for sand and gravel extraction affect a Mineral Safeguarding Area (MSA) for sand and gravel extraction which extends along much of the route in this study area.

8.1.5 Details of baseline information and the land quality assessment methodology are outlined in the following appendices (presented in Volume 5):

- 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); and
- Volume 5: Appendix LQ-001-023: Land quality data appendix.

8.1.6 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Water resources and flood risk assessment (Section 13). Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3, Section 16.

8.1.7 Engagement has been undertaken with Solihull Metropolitan Borough Council (SMBC) and North Warwickshire Borough Council (NWBC) Environmental Health Departments and the Environment Agency regarding contaminated land and landfill data. Engagement has also been undertaken with the Policy and Spatial Planning department of SMBC and Sustainable Communities Department of Warwickshire County Council (WCC) regarding mineral resources and the Ministry of Defence regarding current and historic MoD sites. CEMEX UK Materials Ltd (CEMEX) who operate Berkswell Quarry, has also been consulted. To date, no information has been received from CEMEX.

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 (see Volume 5: Appendices CT-001-000/1) and SMR Addendum (see Volume 5: Appendices 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.

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. Due to access constraints, not all sites considered to have the greatest potential for contamination were visited. However the purpose of the site visits is to verify desktop information, and the lack of complete site walkovers is considered unlikely to have substantially impacted the land quality assessment.

8.3 Environmental baseline

8.3.1 Unless stated otherwise, all features described in this section are presented in Volume 5: Maps LQ-01-050b to LQ-01-052.

Existing baseline

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-02-023.

- 8.3.3 The study area is mostly characterised by agricultural land; however, made ground is present at a number of locations, notably associated with backfilled ponds and pits, together with licensed and historical landfills. There are three historical and one partially historical/partially operational landfill site within the study area. Further details of these are provided in Table 9.
- 8.3.4 In addition to recorded landfill sites, known areas of made ground are present within the study area in the following locations:
- spoil generated from construction of the existing Rugby to Birmingham line, by Berkswell House (between Truggist Lane and the existing railway, east of Balsall Common);
 - made ground associated with the dismantled Kenilworth to Balsall Common line (Kenilworth Greenway), south-east of Berkswell station;
 - made ground associated with the Rugby to Birmingham line; and
 - made ground associated with earthworks undertaken as part of the construction of the existing A452 Kenilworth Road as shown on the British Geological Survey (BGS) 1:50,000 geological map.
- 8.3.5 There are also several infilled pits, excavations and ponds as well as possible marl pits located within the study area. These areas are listed in Volume 5: Appendix LQ-001-023.
- 8.3.6 Superficial glacial deposits are present across much of the study area. Most of the superficial deposits beneath the route are glacial sands and gravels, which are extensive but not continuous and constitute a significant local aggregate resource. They vary widely in lithology from fine grained silty sands to coarse poorly sorted boulder gravel. A dissected layer of glacial till (generally a brown silty or sandy clay) locally overlies the glacial sand and gravel north of Balsall Common. Fluvial/alluvial deposits are present across the lower parts of the River Blythe and other stream valleys that cross the route. These alluvial deposits generally comprise an upper layer of silt and sandy clay and a lower more gravelly layer. The alluvial deposits are most extensive across the River Blythe valley.
- 8.3.7 The upper strata of the Carboniferous Warwickshire Group are present to the east of the Meriden Fault which trends north to south to the west of Lavender Hall Lane. These comprise the Tile Hill Mudstone Formation, which consists of mudstone and laminated siltstone with thin beds of sandstone and occasional conglomeratic lenses.
- 8.3.8 Strata of the Triassic Sherwood Sandstone Group belonging to the Bromsgrove Sandstone Formation occur in faulted inliers associated with the western boundary fault of the Warwickshire Coalfield. A small faulted inlier is present near Lavender Hall Fisheries. A further larger faulted inlier is present to the north-west of Berkswell Marsh. The Bromsgrove Sandstone Formation typically comprises very weak, poorly cemented Sandstone, with some subordinate beds of silty and sandy Mudstone.

8.3.9 The Mercia Mudstone Group is present (beneath superficial deposits in many places) to the west of the Meriden Fault. Mercia Mudstone typically comprises weak red brown silty mudstone. Occasional beds of dolomitic siltstone occur within the Mercia Mudstone which are generally thin. Within the Mercia Mudstone sequence, between the B4102 Meriden Road and Diddington Lane, a thicker horizon of interbedded sandstone, siltstone and mudstone, known as the Arden Sandstone Member outcrops.

Groundwater

8.3.10 There are three categories of aquifer identified within the study area. The Tile Hill Mudstone and the Bromsgrove Sandstone are classified as Principal aquifers. The Arden Sandstone, Glaciofluvial Deposits, River Terrace Deposits and Alluvium are classified as Secondary A aquifers. The Mercia Mudstone is classified as a Secondary B aquifer.

8.3.11 Within the study area one groundwater abstraction is recorded for domestic use, at a residential dwelling known as Silver Birch located near New Mercote Farm. Another abstraction is listed at a residential dwelling known as The Cottage, but the use of the abstraction is not recorded (it may possibly be used for drinking water). This abstraction is located near Windmill Farm approximately 570m to the west of the route and north of West Midlands Golf Club. The remaining recorded abstractions within 1km of the site are associated with industrial use. No groundwater source protection zones are located within the study area (see Volume 5: Map WR-03-039 to WR-03-040).

8.3.12 Further detail on the groundwater beneath the Proposed Scheme can be found in Water resources and flood risk assessment (Section 13).

Surface waters

8.3.13 The River Blythe, which is classified as an SSSI, crosses the study area to the east of Hampton-in-Arden (Volume 5: Map LQ-01-052, D6 and D7). Several other watercourses cross the study area at the following locations:

- an unnamed stream, near Beechwood Farm (Volume 5: Map LQ-01-050b, D6);
- a tributary of the River Blythe named Bayleys Brook flows north near Berkswell station (Volume 5: Map LQ-01-051, I7), continuing north past Berkswell Marsh SSSI and re-crossing the route near Marsh Farm (Volume 5: Map LQ-01-052, I6) before joining the River Blythe to the west (Volume 5: Map LQ-01-052, G8);
- the River Blythe Bypass channel adjacent to the north of a restored area of Berkswell Quarry (Volume 5: Map LQ-01-052, on the boundary between F6 and G6); and
- Shadow Brook flows south-west to north-east to the south of Diddington Hall (Volume 5: Map LQ-01-052, B6) before flowing into the River Blythe.

8.3.14 There are numerous ponds located within fields alongside the route. Large surface waters in the study area include several fish ponds to the south-east of Lavender Hall Farm (Volume 5: Map LQ-01-051, H7 to I8), three ponds at Manor Nurseries (Volume 5: Map LQ-01-052, I7 and I8) and ponds located at the historical sand and gravel quarrying site at Marsh Lane Nature Reserve (see Volume 5: Map LQ-01-052, F7 to H8 and H9).

8.3.15 Several springs are located along the River Blythe and around Berkswell Marsh SSSI. These are detailed on Volume 5: Appendix WR-002-023.

8.3.16 Surface water abstractions recorded within 1km of the site of the Proposed Scheme are listed in the Water resources and flood risk assessment (Section 13). None of the surface water abstractions recorded are used for potable supply.

Current and historical land use

8.3.17 Current potentially contaminative land uses include:

- Berkswell station and the operational Rugby to Birmingham line;
- a garage on Truggist Lane (see Volume 5: Map LQ-01-051, I8);
- a car repair workshop at Lavender Hall Farm (see Volume 5: Map LQ-01-051, G7);
- Evesons fuel depot off the A452 Kenilworth Road, north-west of Balsall Common (see Volume 5: Map LQ-01-051, C8);
- a vehicle depollution facility off the A452 Kenilworth Road, within Bradnocks Marsh Business Centre (see Volume 5: Map LQ-01-051, B8);
- the operational part of Berkswell Quarry located to the south-east of Hampton-in-Arden (see Volume 5: Map LQ-01-052, J5 to I2);
- the operational Meriden Quarry extension located to the south and west of North Warwickshire Golf Club (see Volume 5: Map LQ-01-052, F1 and G3 to E2); and
- a small business park, including craft workshops, occupying a former farmyard at Patrick Farm east of Hampton-in-Arden (see Volume 5: Map LQ-01-052, E6).

8.3.18 There are four landfills in the study area and these are detailed in Table 9. A wide range of contaminants may be associated with the different types of wastes accepted. In addition, these sites may be emitting landfill gases, such as methane, carbon dioxide (CO₂) and volatile organic compounds (VOC). There is a lower risk of contaminants and generation of landfill gas at the landfills which have accepted inert waste only.

Table 9: Landfill sites located within the study area

Name	Location	Description
Lavender Hall Farm Landfill (historical)	Located immediately north-west of Lavender Hall Fisheries Volume 5: Map LQ-01-051, G8, H7 and H8	The waste disposal licence issued for the site in 1991 ⁴⁹ allows bricks, mortar, concrete, sub soil, topsoil, clay, slate, sand, glass, stone and weathered road planings to be accepted at the site. The landfill is recorded to have been operational between 1992 and 1995. Evidence of burning of waste was noted on-site during a site walkover in August 2012 (see Volume 5: Appendix LQ-001-023).
Lincoln Farm Café Landfill (historical)	Adjacent to Arden House Volume 5: Map LQ-01-052, H7 and H8	The site was licensed for waste wood storage and incineration in 1993 ⁵⁰ . The licence application and licence conditions state that waste ashes from the incinerator would be removed off-site. The application states that operations commenced at the site in 1976 and it is unknown whether waste ashes were deposited on or off-site before the site was licensed in 1993. Desk study records from 1995 ⁵¹ indicate that this site was also used as a scrap yard with a paint and solvent recovery operation. The Envirocheck report ⁵² also records a non-retail petrol station at this location.
Berkswell Quarry (partially historical, partially operational)	The larger quarry is located east of the A452 Kenilworth Road (Volume 5: Map LQ-01-052, H1, G2 to J5) The route crosses directly over a restored and mounded section of the quarry adjacent to the A452 Kenilworth Road (Volume 5: Map LQ-01-052, G6, G7 and H7)	The site consists of a large aggregate quarry, divided into separate areas that are mostly restored to agriculture; however, part of the quarry to the east of the A452 Kenilworth Road is still operational. Information from SMBC and the Environment Agency ⁵³ indicates that inert waste was used to backfill the parts of the quarry located to the east of the A452 Kenilworth Road. Composting facilities are also recorded in the Envirocheck report in this area of the quarry. The area of Berkswell Quarry located between the A452 Kenilworth Road and Marsh Lane Nature Reserve was noted to be mounded above the surrounding ground level during a site visit (see Volume 5: Appendix LQ-001-023 for more details). The material used to infill this part of the quarry is unknown.
Jacksons Brickworks Landfill (historical)	The landfill is located between Diddington Hill and the A45 Coventry Road. The landfill site extends north beyond the study area boundary. Volume 5: Map LQ-01-052, A6 to B9 and B10	The site was licensed to accept inert, industrial, commercial, household and special waste from the 1990s, although Waste Regulatory Authority inspection records suggest that infilling had not commenced by 1995 ⁵⁴ . In 2000 the waste licence was amended to allow infilling using inert waste only and the licence was surrendered in 2005. A smaller area of landfilling in the north-western area of the site where the current waste transfer station is located (named in Environment Agency records as rear of Jacksons Brickworks) is recorded between 1966 and 1972. The type of waste used for infilling in this area is unknown. Aerial and historical mapping indicates that landfilling may not have been undertaken in the southern and eastern parts of the site, whereas historical pits shown in the north and west of the site appear to have been infilled. Desk study information indicates that the site has extant minerals permission for clay extraction, with no extraction of clay having occurred in the eastern or southern part of the site (see Volume 5: Appendix LQ-001-023 for more details).

⁴⁹ The waste disposal licence and subsequent licence amendments as provided by SMBC and the Environment Agency are included in Volume 5: Appendix LQ-001-023.

⁵⁰ The waste disposal licence application, waste disposal licence and accompanying correspondence between SMBC and the operator are provided in Volume 5: Appendix LQ-001-023.

⁵¹ Letter from the National Rivers Authority (NRA) dated 1995 (provided by SMBC), as shown in Volume 5: Appendix LQ-001-023.

⁵² Envirocheck report.

⁵³ The Environmental Permit for part of the eastern part of Berkswell Quarry and information from the Berkswell Quarry extension area application are included in Volume 5: Appendix LQ-001-023.

⁵⁴ The waste disposal licence, Waste Regulatory Authority inspection notes and certificate of completion for Jacksons Brickworks landfill are provided in Volume 5: Appendix LQ-001-023. Environment Agency landfill records are also provided.

8.3.19 Other historical potentially contaminative land uses include the former location of Berkswell service station on the A452 Kenilworth Road (Volume 5: Map LQ-01-051, F8 and F9), which historically contained a petrol filling station. In addition, a possible ammunitions storage area was identified during consultation meetings with the public between Patrick Farm and the River Blythe Bypass Channel (see Volume 5: Map LQ-01-052, F6 and F7) however, SMBC does not have any records of this existing at this location. The Ordnance Survey historical maps, provided in the Envirocheck report, record that an ammunitions depot was located south of the B4102 Meriden Road, directly east of Hampton-in-Arden (see Volume 5: Map LQ-01-052, E8 and E9).

8.3.20 All potentially contaminated sites (identified from both current and historical land uses) are shown in Volume 5: Maps LQ-01-050b to LQ-01-052.

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 and control licences (IPPC)). A review of this data did not identify any additional notable data.

Mining and mineral resources

8.3.22 Policy P13 of the 2006 Solihull Unitary Development Plan (SUDP)⁵⁵ defines MSAs for important underground coal resources and for sand and gravel aggregate resources. Within these areas, proposals for non-mineral development will only be permitted where it can be demonstrated that the development will not result in the sterilisation of mineral resources, the loss of important infrastructure or sites of potential infrastructure need in the area.

8.3.23 The glacial sands and gravels and the river terrace deposits that overlie the Mercia Mudstone form a locally important aggregate resource. The route will traverse adjacent to active workings of sand and gravel at Berkswell Quarry (operated by CEMEX), located north of Berkswell Marsh (see Volume 5: Map LQ-01-052, J5 to I2), and Meriden Quarry extension (operated by Tarmac Ltd) to the south and west of North Warwickshire Golf Club (see Volume 5: Map LQ-01-052, F1 and G3 E2 to). Both sites have planning permission^{56 57} for sand and gravel extraction and backfilling with inert waste.

8.3.24 Both the Tile Hill Mudstone and the Mercia Mudstone have been historically dug for marl. The resulting small pits occur widely to the east of Balsall Common, where the Tile Hill Mudstone is close to the surface, and sporadically elsewhere where the Mercia

⁵⁵ Solihull Metropolitan Borough Council (SMBC), (2006), *Solihull Unitary Development Plan 2006*.

⁵⁶ Berkswell Quarry extension area planning application reference 2003/1480.

⁵⁷ Meriden Quarry extension planning application reference 2012/64 (part of which are provided in Volume 5: Appendix LQ-001-023).

Mudstone is close to the surface. Many of these pits have been backfilled or flooded to form ponds.

- 8.3.25 The Solihull Draft Local Plan (SDLP⁵⁸) (2012) designates the area between the Heart of England Way to the south-west of Berkswell and the River Blythe to the north-east of Hampton-in-Arden as a MSA for sand and gravel extraction (see Volume 5: Maps LQ-01-050b to LQ-01-052). Within this area, three proposed mineral sites will be crossed by the route and associated infrastructure works: Hornbrook Farm; Berkswell Quarry West and Marsh House Farm. The proposed mineral sites are located between the areas of former and current mineral extraction at Berkswell Quarry, adjacent to the east of the A452 Kenilworth Road. The Minerals Local Plan⁵⁹ for Warwickshire designates the land to the east of the division between Solihull and Warwickshire, approximately located on the A452 Kenilworth Road, as a MSA for sand and gravel extraction from approximately Mouldings Green Farm northwards (see Volume 5: Maps LQ-01-050b to LQ-01-052).
- 8.3.26 The Proposed Scheme to the east of Lavender Hall Lane is within a MSA for coal, as designated in the SDLP and shown in Volume 5: Maps LQ-01-050b to LQ-01-052. The Warwickshire Thick Coal is at depth to the east of the Meriden Fault and has until recently been mined from a single colliery, Daw Mill, situated near the village of New Arley, Warwickshire. The Proposed Scheme location is outside the current Daw Mill licence area but within the Daw Mill Extension Area (see Volume 5: Appendix LQ-001-023); the Coal Authority granted a mining licence for the Daw Mill Extension Area to UK Coal in 2012. The Daw Mill Extension Area contains the Warwickshire Thick Coal as the workable seam approximately 5m to 7m thick at a depth of between 900m and 1.1km beneath the Proposed Scheme. Since issuing the licence extension mining from Daw Mill colliery has been suspended due to a fire within the coal seam and the site ownership has passed from UK Coal to the Coal Authority, which is preparing to abandon the mine. There are no current plans for unconventional deep mining in this area e.g. by underground coal gasification, and it is considered unlikely that plans to mine this area would be developed in the foreseeable future.

Geo-conservation resources

- 8.3.27 There is one local geological site known as Nursery Cottage Brickworks which is located within the Jacksons Brickworks Landfill site as shown on Volume 5: Map LQ-01-052, A8 and A9. This site is designated due to fresh exposures of Triassic Mercia Mudstone (within an excavation up to 28m deep). The site designation details are provided in Volume 5: Appendix LQ-001-023.

⁵⁸ Solihull Metropolitan Borough Council (SMBC), (2012), *Solihull Draft Local Plan, Shaping a Sustainable Future, Local Development Framework, Pre-Submission Draft*.

⁵⁹ Warwickshire County Council, (1995), *Minerals Local Plan for Warwickshire*.

Receptors

8.3.28 The receptors that have been identified within this study area are summarised in Table 10.

Table 10: Summary of receptors

Issue	Receptor Type	Receptor description	Receptor sensitivity
Land contamination	People	Residents (Pasture Farm, Mouldings Green Farm, Hampton-in-Arden, Patrick Farm, Hornbrook Farm, Mercote Mill Farm, Lincoln Farm, Marsh Farm, Windmill Farm, Marsh House Farm, New Mercote Farm, Wootton Green Farm, Lodge Farm, Balsall Common, Lavender Hall Farm, fern Bank, Moat House Farm, Ram Hall, Truggist Hill Farm, Beechwood Farm, Berkswell House)	High
		Workers (Balsall Common, Bradnocks Marsh, Nurseries to the south-west of Marsh Farm, Hampton-in-Arden, Business Park at Patrick Farm)	Moderate
	Controlled waters	Principal aquifers (Tile Hill Mudstone and Bromsgrove Sandstone)	High
		Secondary A aquifers (Glaciofluvial Deposits, Alluvium, Arden Sandstone)	High
		Secondary B aquifer (Mercia Mudstone)	Moderate
		Rivers (unnamed stream near Beechwood Farm, Bayleys Brook, River Blythe Bypass Channel, River Blythe, Shadow Brook)	High
	Built environment	Buildings and property – various – see people above	Low to high
		Underground structures and services	Low
	Ecological	River Blythe SSSI	High
		Berkswell Marsh SSSI	High
	Mineral resources	Preferred Mineral Sites for sand and gravel extraction – Hornbrook Farm, Berkswell Quarry West and Marsh House	Low
		MSAs – sand and gravel – majority of study area	Low
		MSA – coal – to the east of the Meriden fault	Low
	Geo-conservation sites	Jacksons Brickworks LGS	Low
Impacts on mining/mineral sites	Mining/mineral sites	Preferred Mineral Sites for sand and gravel extraction – Hornbrook Farm, Berkswell Quarry West and Marsh House	High
		MSAs – sand and gravel – majority of study area	Moderate
		MSA – coal – to the east of the Meriden fault	Low
Impacts on geo-conservation sites	Geo-conservation sites	Jacksons Brickworks LGS	Moderate

Future baseline

Construction (2017)

- 8.3.29 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The following developments have been considered as part of the assessment:
- reference 2003/1480 – Full planning permission for an extension to the Berkswell Quarry for sand and gravel extraction and landfilling; and
 - reference: 2012/2064 – Extension of time limit on a full planning permission for sand and gravel extraction, inert waste disposal, restoration to agriculture and nature conservation.
- 8.3.30 At the time of writing no planning applications for mineral extraction had been submitted to SMBC for the three preferred mineral sites for sand and gravel extraction (Hornbrook Farm, Berkswell Quarry West and Marsh House). Consequently it is assumed that these sites will not have been worked by 2017.
- 8.3.31 With respect to contaminated land, no committed developments have been identified that would materially affect the baseline in 2017.

Operation (2026)

- 8.3.32 By 2026 landfilling at the Berkswell Quarry operational site identified in the current baseline should be completed and the site fully restored.
- 8.3.33 By 2026 the Meriden Quarry extension area is expected to have ceased extraction with landfilling complete or mostly complete. The majority or the entire site is likely to have been restored.
- 8.3.34 With respect to contaminated land, no committed developments have been identified that would materially affect the operational baseline.

8.4 Effects arising during construction

Avoidance and mitigation measures

- 8.4.1 The construction assessment takes into account the mitigation measures contained within the draft CoCP (see Volume 5: Appendix CT-003-000). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work. Such requirements include:
- methods to control noise, waste, dust, odour gasses 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/degradation of soils (draft CoCP, Section 7); and
- methods to monitor and manage flood risk and other extreme weather events which may affect ecological resources 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)⁶⁰; and
- British Standard BS10175 Investigation of Potentially Contaminated Sites (2011)⁶¹.

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 the Sustainable Remediation Forum UK's publication A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010)⁶². The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

⁶⁰ Environment Agency, (2004), *CLR11 Model Procedures for the Management of Land Contamination*.

⁶¹ British Standard, (2011), *BS10175 Investigation of Potentially Contaminated Sites*.

⁶² Sustainable Remediation Forum UK, (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*.

8.4.4 Contaminated soils excavated from the site, wherever feasible, will be treated as necessary to remove or render any contamination inactive and re-used within the Proposed Scheme where needed and suitable for use. Techniques are likely to include stabilisation methods, soil washing and bio-remediation to remove oil contaminants. Contaminated soil disposed 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.

Assessment of impacts and effects

8.4.5 Construction of the Proposed Scheme through this section of the route will require earthworks, utility diversions, deep foundations, temporary dewatering and other activities, including the construction of the various viaducts and road infrastructure works. These aspects of the Proposed Scheme, along with other construction features, are shown in Volume 2: Maps CT-05-100b to CT-05-105a.

8.4.6 Much of the Proposed Scheme will be constructed on embankment or viaduct through this section of the route, however four areas of cut are proposed, as follows:

- Park Lane cutting, a large section of cut starting approximately 50m north-east of Lavender Hall Lane overbridge (adjacent to Lavender Hall Farm Landfill) and finishing approximately 450m south-east of Marsh Farm (north of Bradnocks Marsh);
- two short sections of cut either side of the River Blythe Bypass embankment. The Horn Brook cutting extends from Mercote Hall Lane (Bridleway M218) accommodation overbridge to the A452 Kenilworth Road. The second section, Patrick cutting, extends north from the northern end of the restored Berkswell Quarry to the south of Patrick Farm and through the possible ammunitions storage area; and
- Diddington cutting, starting approximately 300m south-east of Pasture Farm (Diddington Hill, north of Hampton-in-Arden) to the end of this section of the route. This section of cut is through the eastern part of Jacksons Brickworks Landfill, however desk study information indicates that landfilling may not have been undertaken in the southern and eastern parts of the site (see Volume 5: Appendix LQ-001-023 for more details).

8.4.7 In addition, five floodplain replacement storage areas and nine balancing ponds are proposed along the route of the Proposed Scheme in this study area, which will require excavation. Proposed balancing ponds are located on potential contaminative risk sites 23-35 (Berkswell Quarry restored) and 23-39 (infilled sand and gravel pit). Site 23-2 (dismantled Kenilworth to Balsall Common line) is located adjacent to two proposed balancing ponds (see Volume 5: Maps LQ-01-050b to LQ-01-052). A water main diversion is proposed through Lavender Hall Landfill (site 23-15) which will require excavation through the inert waste present in the landfill. An oil pipeline diversion which will require excavation, is proposed through the Rugby to Birmingham

line (site 23-11) embankment, and a gas pipeline diversion is proposed adjacent to site 23-33 (an area of potentially infilled land).

- 8.4.8 The Park Lane cutting main compound will be located to the west of Lavender Hall Lane (see Volume 5: Map LQ-01-051, G7 and F7). The compound will include topsoil storage, landscaping fill, storage of fuel in bunded tanks and maintenance facilities for plant and machinery. The compound will be partially located over an infilled marl pit (potentially contaminated site 23-22, see Volume 5: Map LQ-01-051, F7). Several smaller satellite compounds are also proposed. Sites 23-17 and 23-18 (infilled marl pits shown on Volume 5: Map LQ-01-051, H6 and H7) and 23-37 (possible ammunitions storage area shown on Volume 5: Map LQ-01-052, F6 and F7)) are located in the Balsall Common viaduct satellite compound and River Blythe Bypass culvert satellite compound areas respectively.

Land contamination

- 8.4.9 In line with the assessment methodology, as set out in the SMR (see Volume 5: CT-001-000/1), the SMR Addendum (see Volume 5: CT-001-000/2) and its appendices, an initial screening process was undertaken (identified in the methodology as Stages A and B) to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. In total, 53 areas were considered during this screening process; 21 of these areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. The majority of the areas undergoing the more detailed risk assessments were historical landfills or infilled pits/ponds. All areas assessed are shown on Volume 5: Maps LQ-01-050b to LQ-01-052 and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.
- 8.4.10 Conceptual site models (CSM) have been produced for the 21 areas taken to Stage C and D assessments. The detailed CSMs are provided in Volume 5: Appendix LQ-001-023 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 Proposed Scheme or associated off line works, e.g. roads;
 - the vertical route alignment, i.e. whether the Proposed Scheme 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.

8.4.11 Potentially contaminated sites have been grouped, and assessed together, where appropriate. Further detail on the basis for the CSM groups is presented in Volume 5: Appendix LQ-001-023. The groups are defined as follows:

- CSM Group A: Sites within the land required to build 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.

8.4.12 A summary of the baseline CSM is provided in Table 11. The impacts and baseline risks quoted are before any mitigation is applied.

8.4.13 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 11: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area ref (1)	Area name	Main potential impacts	Main baseline risk ⁶³
23-4, 23-5, 23-6, 23-15, 23-17, 23-18, 23-20, 23-22, 23-33, 23-35, 23-39, 23-50 Shown on Volume 5: Maps LQ-01-050b to LQ-01-052. (CSM group A sites(2))	Three historic landfills: Lavender Hall Farm Landfill, Berkswell Quarry and Jacksons Brickworks Landfill Three infilled marl pits, four infilled ponds, an infilled sand and gravel pit and an area of potentially infilled land (either class 2 or 3 uses)	Potential impact to on-site ⁶⁴ human health (gas risk)	Moderate
		Potential impact to human health adjacent to the site (gas risk)	Moderate to high
		Potential impact on groundwater quality	Moderate/low to moderate
		Potential impact on surface water quality	Moderate/low to moderate
		Potential impact on adjacent property receptors	Moderate to high
23-1, 23-2, 23-11, 23-16, 23-29, 23-37	Dismantled Kenilworth to Balsall Common line. Rugby to	Potential impact to on-site human health from soil	Very low to moderate/low

⁶³ The moderate or high risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high or moderate existing baseline risk in the absence of site investigation a precautionary, worst case risk is reported in the table.

⁶⁴ For CSM groups A and B, on-site means within the potential contaminated site identified under the "Area reference" column.

Area ref (1)	Area name	Main potential impacts	Main baseline risk ⁶³
Shown on Volume 5: Maps LQ-01-050b to LQ-01-052. (CSM group B sites(2))	Birmingham line operational	Potential impact to off-site human health from soil	Very low to low
	Manor nursery site		
	Odnall End Farm and Lavender Hall Farm	Potential impact on groundwater quality	Low to moderate/low
	Possible munitions dump (either class 1 or 2 uses)	Potential impact on surface water quality	Low to moderate/low
		Potential impact on property receptors	Low
23-32 Shown on Volume 5: Map LQ-01-052, H7 and H8 (CSM group C sites(2))	Lincoln Farm Café Landfill (historical)	Potential impact on human health on-site (gas risk)	Moderate to high
	(class 3 use)	Potential impact on human health adjacent to the site (gas risk)	Moderate to high
		Potential impact on groundwater quality	Moderate/low to moderate
		Potential impact on surface water quality	Moderate/low to moderate
		Potential impact on adjacent property receptors	Moderate to high
23-19, 23-23 Shown on Volume 5: Map LQ-01-051 (CSM group D sites(2))	Berkswell Service Station	Potential impact to on-site human health from soil	Very low to low
	Evesons Fuel Depot	Potential impact to off-site human health from soil	Very low to low
	(class 3 uses)	Potential impact on groundwater quality.	Moderate/low to high
		Potential impact on property receptors.	Low to moderate/low

(1) Each area is assigned an unique identification number (See Volume 5: Appendix LQ-001-023) .

(2) CSMs have been prepared as part of the detailed land contamination methodology (see Volume 5: Appendix LQ-001-023) for baseline, construction and post-construction. Areas have been grouped where appropriate.

Temporary effects

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

8.4.15 Table 12 presents the summary of the resulting construction effects. The details of these comparisons are presented in Volume 5: Appendix LQ-001-023.

Table 12: Summary of temporary (construction) effects

Area ref ⁶⁵	Main Baseline risk	Main Construction Risk ⁶⁶	Temporary effect and significance
23-4, 23-5, 23-6, 23-15, 23-17, 23-18, 23-20, 23-22, 23-33, 23-35, 23-39, 23-50 Shown on Volume 5: Maps LQ-01-050b to LQ-01-052. CSM group A sites	Potential impact on human health on-site (gas risk) = Moderate	Moderate	Negligible (N)
	Potential impact on human health adjacent to the site (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on groundwater quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Potential impact on surface water quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Potential impact on property receptors (gas risk) = Moderate to high	Moderate to high	Negligible (N)
23-1, 23-2, 23-11, 23-16, 23-29, 23-37 Shown on Volume 5: Maps LQ-01-050b to LQ-01-052. CSM group B sites	Potential impact to on-site human health from soil = Very low to moderate/low	Very low to moderate/low	Negligible (N)
	Potential impact to off-site human health from soil = Very low to low	Very low to low	Negligible (N)
	Potential impact on groundwater quality = Low to moderate/low	Low to moderate/low	Negligible (N)
	Potential impact on surface water quality = Low to moderate/low	Low to moderate/low	Negligible (N)
	Impact on property receptors = Low	Low	Negligible (N)
23-32 Shown on Volume 5: Map LQ-01-052, H7 and H8 CSM group C sites	Potential impact on human health on-site (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on human health adjacent to the site (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on groundwater quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Potential impact on surface water quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Impact on property receptors = Moderate to high	Moderate to high	Negligible (N)

⁶⁵ See Table 11 for site names.

⁶⁶ The low/moderate main construction risk identified in the above table does not necessarily imply an unacceptable risk. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled. The high risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high risk in the absence of site investigation a precautionary, worst case risk is reported in the table. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled.

Area ref ⁶⁵	Main Baseline risk	Main Construction Risk ⁶⁶	Temporary effect and significance
23-19, 23-23 Shown on Volume 5: Map LQ-01-051 CSM group D sites	Potential impact to on-site human health from soil = Very low to low	Very low to low	Negligible (N)
	Potential impact to off-site human health from soil = Very low to low	Very low to low	Negligible (N)
	Potential impact on groundwater quality = Moderate/low to high	Moderate/low to high	Negligible (N)
	Impact on property receptors = Low to moderate/low	Low to moderate/low	Negligible (N)

8.4.16 Table 12 shows that the Proposed Scheme results in either a reduction or no change in the level of risk already existing at each site for both on-site and off-site receptors, and therefore that significant effects will not occur during the construction phase.

8.4.17 Table 12 indicates that based upon the assessment, no significant effects have been identified during the construction phase, in relation to potential land contamination. This is because cutting in Lavender Hall Farm Landfill (containing inert waste) will be limited to cut required for a water main diversion. Cutting in Berkswell Quarry Landfill will be limited to the area of a proposed balancing pond. The area of cutting at Jacksons Brickworks Landfill is located in the north-east of the landfill permit area however desk study information suggests that waste was not placed in this area of the landfill. Lincoln Farm Café Landfill is outside of the land required to construct the Proposed Scheme but within the study area and so will not be directly intersected.

8.4.18 Park Lane cutting main compound located in this area (see Volume 5: Map LQ-01-051, G7 and F7) will include maintenance facilities for plant and machinery and fuel storage in bunded tanks. Construction compounds will store and use potentially contaminative materials such as fuels, oils and solvents, and the measures outlined in the CoCP will manage risks from the storage of such materials.

8.4.19 The main and satellite compounds may also be used for temporary storage of potentially contaminated soils. The measures outlined in the CoCP will manage risks from the storage of such materials. The location of these construction compounds can be found in Section 2.3 and on Volume 2: Maps CT-05-100 to 105.

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

Permanent effects

8.4.21 Baseline and post-construction CSM have been compared to assess the permanent (post-construction) effects.

8.4.22 Table 13 includes the summary of the permanent (post-construction) effects obtained from a comparison of the baseline and post-construction impacts and whether these

are significant. The details of these comparisons are presented in Volume 5: Appendix LQ-001-023.

Table 13: Summary of permanent (post-construction) effects

Area ref ⁶⁷	Main baseline risk	Main post-construction risk ⁶⁸	Post-construction effect and significance
23-4, 23-5, 23-6, 23-15, 23-17, 23-18, 23-20, 23-22, 23-33, 23-35, 23-39, 23-50 Shown on Volume 5: Maps LQ-01-050b to LQ-01-052. CSM group A sites	Potential impact on human health on-site (gas risk) = Moderate	Moderate/low	Minor beneficial (N)
	Potential impact on human health adjacent to the site (gas risk) = Moderate to high	Moderate to high	Negligible (N) to minor beneficial (N)
	Potential impact on groundwater quality = Moderate/low to moderate	Low to moderate	Negligible (N) to minor beneficial (N)
	Potential impact on surface water quality = Moderate/low to moderate	Low to moderate	Negligible (N) to minor beneficial (N)
	Potential impact on property receptors (gas risk) = Moderate to high	Moderate/low to high ⁶⁹	Negligible (N) to minor beneficial (N)
23-1, 23-2, 23-11, 23-16, 23-29, 23-37 Shown on Volume 5: Maps LQ-01-050b to LQ-01-052. CSM group B sites	Potential impact to on-site human health from soil = Very low to moderate/low	Very low to low	Negligible (N) to minor beneficial (N)
	Potential impact to off-site human health from soil = Very low to low	Very low	Negligible (N) to minor beneficial (N)
	Potential impact on groundwater quality = Low to moderate/low	Very low to moderate/low	Negligible (N) to minor beneficial (N)
	Potential impact on surface water quality = Low to moderate/low	Very low to moderate/low	Negligible (N) to minor beneficial (N)
	Impact on property receptors = Low	Very low	Minor beneficial (N)
23-32 Shown on Volume 5: Map LQ-01-052, H7 and H8 CSM group C sites	Potential impact on human health on-site (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on human health off-site (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on groundwater quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Potential impact on surface water quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Impact on property receptors = Moderate to high	Moderate to high	Negligible (N)

⁶⁷ See Table 11 for site names.

⁶⁸ The low/moderate main construction risk identified in the above table does not necessarily imply an unacceptable risk. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled. The high risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high risk in the absence of site investigation a precautionary, worst case risk is reported in the table. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled within acceptable limits as agreed with the appropriate regulator.

⁶⁹ The range of risk reflects the lack of data on type of landfill material present.

Area ref ⁶⁷	Main baseline risk	Main post-construction risk ⁶⁸	Post-construction effect and significance
23-19, 23-23 Shown on Volume 5: Map LQ-01-051 CSM group D sites	Potential impact to on-site human Health from soil = Very low to low	Very low to low	Negligible (N)
	Potential impact to off-site human health from soil = Very low to low	Very low to low	Negligible (N)
	Potential impact on groundwater quality = Moderate/low to high	Moderate/low to high	Negligible (N)
	Impact on property receptors = Low to moderate/low	Low to moderate/low	Negligible (N)

- 8.4.23 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.
- 8.4.24 Table 13 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.
- 8.4.25 Table 13 above indicates that following remediation for sites which are located fully or partially in the area required to construct the Proposed Scheme (CSM Group A and B sites), there will generally be overall negligible to minor beneficial effects. Depending on the type of remediation undertaken the beneficial effect could include an improvement in groundwater quality or reduction in risk to human health as a result of removal of impacted material or the breaking of gas migration pathways.
- 8.4.26 Negligible effects will result from sites where no remediation is likely to be required or will only occur to a small proportion of the potential contamination source area, and therefore, the risks are unlikely to alter much from the baseline assessment.
- 8.4.27 Sites where remediation is minimal or not required may include sites which are not found to contain significant contamination, sites which are only partially situated within the area of the Proposed Scheme or sites where no significant earthworks are proposed. Remediation occurring over a larger proportion or all of the potential contamination source area, resulting in removal of source pathway receptor linkages or a reduction in the contaminant source, will result in minor beneficial impacts compared to the baseline. Sites which require a greater amount of remediation will be those sites found to contain significant levels of contamination where earthworks or sensitive end uses such as public open space are proposed.

- 8.4.28 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.
- 8.4.29 For sites which are located outside of the area required to construct the Proposed Scheme (CSM Group C and D sites), it is assumed that no remediation will be undertaken and therefore the effects are assessed to be negligible.
- 8.4.30 There are anticipated to be no significant cumulative permanent effects.

Mining/mineral sites

- 8.4.31 Construction of the Proposed Scheme has the potential to impact existing mineral resources and proposed areas of mineral exploitation. This could occur by sterilisation of the resource through direct excavation during construction of the Proposed Scheme or through temporary and/or permanent severance⁷⁰ that may occur during the construction phase of the Proposed Scheme, possibly continuing through to its operation.

Temporary effects

- 8.4.32 The majority of effects on mining and mineral sites will be permanent effects. However, temporary adverse effects are anticipated in the areas of the sand and gravel MSA which will be temporarily used as construction compounds (Bradnock auto-transformer station satellite compound, A452 Kenilworth Road overbridge satellite compound and the B4102 Meriden Road underbridge satellite compound and associated storage areas). The locations of construction compounds in this area can be found in Section 2.3 and on Volume 2: Maps CT-05-100b to CT-05-105a. The temporary effect to the sand and gravel MSA will be limited to a temporary sterilisation of the resource during construction works at the locations of the satellite compounds and associated storage areas listed above. Some of these areas will also contain permanent works (as discussed below).
- 8.4.33 There are anticipated to be no significant cumulative temporary effects from construction.

Permanent effects

- 8.4.34 The Proposed Scheme will cross a MSA for sand and gravel extraction, as shown in Volume 5: Maps LQ-01-050b to LQ-01-052. Within this area, there are three preferred mineral sites at Hornbrook Farm, Berkswell Quarry West and Marsh House Farm as identified in the SDLP. The route will be on sections of embankment and cutting

⁷⁰ In this context, severance refers to the Proposed Scheme splitting an actual or proposed mining/mineral site into two or more areas, such that separate accesses would be required to work the whole site.

through these preferred mineral site areas. It is possible that mineral extraction could be undertaken in advance of works for the Proposed Scheme. Mitigation measures (if any) will be discussed in advance of the works with the Mineral Planning Authority, SMBC.

8.4.35 The Proposed Scheme will cross a MSA for coal and the Daw Mill Colliery licence extension area as shown in Volume 5: Maps LQ-01-050b to LQ-01-051 and Volume 5: Appendix LQ-001-023. Construction of the Proposed Scheme will require specific methods and mitigation to be employed during any future mining works (under and either side of the route) and/or sterilisation of a strip of land in which future mining would be severely constrained. In this case however, it is known that mining is not currently operational at Daw Mill colliery and the colliery has been recently passed to the Coal Authority for abandonment.

8.4.36 Table 14 presents the assessment of effects from construction on the mining and mineral resources identified.

Table 14: Summary of effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Preferred Mineral Sites: Hornbrook Farm, Berkswell Quarry West and Marsh House	Preferred mineral site	Preferred mineral sites for sand and gravel extraction.	High	Moderate	Moderate adverse (Y)
MSA – sand and gravel	MSA	MSA for sand and gravel extraction (2012 SDLP).	Medium	Moderate	Minor adverse (N)
Mineral safeguarding area – coal	Mineral safeguarding area	MSA for coal (2012 SDLP).	Medium	Moderate	Minor adverse (N)

8.4.37 There are anticipated to be no significant cumulative permanent effects from construction.

Geo-conservation sites

Temporary effects

8.4.38 There are not anticipated to be any temporary effects on geo-conservation sites.

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

Permanent effects

8.4.40 One LGS site has been identified within the study area at Nursery Cottage Brickworks, within the larger Jacksons Landfill site as shown in Volume 5: Map LQ-01-052, A8 and A9. The site is located more than 250m from the area required to construct the Proposed Scheme and therefore is unlikely to be affected by the works. The effect on the LGS is assessed to be negligible.

- 8.4.41 There are anticipated to be no significant cumulative permanent effects from construction.

Other mitigation measures

- 8.4.42 At this stage, no additional mitigation measures are considered necessary to mitigate risks from land contamination at construction stage beyond those set out in the draft CoCP and instigated as part of required remediation strategies. In addition to the excavation and treatment of contaminated soils, it may also be necessary to install ground (landfill) gas and leachate control systems within affected old landfill sites, on a temporary or permanent basis, to ensure that ground (landfill) 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.

- 8.4.43 Mitigation of the effects on mineral resources at the three preferred mineral sites for sand and gravel extraction could include prior extraction of the resource, for use within the project, or elsewhere. Extraction may be limited to landscaping areas within the Proposed Scheme adjacent to rather than beneath the trackbed, which will require good founding conditions. A plan will be discussed in advance of the construction works with the landowner, the mineral planning department at SMBC, and any other interested parties to assist in achieving an effective management of minerals within the affected location of the MSA.

Summary of likely significant residual effects

- 8.4.44 With the application of the mitigation measures detailed in Section 8.4, no likely significant residual effects are anticipated with respect to contaminated land.
- 8.4.45 A potential moderate adverse residual effect on the three preferred mineral sites for sand and gravel extraction will occur if they are not exploited before construction, and hence sterilised. The likelihood of mitigation being undertaken depends on the outcome of future discussions with the landowners and the Minerals Planning Authority at SMBC.

8.5 Effects arising from operation

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

Avoidance and mitigation measures

- 8.5.2 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice. Spillage and pollution response procedures similar to those outlined in the draft COCP will be established for all high risk activities and employees will be trained in responding to such incidents.

Assessment of impacts and effects

- 8.5.3 There is one auto-transformer station located at Bradnocks Marsh (Volume 5: Map LQ-01-051, B6). An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer station, in common with other modern substations, will use secondary containment appropriate to the level of risk.
- 8.5.4 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.
- 8.5.5 It is unlikely that there will be any cumulative effects on land quality receptors due to the environmental controls that will be placed on operational procedures.

Other mitigation measures

- 8.5.6 No other mitigation measures are expected to be required beyond what has already been outlined relating to land quality in the study area.
- 8.5.7 There may be on-going monitoring requirements following remediation works carried out during construction. Such monitoring, including monitoring of groundwater quality or ground gas, could extend in to the operational phase of the Proposed Scheme.

Summary of likely significant residual effects

- 8.5.8 No significant residual effects are anticipated associated with operation of the Proposed Scheme.

9 Landscape and visual assessment

9.1 Introduction

- 9.1.1 This section of the report 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 compounds, removal of existing vegetation and the introduction of new landform, highway modifications and built forms in the predominantly rural landscape in the vicinity of Balsall Common and Hampton-in-Arden; and
 - permanent landscape and visual effects during operation arising from the introduction of new embankment and cutting landforms, and infrastructure associated both with the rail and highway components within the land required permanently for the Proposed Scheme. Effects will include severance of field patterns through sections of the rural landscape of Balsall Common and Hampton-in-Arden, periodic visibility of trains and permanent visibility of overhead line equipment and major infrastructure such as viaducts and bridges.
- 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-001-023, which comprises the following parts:
- Part 1 Engagement with technical stakeholders;
 - Part 2 Environmental baseline report;
 - Part 3 Assessment matrices; and
 - Part 4 Schedule of non-significant effects.
- 9.1.5 The extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages has been discussed with Solihull Metropolitan Borough Council (SMBC). The purpose of the photomontages is to illustrate the landscape and visual effects within the study area. However, the

number and location of photomontages has been determined by professional judgment and has evolved during the design programme. Summer field surveys, including photographic studies of LCAs and visual assessment of viewpoints, were undertaken from May to July 2012 and from May to 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 (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2) and Volume 5: Appendix LV-001-023. 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-07-077b to LV-07-080a and Volume 5: Map LV-08-077b to LV-08-080a. 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 visibility of the Proposed Scheme. In some locations, lack of data on vegetation cover may 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 into 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.

Limitations

- 9.2.4 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 meandering River Blythe forms a broad and undulating valley and ridgeline. The floodplain of the valley floor is predominantly pasture with occasional lakes and woodland. Arable land and parkland is more common where the land rises up, away from the river. In the south of the study area, fields are commonly small to medium scale and bounded by hedgerows and woodland. Medium scale villages, such as

Balsall Common, Hampton-in-Arden and Meriden form larger settlements within a network of smaller villages, such as Berkswell, hamlets and individual farmsteads.

- 9.3.2 Further north in the study area the dominant vegetation pattern in the landscape is large regular fields, bounded by hedges and woodland. Mature hedgerow trees are also common and many form significant landscape features. The A452 Kenilworth Road is the primary road in the study area, with the corridors of the M42 and the A45 Coventry Road dominant in the north. A network of lanes and public rights of way (PRoW) provide access to the countryside and include the Millennium Way, Heart of England Way and the Kenilworth Greenway.
- 9.3.3 The LCAs have been determined with reference to the Warwickshire Landscapes Guidelines⁷¹, The North Warwickshire Landscape Character Assessment⁷² and the Solihull Countryside Strategy⁷³.
- 9.3.4 Descriptions of all LCAs are provided in Volume 5: Appendix LV-001-023. For the purposes of this assessment the study area has been sub-divided into ten discrete LCAs, four of which accommodate the Proposed Scheme. A summary of these LCAs is provided below. The LCAs are shown in Volume 5: Maps LV-02-077 to LV-02-080.

Stoneleigh Parklands LCA

- 9.3.5 The extent of the Stoneleigh Parklands LCA within the study area is limited to an isolated area to the west of the Proposed Scheme.
- 9.3.6 The majority of this LCA is located within the adjacent Stoneleigh, Kenilworth and Burton Green study area (CFA18). For the summary baseline description refer to Volume 2 CFA 18, and for the full baseline description refer to Volume 5 CFA 18.

Coventry rural fringe LCA

- 9.3.7 The extent of the Coventry rural fringe LCA within the study area is limited to an isolated area to the east of the Proposed Scheme.
- 9.3.8 The majority of this LCA is located within the adjacent Stoneleigh, Kenilworth and Burton Green study area (CFA18). For the summary baseline description refer to Volume 2 CFA 18, and for the full baseline description refer to Volume 5 CFA 18.

Balsall Common Rural LCA

- 9.3.9 The rural character of this LCA is influenced by an irregular pattern of well-managed, small scale fields, often bounded by hedgerows and trees. The area provides the

⁷¹ Warwickshire County Council; (1993); *Warwickshire Landscapes Guidelines* [online]; <http://www.warwickshire.gov.uk/landscapeguidelines>; Accessed June 2013.

⁷² North Warwickshire Borough Council; (2010); *North Warwickshire Landscape Character Assessment* [online]; http://www.northwarks.gov.uk/site/scripts/download_info.php?downloadID=1668; Accessed: June 2013.

⁷³ Solihull Metropolitan Borough Council; (2010); *Solihull's Countryside Strategy: First Review 2010 – 2020* [online]; www.solihull.gov.uk/Attachments/countysidestrat_firstrev.pdf; Accessed: June 2013.

setting for the settlement of Balsall Common and is crossed by a number of major transport routes such as the Rugby to Birmingham line and the A452 Kenilworth Road which reduces tranquillity locally. The LCA is considered to be in good overall condition and is valued at the borough level for its extensive network of PRoW. Therefore, this area has a medium sensitivity to change. Part of the LCA is located within the adjacent Stoneleigh, Kenilworth and Burton Green area (CFA18).

Solihull Rural Heartland LCA

- 9.3.10 This LCA is a well-wooded farmland landscape with rolling landform, an ancient pattern of small fields, winding lanes and dispersed hamlets. It provides a rural setting for long established and often attractive villages including Hampton-in-Arden. Fields are mainly arable and bounded by woodland edges, tree belts and wooded streamlines. Incongruous elements include large-scale mineral workings and golf courses. The area is crossed by a number of major transport routes such as the Rugby to Birmingham line and the A452 Kenilworth Road, which reduces tranquillity locally. This LCA is in good condition and is of borough value due to the contrast it provides to neighbouring urban areas. Therefore, this area has a medium sensitivity to change. Part of the LCA is located within the adjacent Stoneleigh, Kenilworth and Burton Green area (CFA18) and Birmingham Interchange and Chelmsley wood area (CFA24).

Blythe Valley LCA

- 9.3.11 Within this area, the meandering River Blythe forms a wide and physically indistinct valley between the settlements of Meriden and Hampton-in-Arden, characterised by the tree lined watercourse and open floodplain pasture. Hedges are largely absent along field boundaries. The area is crossed in places by major transport routes, including the flight path of Birmingham Airport, which reduces tranquillity locally. The landscape elements of this LCA are in good condition and are of borough/district value, offering a distinct contrast to the adjacent more intensively used and built-up areas. Therefore, this area has a high sensitivity to change.

Hampton-in-Arden Residential LCA

- 9.3.12 Hampton-in-Arden is a quiet, attractive and well-maintained, medium scale village of largely late 19th century brick buildings, centred on a medieval church and designated as a conservation area. These high quality and well maintained elements create an attractive environment with an overall good landscape condition. Small-scale fields, including pasture, enclose the settlement and provide a high level of tranquillity. The village's hilltop location provides long views over the surrounding predominantly rural landscape. These factors contribute to an area with borough/district value as the village is visited by tourists and recreational visitors. Therefore, this area has a high sensitivity to change.

M42 corridor LCA

9.3.13 The extent of the M42 corridor LCA within the study area is distant from, and to the west of, the Proposed Scheme.

9.3.14 The majority of the LCA affected by the Proposed Scheme is located within Birmingham Interchange and Chelmsley Wood study area (CFA24). For the summary baseline description refer to Volume 2, CFA Report 24, Birmingham and Chelmsley Wood, and for the full baseline description refer to Volume 5: Appendix LV-01-024 (Birmingham and Chelmsley Wood, CFA 24).

Visual baseline

9.3.15 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-023. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are numbered to identify their locations which are shown in Volume 5: Maps LV-03-077b to LV-03-080a and LV-04-077b to LV-04-080a. 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.

9.3.16 No protected views have been identified within the study area.

9.3.17 Residential receptors have a high sensitivity to change and are located on the edges of Balsall Common, Berkswell, Bradnocks Marsh and Hampton-in-Arden, in addition to many isolated groups or individual properties throughout the study area. Views are typically rural across pasture or agricultural fields with the roofline of buildings occasionally visible through vegetation. The combination of flat or gently undulating topography with successive belts of dense mature vegetation bordering fields limits the extent of views.

9.3.18 Recreational receptors, also with a high sensitivity to change, are located on PRoW throughout the study area, including the Kenilworth Greenway, Heart of England Way and Millennium Way. The viewpoints are typically located in rural agricultural locations, with pasture fields forming the foreground and wooded skylines or planted field boundaries forming some degree of enclosure.

9.3.19 People travelling on the main roads, principally the A452 Kenilworth Road and the B4102 Meriden Road, have a low sensitivity to change. Other roads within the study area are typically rural lanes, used principally for local access rather than as scenic vehicle routes and consequently are of low sensitivity to change. Views from the main roads are characterised by arable farmland and grazing pasture, with wooded backdrops including tree lined watercourses. Views from the rural lanes are typically restricted by hedges, although long views are locally present where landform variations create locally elevated views across the landscape.

Future Baseline

- 9.3.20 A summary of the committed developments which are assumed to be built and occupied prior to either the construction or operation of the Proposed Scheme is provided below, along with the consequential effect on the character of LCAs and nature of views. Developments which would introduce new visual receptors which may be significantly affected are also described. These developments are shown on Volume 5: Maps CT-13-050b to CT-13-052-R1.

Construction (2017)

- 9.3.21 It is not considered that any of the developments detailed in Volume 5: Appendix CT-004-000 would give rise to any new landscape or visual receptors.

Operation (year 1 – 2026)

- 9.3.22 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 the route on embankment and in cutting. The effects associated with the peak construction phase in this 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 start of 2023. The Park Lane cutting main compound will be in place for approximately four years and three months. Satellite compounds will be in place for between approximately one year and four years, with the exception of the Beechwood Farm accommodation underpass satellite compound which will be in place for approximately four years and three months. The civil engineering works at most individual sites along the route in this CFA would occur for a period of between approximately three months and two 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.
- 9.4.2 The construction works that have been taken into account in determining the significant effects on landscape and visual receptors include:

- general earthworks along the route requiring cut/fill such as Patrick cutting , Horn Brook cutting and Diddington Lane cutting requiring vegetation removal and landform modification and the presence of construction plant;
- general overhead power line and utilities diversions and earthworks to create balancing ponds, ditches and floodplain replacement storage areas;
- construction of Beechwood embankment, adjacent to the Kenilworth Greenway;
- construction of Carol Green Rail underbridge;
- construction of Balsall Common viaduct;
- construction of a 4m high noise fence barrier along the Balsall Common viaduct and at Carol Green underbridge and at Hampton-in-Arden on Diddington Lane embankment;
- construction of Lavender Hall Lane overbridge and highway diversion;
- construction of Park Lane diversion;
- construction of Park Lane cutting;
- construction of Footpath M214 overbridge and Footpath M215 overbridge;
- construction of Bradnock auto-transformer station;
- construction of Marsh Farm viaduct;
- construction of embankments associated with the Mercote Hall Lane (Bridleway M218) accommodation overbridge, in close proximity to Mercote Mill Farm;
- construction of A452 Kenilworth Road overbridge and highway diversion;
- construction of B4102 Meriden Road underbridge;
- construction of Shadow Brook underbridge;
- construction of Patrick embankment, in close proximity to Patrick Farm;
- construction of River Blythe viaduct; and
- construction of Pasture Farm accommodation overbridge.

Avoidance and mitigation measures

9.4.3 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 (see draft CoCP, Section 12);
- use of well-maintained hoardings and fencing (see draft CoCP, Section 12);

- replacement of any trees intended to be retained which may be accidentally felled or die as a consequence of construction works (see draft CoCP, Section 12);
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (see draft CoCP, Section 12); and
- management of flood risk and other extreme weather events which may affect landscape and visual resources during construction (draft CoCP, Section 16).

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

Assessment of temporary impacts and effects

9.4.5 The most apparent changes to views during construction will relate to the temporary presence of construction plant and the removal of existing landscape elements, such as trees, hedges and agricultural land and landform modification to create embankments or viaducts.

9.4.6 Changes will be most notable along the route of the dismantled Kenilworth to Balsall Common line (Kenilworth Greenway), Truggist Lane, Lavender Hall Lane, Bradnocks Marsh Lane, and Diddington Lane, and the emerging construction of the Balsall Common, Marsh Farm, River Blythe viaducts; Shadow Brook, Carol Green Rail and B4102 Meriden Road underbridges; A452 Kenilworth Road realignment; and Footpath M214, Footpath M215, and Pasture Farm accommodation overbridges. 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. The topography in certain locations and the retention of intervening hedgerows and trees will partially screen low level construction activity.

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-001-023.

Stoneleigh Parklands LCA

9.4.8 The majority of this LCA is located within CFA 18. For the assessment of temporary effects during construction refer to Volume 2 CFA 18.

Balsall Common Rural LCA

9.4.9 The route will pass through this LCA between B4101 Waste Lane and Truggist Lane, to the east of Balsall Common, broadly following the line of Kenilworth Greenway but diverging from it slightly near the existing Rugby to Birmingham line. Construction

activities will include removal of woodland along Kenilworth Greenway and sections of hedges in fields adjacent to it associated with the construction of the Carol Green Rail underbridge. An agricultural building at Truggist Hill Farm will be demolished and Balsall Common viaduct constructed to the north of Truggist Lane.

- 9.4.10 Some loss and severance of agricultural land will occur between Kenilworth Greenway, the Rugby to Birmingham line and the route, creating permanent slivers of isolated farmland. The character of the area will also be affected by the presence of large scale earthworks and construction plant associated with the Balsall Common viaduct and Carol Green Rail underbridge. This will create a temporary but new element in the rural landscape.
- 9.4.11 Construction activity will also introduce large scale earthworks, vehicles, and lighting into the area, which will reduce tranquillity for much of the LCA, particularly during the construction of the Balsall Common viaduct.
- 9.4.12 Due to the removal of characteristic, long established landscape components and introduction of construction plant into the rural landscape, the magnitude of change is considered to be high, although diminishing across the wider LCA as a whole due to the screening effect of landform and vegetation.
- 9.4.13 The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a major adverse effect.

Solihull Rural Heartland LCA

- 9.4.14 The route will pass through this LCA between Lavender Hall Lane and the point at which it enters the Blythe Valley LCA, to the east of the Bradnocks Marsh Lane/A452 Kenilworth Road roundabout. There will be localised loss of hedges and mature hedgerow trees along Lavender Hall Lane and at successive field boundaries crossing the route north and south. There will also be a temporary loss of agricultural land either side of the route and disruption of field use.
- 9.4.15 The character of the area will be directly affected by the presence of temporary new elements in the rural landscape, including large scale earthworks and construction plant, in particular those required to construct Park Lane cutting and Lavender Hall Lane overbridge.
- 9.4.16 Construction activity will introduce vehicles, disturbance and lighting into an area of medium tranquillity, reducing it locally for the duration of the works.
- 9.4.17 Construction will result in loss of characteristic landscape elements such as trees, hedges and agricultural land severing land parcels as the route crosses the centre of a succession of fields. However, these changes to character will be confined to a relatively small part of the LCA, and therefore the magnitude of change is considered to be medium.

- 9.4.18 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Blythe Valley LCA

- 9.4.19 The route will pass through this LCA in the vicinity of Marsh Farm and Mercote Hall Lane. There will be a permanent loss of landscape elements characteristic to the valley context of a tributary of the River Blythe, such as wet grassland and wet woodland. There will also be a temporary loss of agricultural land either side of the route. The key effect on landscape character of the LCA will arise through the presence of temporary new elements in the rural landscape, including the construction plant required for the Marsh Farm viaduct.
- 9.4.20 Construction activity will introduce vehicles, disturbance and lighting into an area of medium tranquillity, reducing it locally for the duration of the works.
- 9.4.21 Construction will involve some loss of characteristic landscape elements such as trees, hedges and agricultural land. However, the presence of new elements, earthworks and activity within the relatively secluded and confined context of the LCA will generate a high magnitude of change to landscape character throughout the construction period. The majority of the LCA will be directly affected and overall the magnitude of change is considered to be high.
- 9.4.22 The high magnitude of change, assessed alongside the high sensitivity of the character area, will result in a major adverse effect.

Hampton-in-Arden Residential LCA

- 9.4.23 The Proposed Scheme will lie outside of this LCA and therefore no landscape elements within the LCA will be directly impacted. Effects therefore relate to the setting of the LCA and effects experienced on entering and leaving the village on the A452 Kenilworth Road. However, access to and from the LCA to the east, via Diddington Lane and the B4102 Meriden Road, will be disrupted during construction due to the presence of construction infrastructure, including plant required to construct Patrick embankment and the River Blythe viaduct.
- 9.4.24 Given the proximity of construction activity to this LCA, tranquillity will be reduced by the introduction of vehicles, disturbance and lighting. Construction will involve no loss of characteristic landscape elements within the LCA. However, given the presence of new elements and construction activity adjacent to the LCA, the magnitude of change is considered to be medium.
- 9.4.25 The medium magnitude of change assessed alongside the high sensitivity of the character area, will result in a moderate adverse effect.

M42 corridor LCA

- 9.4.26 The majority of this LCA affected by the Proposed Scheme is located within Birmingham Interchange and Chelmsley Wood study area (CFA24). For the

assessment of temporary effects during construction refer to Volume 2, CFA Report 24.

Visual assessment

- 9.4.27 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, for some receptors, 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-001-023.
- 9.4.28 The number identifies the viewpoint locations which are shown in Volume 5: Maps LV-03-077b to LV-03-080a. 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.
- 9.4.29 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 283.2.002: View north-east across pastures from Millennium Way (Footpath M198) adjacent to residences on Old Waste Lane

- 9.4.30 The centre line of the Proposed Scheme will lie approximately 400m away from this viewpoint, in front of the mature belt of trees on the skyline. Construction activity will include substantial removal of trees on the skyline, which mark the line of the disused line now used as part of the Kenilworth Greenway. The Beechwood underpass satellite compound and series of temporary material stockpiles will be located between the route and the viewpoint. Construction plant will be visible across the panorama to the rear of field boundaries to be retained. Although intervening hedges will partially screen construction activities, visibility of taller construction plant and the loss of trees will result in a medium magnitude of change. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 284.3.001: View south across Beechwood Farm pastures from Millennium Way (Footpath M198)

- 9.4.31 Visual effects during construction will include removal of trees/woodland along the Kenilworth Greenway and construction of the Proposed Scheme parallel to it, centrally within the view. Construction plant will be prominent in the background of the view forming the Beechwood embankment, adjacent to the Kenilworth Greenway, which will be up to 11m high. Views will be partially screened by the retention of a well-developed intervening hedge in the middle ground. Given the

proximity of the viewpoint to the Proposed Scheme, the elevated nature of the earthworks and the removal of background vegetation the change will be of medium magnitude.

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

Viewpoint 284.3.003: View south across Truggist Hill Farm pastures from Footpath M191

- 9.4.33 Construction of the on the Beechwood embankment of up to 10m will be visible from this location. The removal of hedges and trees in the middle ground, and the presence of construction plant required on embankment and forming the Carol Green Rail underbridge will be prominent. The Carol Green Rail underbridge (north) satellite compound and haul road will be prominent in the foreground. Whilst much of the vegetation in the background will be retained there will be both visual obstruction of it and visual intrusion derived from the elements listed above. The absence of intervening screening, the elevated nature of the Proposed Scheme and the proximity of the satellite compound to the viewpoint will result in a high magnitude of change.

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

Viewpoint 285.2.002: View north from residences along Ridings Hill

- 9.4.35 The proposed Balsall Common viaduct and associated embankments will lie approximately 350m beyond the dense woodland associated with the Rugby to Birmingham line. The upper sections of cranes will be prominently visible above the intervening trees. Other lower elements, including the viaduct, which will be approximately 14m high to the top of noise fence barrier, will be screened by intervening vegetation. As the cranes will form the only visible element impacts from construction, the magnitude of change in the view is considered to be low.

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

Viewpoint 285.2.003: View north-east across pastures from Footpath M196 adjacent to residences on Barrett's Lane

- 9.4.37 Trees in the background of this view, along the Kenilworth Greenway, will be removed during construction. Cranes, involved in the construction of the Carol Green Rail underbridge will be visible within the centre of the view. However, transmission towers are already visible beyond the intervening vegetation and will reduce the overall impact of the cranes. Given that the main construction works will be screened by existing vegetation the overall magnitude of change is considered to be low.

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

Viewpoint 285.3.001: View north-east across pastures from the junction of Footpaths M191 and M196

9.4.39 The vegetation in the middle ground of the view will be substantially removed in order to construct the Beechwood embankment, adjacent to the Kenilworth Greenway, and Carol Green Rail underbridge. The Carol Green Rail underbridge (south) satellite compound and temporary material stockpile area to the south will be prominent in the view. Construction will be a dominant element in close proximity, in the middle ground of the view. The absence of intervening screening, the elevated nature of the scheme and the proximity to the viewpoint will result in a high magnitude of change.

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

Viewpoint 286.2.003: View south-west across pastures from residences on Baulk Lane

9.4.41 Construction activity associated with the Balsall Common viaduct will occupy the middle ground of this view. Changes in view will include the minor loss of vegetation, prominent views of cranes and the appearance of the viaduct under construction with associated barriers and infrastructure. Vehicles using the temporary site access/haul road will be visible. The height of the viaduct, at approximately 10m above ground level and additional 4m noise fence barrier, and proximity to the viewpoint will result in a high magnitude of change.

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

Viewpoints 286.3.001 and 286.3.002: View south across Moat House Farm farmland from Footpath M191

9.4.43 Visibility of construction activity will be limited to the upper sections of tall construction plant required at the Balsall Common viaduct and Beechwood and Lavender Hall embankments. Intervening topography and to a lesser extent existing vegetation will obstruct other views. There will be some loss of vegetation within the context of the overall wooded panorama. Together, these effects will result in a medium magnitude of change.

9.4.44 The medium magnitude of change assessed against the high sensitivity of these receptors will result in moderate adverse effects.

Viewpoint 286.3.004: View south-west across pastures off Baulk Lane from Footpath M191

9.4.45 The panorama will encompass the Balsall Common viaduct to the north of Truggist Lane and construction of the Lavender Hall embankment in close proximity to Lavender Hall Lane, with the Proposed Scheme approximately 10m above existing ground levels and a noise fence barrier on the Balsall Common viaduct adding a further 4m. Construction of the viaduct and embankment will involve some loss of

vegetation within the panorama, although vegetation alongside the watercourse in the foreground will be retained. Construction plant will be very prominent in the middle ground of the view above intervening vegetation. Vehicles using the haul road will be visible. The elevated nature of the Proposed Scheme, visible above low level screening, and the proximity to the viewpoint will result in a high magnitude of change.

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

Viewpoint 286.3.006: View south-west across Ram Hall pastures from Footpath M192

- 9.4.47 The cranes required to construct the Balsall Common viaduct will be visible in the view frame. Construction plant will be visible above the intervening middle ground topography and hedges. Vehicles using the temporary site access/haul road will be visible. A temporary materials stockpile between the viewpoint and Lavender Hall Lane and temporary materials stockpile area adjacent to Ram Hall will be visible at this location. Construction activity at a low level and the Balsall Common viaduct satellite compound will be largely screened by the existing topography and intervening vegetation. The construction of the viaduct will be screened by the rising topography in the left hand side of the view. Overall there is considered to be a medium magnitude of change.

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

Viewpoint 287.2.004: View north-east along Lavender Hall Lane from Lavender Hall residences

- 9.4.49 Construction activity associated with the Lavender Hall Lane overbridge and diversion of Park Lane will occupy the middle ground of this view. Vegetation in the foreground and middle ground of the viewpoint will be substantially removed and earthworks and construction plant will be visible along with vehicles using the haul road which crosses the panorama. The temporary materials stockpile to the west of Park Lane and the more distant temporary materials stockpile adjacent to Lavender Hall Lane will be prominent along with the Balsall Common viaduct satellite compound. The construction activity will result in a high magnitude of change.

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

Viewpoint 287.4.003: View north across the A452 Kenilworth Road from Wootton Lane

- 9.4.51 Views will initially comprise extensive formation of a substantial temporary material stockpile on the agricultural field in the foreground. Once in place views of the Proposed Scheme under construction, within the Park Lane cutting, of up to 12m in

depth, will be obstructed by the temporary material stockpile. Construction will involve the removal of some woodland at Park Lane Spinney. Consequently, the woodland in the background of the view, which will remain visible above the temporary material stockpile, will be reduced in extent. Views of construction other than the temporary material stockpile will be limited but, due to the degree of visual obstruction in close proximity to the viewpoint, the magnitude of change is considered to be medium.

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

Viewpoint 289.4.001: View north across New Mercote Farm farmland from the A452 Kenilworth Road

- 9.4.53 The construction of the Footpath M215 overbridge across the cutting will be evident within the middle ground of this view. The presence and movement of cranes will therefore be discernible against the sky in the centre of the view. Construction activity will involve the removal of the northern extent of the woodland block. Although the lower sections of some construction traffic will be largely contained within the proposed cutting profile, up to 12m in depth, tall construction plant will be visible above the backdrop of woodland in the background of the view. Vehicles using the haul road which crosses the panorama will be visible in the middle ground. Therefore, the magnitude of change is considered to be medium.

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

Viewpoint 290.3.001: View south-east across New Mercote Farm farmland from Millennium Way (Footpath M215)

- 9.4.55 The Proposed Scheme will be in cutting across this panorama, with visibility of structures limited to the Footpath M215 overbridge. However, works to create a false cutting to the east of the route will extend to the viewpoint location through the creation of a natural slope gradient to achieve landscape mitigation. Soil stripping, machinery and earthworks will therefore be prominent in the immediate foreground. Some of the mature trees within the panorama will be removed. Given the proximity of the Proposed Scheme and the absence of screening by vegetation, the construction activity of the mitigation earthworks associated with the false cutting will be openly visible within the view, resulting in a high magnitude of change.

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

Viewpoint 291.2.001: View north across Bradnocks Marsh Lane/A452 Kenilworth Road roundabout from residences on Bradnocks Marsh Lane

- 9.4.57 Part of the woodland in the middle ground will be removed and an access road to the Bradnock auto-transformer station will be constructed to link into the roundabout in

the foreground of the view. Temporary material stockpiles and the Bradnock auto-transformer station satellite compound will be located between the A452 Kenilworth Road and the route. The construction of the Sixteen Acre Wood embankment, of up to 5m height, will be visible either side of the temporary material stockpile centrally within the view. Therefore the magnitude of change in this view is considered to be medium.

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

Viewpoints 291.3.003: Views north across Marsh Farm pasture from Millennium Way (Footpath M216)

- 9.4.59 Construction within these views will include the Sixteen Acre Wood embankment and Marsh Farm viaduct at approximately 5m above existing ground level. Changes within the views will include minor loss of vegetation, prominent views of tall construction plant and the appearance of the viaduct and associated noise fence barriers. Vehicles using the haul road which crosses the panorama will be visible in the middle ground. The height of the viaduct and embankment and close proximity of construction and the haul road to the viewpoints, coupled with the absence of intervening screening, will result in a high magnitude of change.

- 9.4.60 The view of the Proposed Scheme from this location at 291-3-003 during construction is illustrated on the photomontage shown in Volume 2: Figure LV-01-213.

- 9.4.61 The high magnitude of change assessed alongside the high sensitivity of these receptors will result in major adverse effects.

Viewpoint 291.4.004: View north-east across the A452 Kenilworth Road from Marsh Lane

- 9.4.62 Short range views from this location will be dominated by construction activity associated with the A452 Kenilworth Road realignment including the removal of the existing road in the foreground. Construction plant undertaking earthworks and carriageway construction will also be evident within the middle ground of the view, including cranes in the right extent of the view to construct the Marsh Farm viaduct. Tall construction plant associated with the Mercote Hall Lane (Bridleway M218) accommodation overbridge and A452 Kenilworth Road overbridges will punctuate the skyline forming elements of the horizon and background of the view. The removal of hedgerows and other vegetation in the middle ground, in order to accommodate the Proposed Scheme, will increase the prominence of construction activity. Therefore, the magnitude of change in this close range view is considered to be high.

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

Viewpoint 292.3.003: View north-west across farmland adjacent to Mercote Hall Lane from Millennium Way (Footpath M217)

- 9.4.64 Construction elements within the view will include the Marsh Farm viaduct, the Sixteen Acre Wood embankment and the diversion of the Bayleys Brook, as well as partial visibility of the A452 Kenilworth Road overbridge. Vegetation loss will be minimal and construction activity will be viewed beyond the vegetation in the middle ground of the view. The scale of the A452 Kenilworth Road overbridge at approximately 10m above its existing elevation and the Marsh Farm viaduct will require the use of tall cranes. Therefore, given the presence of construction plant in the context of the existing view over the Bayleys Brook, the magnitude of change will be medium.
- 9.4.65 The medium magnitude of change assessed against the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 292.3.004: View west across Mercote Mill Farm farmland from Footpath M218

- 9.4.66 Vegetation loss will be minimal but temporary material stockpile formation in the foreground and construction activity associated with the Mercote Hall Lane (Bridleway M218) accommodation overbridge and the realigned A452 Kenilworth Road overbridge will be openly visible in the middle ground. The scale of the A452 Kenilworth Road overbridge at approximately 10m above the level of the existing road and Marsh Farm viaduct will require the use of cranes, which will be prominent in the view along with other construction plant to the right hand side of the view. Despite the existing woodland blocking views due west, the scale of the Proposed Scheme coupled with the relative proximity of the viewpoint will result in a medium magnitude of change.
- 9.4.67 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 293.4.002: View east across the River Blythe valley from the B4102 Meriden Road

- 9.4.68 Construction activity will involve the removal of the small woodland in the middle ground of the view, resulting in direct views of construction plant associated with the construction of Patrick cutting and Patrick embankment. These construction elements will form prominent features in the middle ground of the view due to the elevated nature of the location and as a consequence of proposed vegetation removals. The loss of trees in the centre of the view will increase the prominence of large construction plant. Therefore, the magnitude of change is considered to be high.
- 9.4.69 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 293.4.003: View north across the River Blythe valley from the B4102 Meriden Road

- 9.4.70 The construction phase will introduce large construction plant into a landscape currently devoid of such features and characterised by agricultural land use. Construction activity associated with the B4102 Meriden Road underbridge, Patrick embankment and the River Blythe viaduct will be visible in the middle ground of the view. The B4102 Meriden Road underbridge satellite compound will be visible in the middle ground. Cranes and construction activity will be prominent in close proximity, forming the only vertical visual element within the wider panorama. Vehicles using the haul road which crosses the panorama will be visible in the foreground. Overall the view will be dominated by construction activity. Consequently, the magnitude of change in this close range view is considered to be high.
- 9.4.71 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 295.2.003: View north-east across Mouldings Green Farm farmland from residences on Diddington Lane

- 9.4.72 The prominent tree in the middle ground of the view, located at the corner of a field boundary, will be removed and the construction of Diddington Lane embankment, of up to 8m in height, will dominate the centre of the view. The temporary material stockpile to the rear of the properties on Diddington Lane will be visible. The absence of intervening screening, the elevated nature of the Proposed Scheme and the close proximity to the viewpoint will result in a high magnitude of change.
- 9.4.73 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 295.3.001: View east across the River Blythe valley from Footpath M118

- 9.4.74 During construction there will be visibility of substantial loss of vegetation within the woodland and hedgerows, cranes required for the B4102 Meriden Road underbridge and other construction plant required to construct Patrick Farm cutting and Patrick embankment will be prominent in the middle ground. The prominence of construction activity in close proximity to the viewpoint, with limited intervening screening, will result in a high magnitude of change.
- 9.4.75 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 295.3.002: View north-east across farmland adjacent to Diddington Lane from Footpath M115

- 9.4.76 During construction, views will be available, in part due to the loss of trees adjacent to Diddington Lane. Cranes required for the Shadow Brook underbridge and construction plant associated with Diddington Lane embankment of up to 8m in

height will be visible centrally within the view. Vehicles using the haul road which crosses the panorama will be visible in the middle ground. The prominence of construction activity in the background of the view will be partly screened by intervening trees and field boundaries to be retained, with the dominant foreground context unchanged and the extent of vegetation loss limited. However, taller elements of the construction activity will be prominent and visually new in the rural landscape, resulting in a medium magnitude of change.

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

Viewpoint 296.2.001: View south-west along the B4102 Meriden Road from Patrick Farm

- 9.4.78 The view will change during construction as a result of removal of vegetation and presence of construction plant required for the B4102 Meriden Road underbridge and Patrick embankment, at up to 11m above existing ground levels. The elevated nature of the Proposed Scheme, the proximity to the view and the scale of the construction plant required will result in a high magnitude of change.

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

Viewpoint 298.3.001: View south-west across farmland from Footpath M114

- 9.4.80 During construction there will be visibility of the removal of trees and hedges in the middle ground of the view. The construction of Diddington cutting in close, of up to 9m in depth, will occur centrally within the view, also in the middle ground. Construction plant will be highly visible along with vehicles using the haul road which crosses the panorama in the middle ground. A temporary material stockpile and the A45 Service Road overbridges satellite compound (located within the Birmingham Interchange and Chelmsley Wood area (CFA24)) will be prominent in the view. Therefore, the change will be of a high magnitude.

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

Cumulative effects

- 9.4.82 Volume 5: Appendix CT-004-000 and Volume 5: Maps CT-13-050b to CT-13-052-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.

- 9.4.83 There are no known developments that will result in any cumulative effects and therefore, there are no consequential cumulative effects on LCAs and viewpoints.

Other mitigation measures

- 9.4.84 Other mitigation measure to further reduce the significant effects described above will be considered during the detailed design stage including consideration of where planting can be established early in the construction programme. 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

- 9.4.85 As no other mitigation measures are considered practicable at this time without further third party dialogue, the temporary residual significant effects during construction will remain as described above for the Balsall Common Rural LCA, Solihull rural heartland LCA, Blythe Valley LCA and Hampton-in-Arden Residential LCA (see Volume 5: Map LV-02-077b to LV-02-080a) and for the identified viewpoints.
- 9.4.86 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 PRoW 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 significant effects on landscape and visual receptors includes:
- presence of new engineered landforms such as Beechwood embankment, adjacent to the Kenilworth Greenway, Lavender Hall embankment, Sixteen Acre Wood embankment and Blythe Bypass embankment and overhead line equipment cutting across the existing rural landscape;
 - presence of new engineered landforms such as Patrick cutting, Horn Brook cutting and Diddington Lane cutting and overhead line equipment cutting across the existing rural landscape;
 - removal and diversion of overhead power lines and transmission towers and diversion of underground utilities, including an oil pipeline and presence of balancing ponds and floodplain replacement storage areas;
 - presence of Balsall Common viaduct;
 - presence of Lavender Hall Lane overbridge and highway diversion;
 - presence of Park Lane diversion;
 - presence of presence of Footpath M214 overbridge;
 - presence of Footpath M215 overbridge;
 - presence of Bradnock auto-transformer station;

- presence of Marsh Farm viaduct;
- presence of A452 Kenilworth Road overbridge;
- presence of 4m high noise fence barriers in the vicinity of Diddington Lane;
- presence of an Patrick embankment, in close proximity to Patrick Farm;
- presence of River Blythe viaduct;
- presence of Pasture Farm accommodation overbridge;
- floodplain replacement storage area;
- presence of the A45 Coventry Road overbridge, A45 Service Road and East way located within Birmingham Interchange and Chelmsley Wood (CFA24) which will be visible from within this study area; and
- the regular presence of high speed trains through the landscape.

Avoidance and mitigation measures

9.5.2

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

- adoption of a green infrastructure approach to ensure the creation of a well-connected landscape that helps to alleviate flooding, benefits biodiversity and recreation and is robust and has the capacity to adapt to climate change impacts;
- reflecting the sensitivity of this area viaducts have been specifically designed, where practicable, to reduce the vertical alignment and reduce visual intrusion;
- embankment and cuttings, both for the route and highway realignments, have been shaped so as to integrate the Proposed Scheme into the character of the surrounding landscape. Planting will reflect tree and shrub species native to the Arden landscape character;
- where it is considered that a noise fence barrier will create a visual impact on neighbouring residential properties a landscape bund will be provided where reasonably practicable;
- floodplain replacement storage areas and balancing ponds will be integrated into the landscape to alleviate flooding with associated planting around these features also providing opportunities for biodiversity;
- the section of the existing A452 Kenilworth Road, where it will become redundant, will be planted to integrate the road into the local landscape as well as providing screening to users of Footpath M230a; and

- planting, including native broad-leaved woodland, shrub and hedgerows, will be implemented at areas such as Beechwood embankment, land adjacent to the Lavender Hall Lane, Footpath M215 overbridge and A452 Kenilworth Road realignment. This planting will assist in screening the route from neighbouring residential properties and users of adjacent PRoW and to aid integration of the Proposed Scheme into the landscape. Selection of species will take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases.

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 Effects on LCAs will arise from: new engineered landforms cutting across the existing landscape; the introduction of overhead line equipment; the introduction of new viaducts with associated infrastructure; the introduction of noise fence barriers that will create a manmade linear feature; permanent severance of land; the introduction of highway infrastructure and bridges into the rural environment; and the introduction of regular high speed trains.

9.5.5 Effects in the Balsall Common Rural LCA will arise from the presence of embankments with sections of viaduct with noise fence barriers, severing agricultural land and contrasting with natural landforms. Within the Solihull Rural Heartland LCA viaducts and highway overbridges will increase urbanisation. Within the Blythe Valley LCA viaducts with noise fence barriers will cut across the natural valley and both introduce infrastructure and obstruct views along the valley. Although no landscape elements will be directly affected within the Hampton-in-Arden LCA, the visual presence and noise of trains in the predominantly rural context will result in a reduction in tranquillity.

Landscape assessment

9.5.6 This section describes the significant effects on landscape character areas during year 1, year 15 and year 60 of operation. Non-significant effects on landscape character areas are presented in Volume 5: Appendix LV-001-023.

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

Stoneleigh Parklands LCA

9.5.8 The majority of this LCA is located within the Stoneleigh, Kenilworth and Burton Green area (CFA18). For the assessment of permanent effects during operation refer to Volume 2, CFA18.

Coventry rural fringe LCA

- 9.5.9 The majority of this LCA is located within the Stoneleigh, Kenilworth and Burton Green area (CFA18). For the assessment of permanent effects during operation refer to Volume 2 CFA18.

Balsall Common Rural LCA

- 9.5.10 The route passes through this LCA largely on embankment (typically 5m high) and, to the north of Truggist Lane, on the Balsall Common viaduct at 10m above existing ground levels. Landscape effects of the Proposed Scheme will include:

- engineered landforms of steep slopes cutting across the natural landform and contrasting with the topography of the adjacent landscape;
- introduction of overhead line equipment and trains visible on the Beechwood embankment, which although already present within the adjacent Rugby to Birmingham line, introduces additional infrastructure within a largely rural context;
- introduction of the 10m high Balsall Common viaduct and additional 4m high noise fence barriers and Lavender Hall embankment spanning Bayleys Brook to the north of Truggist Lane and forming a man-made structure cutting across the landscape;
- introduction of noise fence barriers as a distinct linear feature, contrasting with the natural landscape; and
- agricultural land either side of the Proposed Scheme will be reinstated, where practicable, and returned to agricultural use but there will be permanent severance of land, creating slivers of isolated farmland between the Kenilworth Greenway, the Rugby to Birmingham line and the route.

- 9.5.11 There will be a reduction in tranquillity of the character area derived from the visual presence and noise of trains in the predominantly rural context.

- 9.5.12 Therefore, due to these substantial changes in the character of the area, the magnitude of change is considered to be high in year 1 of operation.

- 9.5.13 The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.

- 9.5.14 By year 15 of operation, planting will have established sufficiently to achieve greater landscape integration of the Proposed Scheme into the rural landscape, including through:

- reducing the influence of engineered landforms; and
- partially screening of overhead line equipment and trains on embankment;

- 9.5.15 However, due to the continued influence of the viaduct, which will remain highly apparent, and the changes to the tranquillity of the area, the magnitude of change will be medium in year 15 of operation.

9.5.16 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 15 of operation.

9.5.17 By year 60 of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape resulting in effects becoming non-significant. These are reported in Volume 5: Appendix LV-001-023.

Solihull Rural Heartland LCA

9.5.18 Between Lavender Hall Lane and the Blythe Valley the route will be largely in cutting, reducing its influence on the adjacent landscape. To the north of the Marsh Farm viaduct the route will be at grade before crossing into the Blythe Valley LCA. On re-entering the Solihull Rural Heartland LCA it remains close to original ground level or on low embankment before entering Diddington cutting. Effects within the LCA therefore vary considerably according to elevation of the Proposed Scheme.

9.5.19 In areas of cutting, the effects on landscape character will include:

- engineered landforms of steep slopes, cutting across the natural landform, contrasting with the topography of the adjacent landscape;
- introduction of overhead line equipment and trains in cutting and at grade, which are a new feature in the rural context;
- agricultural land either side of the Proposed Scheme will be reinstated, where practicable, and returned to use but severance of land will create slivers of farmland or small fields unviable for farming; and
- introduction of overbridges at Lavender Hall Lane, Footpath M215, and A452 Kenilworth Road will introduce further man-made infrastructure associated with the Proposed Scheme.

9.5.20 In areas at grade or on viaduct, the effects on landscape character will include:

- engineered landforms of steep slopes associated with modifications of highways crossing the route (e.g. the A452 Kenilworth Road), contrasting with the natural landform and locally introducing highway lighting;
- introduction of viaducts forming prominent man-made structures cutting across the landscape at or above the tree line;
- introduction of noise fence barriers as a distinct linear feature, contrasting with the natural landscape; and
- introduction of balancing ponds, floodplain replacement storage areas and maintenance access tracks such as that to the Bradnock auto-transformer station.

9.5.21 There will be a reduction in tranquillity of the character area derived from the visual presence and noise of trains in the predominantly rural context.

- 9.5.22 Overall, due to the presence of these new elements in the natural landscape affecting a relatively small part of the LCA, the magnitude of change is considered to be medium in year 1 of operation.
- 9.5.23 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.
- 9.5.24 By year 15 and beyond to year 60 of operation, the maturity of planting established as part of the Proposed Scheme will result in greater landscape integration and reduce effects to be non-significant in this study area (not for the LCA as a whole due to effects in Birmingham Interchange and Chelmsley Wood (CFA24)). These are reported in Volume 5: Appendix LV-001-023.

Blythe Valley LCA

- 9.5.25 The Blythe Valley LCA is characterised by the meandering River Blythe, which traverses, in its narrow course, through the broad gently sloping valley. A mix of agriculture, mainly pastoral fields, and former landed estates and deer parks dominate this sparsely settled landscape.
- 9.5.26 Effects on landscape character in year 1 of operation within this LCA will include:
- introduction of high level viaducts forming prominent man-made structures cutting across the landscape at or above the tree line;
 - introduction of noise fence barriers as a distinct linear feature, contrasting with the natural landscape; and
 - engineered landforms of steep slopes, cutting across the natural landform, contrasting with the adjacent topography.
- 9.5.27 There will be a reduction in tranquillity of the character area derived from the visual presence and noise of trains in the predominantly rural context.
- 9.5.28 The presence of rail infrastructure, landforms and the scale of the viaducts at Marsh Farm and the River Blythe, evident across a large proportion of the LCA, will generate a high magnitude of change in year 1 of operation.
- 9.5.29 The high magnitude of change, assessed alongside the high sensitivity of the character area, will result in a major adverse effect in year 1 of operation.
- 9.5.30 By year 15 and beyond to year 60 of operation, elements of the Proposed Scheme will remain clearly visible despite the incremental growth of vegetation. Therefore the effects will be unchanged.

Hampton-in-Arden Residential LCA

- 9.5.31 The Proposed Scheme will lie outside of this LCA and therefore no landscape elements within the LCA will be directly affected during operation. However, the Proposed Scheme will have the following indirect effects on landscape character:

- introduction of overhead line equipment, and new landforms into the rural landscape to the east of Hampton-in-Arden;
- engineered landforms of steep slopes, cutting across the natural landform, contrasting with the adjacent topography; and
- introduction of the River Blythe viaduct forming a visually prominent manmade structure cutting across the landscape at, or above the tree line.

- 9.5.32 There will be a reduction in tranquillity of this LCA derived from the visual presence and noise of trains in the predominantly rural context. However, these effects will be indirect and localised and occur in the context of influence on tranquillity arising from the existing Rugby to Birmingham line through Hampton-in-Arden and aircraft on approach to Birmingham Airport.
- 9.5.33 While these indirect changes will serve to alter the character of an important entrance and exit to and from the village, the overall character of the LCA will not be substantially affected. Therefore, the magnitude of change is considered to be low in year 1 of operation.
- 9.5.34 The low magnitude of change, assessed alongside the high sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.
- 9.5.35 By year 15 and beyond to year 60 of operation, the maturity of planting established as part of the Proposed Scheme will result in greater landscape integration and reduce effects to be non-significant. These are reported in Volume 5: Appendix LV-001-023.

M42 corridor LCA

- 9.5.36 The majority of this LCA, affected by the Proposed Scheme, is located within Birmingham Interchange and Chelmsley Wood, CFA 24. For the assessment of permanent effects during operation refer to Volume 2, CFA Report 24.

Visual assessment

- 9.5.37 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-01-023. 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.
- 9.5.38 Where significant effects have been identified, an assessment of effects at night time arising from additional lighting has also been undertaken.

9.5.39 The number identifies the viewpoint locations which are shown in Volume 5: Maps LV-04-077 to LV-04-080. In each case, the middle number (xxx.x.xxx) identifies the type of receptor – 2: Residential, 3: Recreational, 4: Transport.

9.5.40 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 283.2.002: View north-east across pastures from Footpath M198 adjacent to residences on Old Waste Lane

9.5.41 The route will be located on the Beechwood embankment, adjacent to the Kenilworth Greenway, up to 10m high within the width of this panorama. It will lie in the middle ground beyond the retained hedgerow field boundary. The overhead line equipment will be visible due to the removal of vegetation required. However, these elements will form only a small component of the view from this location. The landform of the existing Kenilworth Greenway will screen views towards the embankment of the Proposed Scheme and the proposed Beechwood Farm accommodation underpass. Therefore, the magnitude of change is considered to be low.

9.5.42 The low 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.

9.5.43 In summer of year 1 of operation, while existing vegetation will provide some additional screening, the magnitude of change is considered to remain low so it is judged that the overall effect will be unchanged.

9.5.44 The view of the Proposed Scheme from viewpoint 282.2.003 (illustrated in the photomontage shown in Volume 2: Figure LV-01-163 would not be significantly affected due to the distance and degree of intervening vegetation.

9.5.45 By year 15 and beyond to year 60 of operation, planting established on the boundaries as part of the Proposed Scheme will have grown to a height of approximately 7m (by year 15), providing additional screening to the elements of the Proposed Scheme. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 284.3.001: View south across Beechwood Farm pastures from Millennium Way (Footpath M198)

9.5.46 The Beechwood embankment, adjacent to the Kenilworth Greenway, varying in height from approximately 10m in height to 5m above existing ground level, will be visible immediately in front of the disused line forming the Kenilworth Greenway, and to the rear of the electricity transmission tower, apparent in the middle ground of the view. Elements of the Proposed Scheme including noise fence barriers, trains and overhead line equipment will be seen on the skyline in close proximity to the viewpoint, also causing obstruction of wider views. The structure of the Carol Green

Rail underbridge will be visible in the view frame, approximately 10m above existing ground level. Therefore, the magnitude of change is considered to be high in year 1 of operation.

- 9.5.47 The view of the Proposed Scheme from this location during operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-164.
- 9.5.48 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.
- 9.5.49 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.
- 9.5.50 By year 15 and beyond to year 60 of operation, proposed planting on embankments will serve to soften their engineered appearance and also partially screen trains, noise fence barriers and overhead line equipment. This will also serve to partially recreate the wooded panorama in the middle ground of the baseline view. However, due to the height of the overhead line equipment and trains, the upper sections of both will remain visible, resulting in medium magnitude of change, giving rise to a moderate adverse effect in the summer of years 15 and 60 of operation.

Viewpoint 284.3.003: View south across Truggist Hill Farm pastures from Footpath M191

- 9.5.51 The route will pass through the middle ground of this view on Beechwood embankment (maximum 10m above original ground) and on the Carol Green Rail underbridge (10m above original ground level), beyond the existing hedgerow field boundary and the Rugby to Birmingham line. The retention of this vegetated margin will result in only partial, heavily filtered, views towards the embankment landform, noise fence barriers and the glimpsed movement of trains. The upper extent of overhead line equipment and gantries will be intermittently visible above intervening vegetation. However, these will be seen in the context of the existing Rugby to Birmingham line an existing network of overhead power lines and high voltage transmission towers in the middle ground of the view. The dense wooded backdrop provided by vegetation running parallel to the Kenilworth Greenway will be removed from this view. Therefore, the magnitude of change is considered to be low.
- 9.5.52 The low 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.
- 9.5.53 In summer of year 1 of operation, while the existing intervening hedgerow will provide some additional screening, the magnitude of change is considered to remain low, meaning the overall effect will be unchanged.
- 9.5.54 By year 15 and beyond to year 60 of operation, planting established at the base of the Beechwood embankment will have grown to a height of approximately 7m (by year 15), providing additional screening to the elements of the Proposed Scheme. This will

reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 285.3.001: View north-east across pastures from junction of Footpath M191 and M196

- 9.5.55 The Beechwood embankment and Carol Green Rail underbridge, approximately 5 to 10m above the existing level of the Rugby to Birmingham line will be visible in the foreground of the view, unobstructed by intervening vegetation. Elements of the Proposed Scheme including overhead line equipment and noise fence barriers will be evident within the middle ground of the wider panorama. Although judged to be visually prominent, the Proposed Scheme will be seen within the context of existing overhead line equipment. The magnitude of change is considered to be high.
- 9.5.56 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.
- 9.5.57 In summer of year 1 of operation, the removal of the existing vegetation will mean the overall effect will be unchanged.
- 9.5.58 By year 15 and beyond to year 60 of operation, planting established on the retained Kenilworth Greenway in front of the Proposed Scheme will have grown to a height of approximately 7m (by year 15), providing additional screening to the elements of the Proposed Scheme. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 286.2.003: View south-west across pastures from residences on Baulk Lane

- 9.5.59 The Balsall Common viaduct, approximately 10m high above the existing ground level, will be visible at or above the tree line across the width of this panorama. It will include additional 4m high noise fence barriers along the viaduct and 8m high overhead line equipment, giving a total combined height of 22m of infrastructural elements. Proposed planting will be located along the open hedge line/field boundary in the middle ground of the view, but this will not reduce visibility in year 1 of operation due to the elevation of the Proposed Scheme at this location. The open visibility of the viaduct and associated infrastructure coupled with the close proximity to the viewpoint will result in a high magnitude of change in year 1 of operation.
- 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 The view of the Proposed Scheme from this location during year 1 of operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-165.
- 9.5.62 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.

9.5.63 By year 15 of operation, although mitigation planting will have grown to a height of around 7m, providing some screening, the Balsall Common viaduct will remain clearly visible beyond. Therefore the magnitude of effects will be unchanged.

9.5.64 By year 60 of operation, the further growth and maturity of the proposed planting along the field boundary will provide substantial screening of the Proposed Scheme, but also obstruct long views such that the nature of change in the view will remain of medium magnitude. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 60 of operation.

Viewpoint 286.3.004: View south-west across pastures off Baulk Lane from Footpath M191

9.5.65 Views towards this section of the Proposed Scheme will include a partial view of Balsall Common viaduct in the view frame. The viaduct will be approximately 10m above existing ground levels, with 4m high noise fence barriers and 8m high overhead line equipment adding to the visual intrusion within the wider panorama. The Lavender Hall embankment in close proximity to Lavender Hall Lane, at up to 8m above existing ground level on its western side but merging with existing levels on the eastern side, will be central in the middle ground. The overhead line equipment and trains will be prominent.

9.5.66 In winter, screening from existing trees will be limited and the magnitude of change is therefore considered to be high. 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.

9.5.67 In summer of year 1 of operation, the presence of retained vegetation along the watercourse in the middle ground of the view will increase screening of the Proposed Scheme. The magnitude of change will therefore be medium, giving rise to a moderate adverse effect in the summer of year 1 of operation.

9.5.68 By year 15 of operation and beyond, although proposed planting will have grown to a height of around 7m (by year 15), providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond. Therefore effects will be unchanged. However, by year 60 the continued growth and maturity of proposed planting will further restrict views towards the Proposed Scheme. The magnitude of change will therefore reduce to low, giving rise to a non-significant adverse effect by year 60 of operation. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 287.2.004: View north-east along Lavender Hall Lane from Lavender Hall residences

9.5.69 The Lavender Hall Lane overbridge will rise up within the centre of the view from the foreground by approximately 8m above existing ground levels, forming the most prominent element of the Proposed Scheme. This will create visual obstruction and

introduce engineered landforms and highway infrastructure into the panorama. The Proposed Scheme, in a shallow cutting of average 5m and through false cutting to the south of the overbridge, will also be visible, along with 8m high overhead line equipment and fencing. The upper sections of trains will also be visible in the middle ground of the view. Proposed planting will not provide screening in year 1 of operation, and therefore this view is considered to experience a high magnitude of change.

- 9.5.70 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.
- 9.5.71 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.
- 9.5.72 By year 15 of operation, although proposed planting will have grown to a height of around 7m, providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond. Therefore effects will be unchanged.
- 9.5.73 By year 60 of operation, the further growth and maturity of the proposed planting will provide substantial screening of the Proposed Scheme, meaning effects on this viewpoint will be non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 287.4.003: View north across the A452 Kenilworth Road from Wootton Lane

- 9.5.74 The majority of the Proposed Scheme will not be visible from this location due to location within the Park Lane cutting which will be up to 12m depth. Glimpsed views of the realigned carriageway of Park Lane will be apparent in the middle ground. Footpath M214 overbridge across the cutting will be visible due to the removal of a section of intervening woodland in Park Lane Spinney to construct the Proposed Scheme. In winter the view will be more open and therefore, the magnitude of change is considered to be medium.
- 9.5.75 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.
- 9.5.76 In summer of year 1 of operation, the screening effects of small groups of existing trees in the middle ground will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023.
- 9.5.77 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will further obscure views resulting in non-significant effects. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 290.3.001: View south-east across New Mercote Farm farmland from Millennium Way (Footpath M215)

9.5.78 The Proposed Scheme will be in close proximity to this viewpoint, although it will be located in cutting within the Park Lane cutting and false cutting in close proximity to Park Lane, serving to screen views. The proposed Footpath M215 overbridge will be visible along with upper sections of new vertical elements including the overhead line equipment which may locally protrude above the top of the cutting. The existing vegetated backdrop to the view will be removed in its entirety, with the exception to the corner of Sixteen Acre Wood located within the view frame. Therefore, the magnitude of change is considered to be medium.

9.5.79 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.

9.5.80 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.

9.5.81 By year 15 and beyond to year 60 of operation, hedges established along the fence line to the top of the false cutting will have matured and screen views of the route. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 291.2.001: View north across Bradnocks Marsh Lane/A452 Kenilworth Road roundabout from residences on Bradnocks Marsh Lane

9.5.82 The Proposed Scheme will be visible on Sixteen Acre Wood embankment across the panorama at levels above existing ground of up to 6m. Overhead line equipment and trains will be visible in the background above the existing hedge along the highway. The extent of woodland in the panorama will not be noticeably different to the existing baseline and the visual effect will therefore relate to intrusion from the rail line infrastructure. This will be visually prominent, albeit at a distance of approximately 375m and within the context of a foreground dominated by highway and in contrast to a wooded background. Proposed planting will not provide screening in year 1 of operation, and therefore this receptor is considered to experience a medium magnitude of change.

9.5.83 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.

9.5.84 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.

9.5.85 By year 15 and beyond to year 60 of operation, planting established on the Sixteen Acre Wood embankment as part of the Proposed Scheme will have grown to a height of approximately 7m, providing screening to both the embankment and trains. While

the upper sections of the overhead line equipment will remain visible, the effect will be non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 291.3.003: View north across Marsh Farm pasture from Millennium Way (Footpath M216)

- 9.5.86 The Sixteen Acre Wood embankment at up to 6m high will be visible in the middle ground of this view on land between Marsh Farm and the woodland tract of Coronation Spinney in the background of the view. The relatively open nature of the view, due to the lack of retained planting in the fore and middle ground, will afford prominent views of the route. In addition, the embankment landform will partially obscure wider views towards the existing vegetated backdrop in the central frame.
- 9.5.87 The view of the Proposed Scheme from this location during year 1 of operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-166.
- 9.5.88 In winter, the magnitude of change is considered to be high. 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.
- 9.5.89 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.
- 9.5.90 By year 15 and beyond to year 60 of operation, although proposed planting will have grown to a height of around 7m (by year 15), providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond. Therefore effects will be unchanged. Despite the continued growth and maturity of proposed planting by year 60, effects will remain unchanged.

Viewpoint 291.4.004: View north-east across A452 Kenilworth Road from Marsh Lane

- 9.5.91 The foreground of the view from this location will be dominated by the A452 Kenilworth Road overbridge and associated earthworks, although this will not represent a substantial variation in the nature of the view compared with the existing situation. The removal of mature vegetation will afford views towards the Marsh Farm viaduct and Mercote Hall Lane. Both the A452 Kenilworth Road overbridge and Mercote Hall Lane (Bridleway M218) accommodation overbridge will form additional vertical visual detractors against the skyline of this view. Earthworks associated with Mercote Hall Lane (Bridleway M218) accommodation overbridge will also be prominent within this view. Therefore, the magnitude of change is considered to be medium.
- 9.5.92 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.
- 9.5.93 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.

9.5.94 By year 15 and beyond to year 60 of operation, planting established along the overbridge embankments of the realigned A452 Kenilworth Road will partially screen views towards the overhead line equipment and other structures and integrate the Proposed Scheme into the landscape, resulting in non-significant effects. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 292.3.003: View south-west across the River Blythe valley from Millennium Way (Footpath M217)

9.5.95 The Marsh Farm viaduct will be prominent in the centre of the middle ground of this view. The scale of the structure, approximately 5m above existing ground levels and 145m in length, will obscure views of hedgerow vegetation and pastoral land use within the background. Overhead line equipment will be visible against the sky in some sections of the panorama although vegetation alongside with the River Blythe will filter some of these views.

9.5.96 In winter, the magnitude of change will be high. 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.

9.5.97 In summer of year 1 of operation, although the existing vegetation along the River Blythe will afford a greater level of screening, overall effects will be unchanged.

9.5.98 By year 15 and beyond to year 60 of operation, although proposed planting will have grown to a height of around 7m (by year 15), providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond. Therefore effects will be unchanged. Despite the continued growth and maturity of proposed planting by year 60, effects will remain unchanged.

Viewpoint 292.3.004: View west across Mercote Mill Farm farmland from Footpath M218

9.5.99 The Proposed Scheme, including the farm access on embankment and the A452 Kenilworth Road overbridge and associated earthworks will be prominent within the centre of this view due to the absence of intervening fore and middle ground elements. Views of the overhead line equipment and the frequent movement of trains in the shallow cutting in close proximity will be visible in the panorama, although the existing woodland edge planting will obscure some of these views. Whilst the character of the view is largely rural, the Proposed Scheme will be viewed within the context of the A452 Kenilworth Road overbridge which will give rise to the main visual effects. In winter the change will be of medium magnitude.

9.5.100 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.

9.5.101 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.

- 9.5.102 By year 15 and beyond to year 60 of operation, planting established along the embankment slopes of the Proposed Scheme will have matured, helping to integrate the Proposed Scheme into the landscape and partially screen the new infrastructure. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 293.4.002: View east across the River Blythe valley from the B4102 Meriden Road

- 9.5.103 The route will run within Patrick cutting centrally within the view, emerging on the Patrick embankment in close proximity to Patrick Farm on the approach to the River Blythe viaduct. These earthworks will partially obscure views towards buildings at Patrick Farm beyond. Elements of the Proposed Scheme such as the overhead line equipment, noise fence barriers and trains themselves will be evident crossing the middle ground of the view. The B4102 Meriden Road underbridge will also be perceptible in the fore to middle ground.
- 9.5.104 In winter, the magnitude of change is considered to be medium. 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.
- 9.5.105 In summer of year 1 of operation, effects will be unchanged due to the lack of intervening planting.
- 9.5.106 By year 15 and beyond to year 60 of operation, the lack of intervening planting means effects will be unchanged.

Viewpoint 293.4.003: View north across the River Blythe valley from the B4102 Meriden Road

- 9.5.107 The Proposed Scheme will introduce a new rail corridor into this view which is currently largely rural with few visual detractors. The River Blythe viaduct, 150m in length, will disrupt views towards the wooded backdrop provided by mature trees although blocks of tree cover associated with the River Blythe in the foreground of the view will screen some direct views, the 6m high viaduct and 4m high noise fence barrier on top of the viaduct will form a prominent element dissecting middle ground views. The overhead line equipment will protrude above woodland cover in the background view and will be visible against the sky.
- 9.5.108 Therefore, in winter the magnitude of change is considered to be high. 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.
- 9.5.109 In summer of year 1 of operation, despite some additional screening from vegetation, the overall effect will remain unchanged.
- 9.5.110 The view of the Proposed Scheme from this location during year 1 of operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-167.

9.5.111 By year 15 and beyond to year 60 of operation, maturing planting provided as part of the Proposed Scheme will provide yet further screening. However, the viaduct will remain prominent in the middle ground of the view and therefore the overall effect on this view will remain unchanged.

Viewpoint 295.2.003: View north-east across Mouldings Green Farm farmland from residences on Diddington Lane

9.5.112 The Diddington Lane embankment, up to 8m high with 4m high noise fence barriers on the western side, will be visible in the centre of this view. Overhead line equipment will be clearly visible on the skyline in the middle ground.

9.5.113 In year 1, proposed planting on the embankment will provide no visual screening effect at this stage and the absence of intervening screening, the elevated nature of the Proposed Scheme and the close proximity of the viewpoint will result in a high magnitude of change.

9.5.114 The view of the Proposed Scheme from this location during year 1 of operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-168.

9.5.115 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.

9.5.116 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.

9.5.117 By year 15 of operation, proposed planting on embankments will serve to soften their engineered appearance and partially screen trains but not the overhead line equipment. Effects will therefore be unchanged by year 15. By year 60 the magnitude of change will be low, largely derived from obstruction of long views will give rise to a non-significant effect in the summer of year 60 of operation. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 295.3.001: View east across River Blythe valley from Footpath M118

9.5.118 The Patrick cutting and Patrick embankment in close proximity to Patrick Farm leading up to the River Blythe viaduct will be visible in the middle ground of this view. Although some intervening vegetation located adjacent to the River Blythe will be retained, the loss of middle ground vegetation to construct the Proposed Scheme will afford views towards the overhead line equipment and trains on the short section of embankment. Noise fence barriers running parallel to the track will also be prominent within the view. Due to the short range nature of the view, the magnitude of change is considered to be high.

9.5.119 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.

- 9.5.120 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.
- 9.5.121 By year 15 and beyond to year 60 of operation, although proposed planting will have grown to a height of around 7m (by year 15), providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond. Therefore effects will be unchanged. Despite the continued growth and maturity of proposed planting by year 60, effects will remain unchanged.

Viewpoint 295.3.002: View north-east across farmland adjacent to Diddington Lane from Footpath M115

- 9.5.122 The Diddington Lane embankment will be within the background of the view, up to 8m above existing ground levels with 4m high noise fence barriers on the western side. The removal of sections of vegetation running parallel to Diddington Lane will afford partial views of the route on embankment up to 6m high towards the Shadow Brook underbridge in the view frame. Views towards overhead line equipment and glimpsed frequent movement of trains will also be available within the wider panorama. Therefore, the magnitude of change is considered to be medium.
- 9.5.123 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.
- 9.5.124 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.
- 9.5.125 By year 15 of operation, planting established as part of the Proposed Scheme will have matured, helping to integrate the Proposed Scheme into the landscape and partially screen the new infrastructure although noise fence barriers of 4m height will be visible above the intervening planting. The change in the nature of the view will remain at medium magnitude. 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 15 of operation.
- 9.5.126 By year 60 of operation, planting established as part of the Proposed Scheme will have matured, helping to integrate the Proposed Scheme into the landscape and substantially screen the new infrastructure. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Viewpoint 296.2.001: View south-west along the B4102 Meriden Road from Patrick Farm

- 9.5.127 In year 1 of operation, the River Blythe viaduct will be visible in the middle ground of the view, approximately 100m from the viewpoint. The viaduct and associated embankments will be approximately 6m above existing ground levels with 4m high noise fence barriers and 8m high overhead line equipment adding to the presence of new infrastructure. The viaduct will obstruct long views and form the skyline. The

overhead line equipment will be visible in the centre of the view and on the skyline. The upper two thirds of trains crossing the viaduct will be visible above the noise fence barriers. The elevated nature of the route, the proximity to the view and the lack of screening provided by proposed planting in year 1 of operation will result in a high magnitude of change.

- 9.5.128 The view of the Proposed Scheme from this location during year 1 of operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-169.
- 9.5.129 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.
- 9.5.130 In summer of year 1 of operation, effects will be unchanged due to the low height of the proposed planting.
- 9.5.131 By year 15 and beyond to year 60 of operation, although proposed planting, including trees in the River Blythe corridor, will have grown to a height of approximately 7m, providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond. Therefore effects will be unchanged.

Viewpoint 298.3.001: View south-west across farmland from Footpath M114

- 9.5.132 The Diddington cutting will dissect the agricultural land in the middle ground of the view. The Proposed Scheme, including overhead line equipment, will be largely contained within the cutting. However, the Proposed Scheme will change the dominant arable foreground context. Removal of vegetation in the middle ground to accommodate the Proposed Scheme will also reduce the extent of wooded backdrop within the wider panorama. Therefore, the magnitude of change is considered to be medium.
- 9.5.133 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.
- 9.5.134 In summer of year 1 of operation, the removal of the existing vegetation will mean the overall effect will be unchanged.
- 9.5.135 At or before year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-023, Part 4.

Cumulative effects

- 9.5.136 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.

- 9.5.137 It is considered that there are no cumulative effects due to implementation of the Proposed Scheme and based on committed development as referred to in Section 2.1, significant in combination effects are also unlikely.

Other mitigation measures

- 9.5.138 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

- 9.5.139 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 Balsall Common Rural LCA, due to the influence of engineered landforms and the Balsall Common viaduct will have on the rural landscape. These effects will reduce by year 60 of operation, following greater maturity of the proposed planting;
- effects on views from residences on Baulk Lane (viewpoint 286-2-003) and Lavender Hall Lane (viewpoint 287-2-004) arising from visibility of Balsall Common viaduct, the Lavender Hall Lane overbridge and the route on embankment. These will reduce further by year 60 of operation, following greater maturity of the proposed planting;
- effects on views from residences on Diddington Lane (viewpoint 295-2-003) and at Patrick Farm (viewpoint 296-2-001) arising from visibility of the route on embankment and the River Blythe viaduct;

- effects on users of PRow (viewpoints 284-3-003, 285-3-001, 286-3-004, 290-3-001, 291-3-003, 292-3-003, 292-3-004, 293-4-002, 295-3-001 and 295-3-002) across parts of the study area, arising from visibility of different elements of the Proposed Scheme including trains, noise fence barriers and overhead line equipment; and
- effects on people travelling along B4102 Meriden Road, arising from visibility of the Proposed Scheme in shallow cutting and the River Blythe viaduct and Patrick embankment within the river valley.

10 Socio-economics

10.1 Introduction

10.1.1 This section reports the 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; and
- potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

10.1.5 The operation of the route 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 8.10 of Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

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 Balsall Common and Hampton-in-Arden 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 available within the area.
- 10.3.2 The Balsall Common and Hampton-in-Arden area lies within the administrative areas of Solihull Metropolitan Borough Council (SMBC) and North Warwickshire Borough Council (NWBC) local authority areas. Based on the distribution of affected resources, the focus of this environmental baseline is on the SMBC area.
- 10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)⁷⁴ to provide a profile of local communities. Volume 5: Map SE-02-151 shows the location of the DCA. This area contains two DCA which have been defined for the Balsall Common and Hampton-in-Arden area.

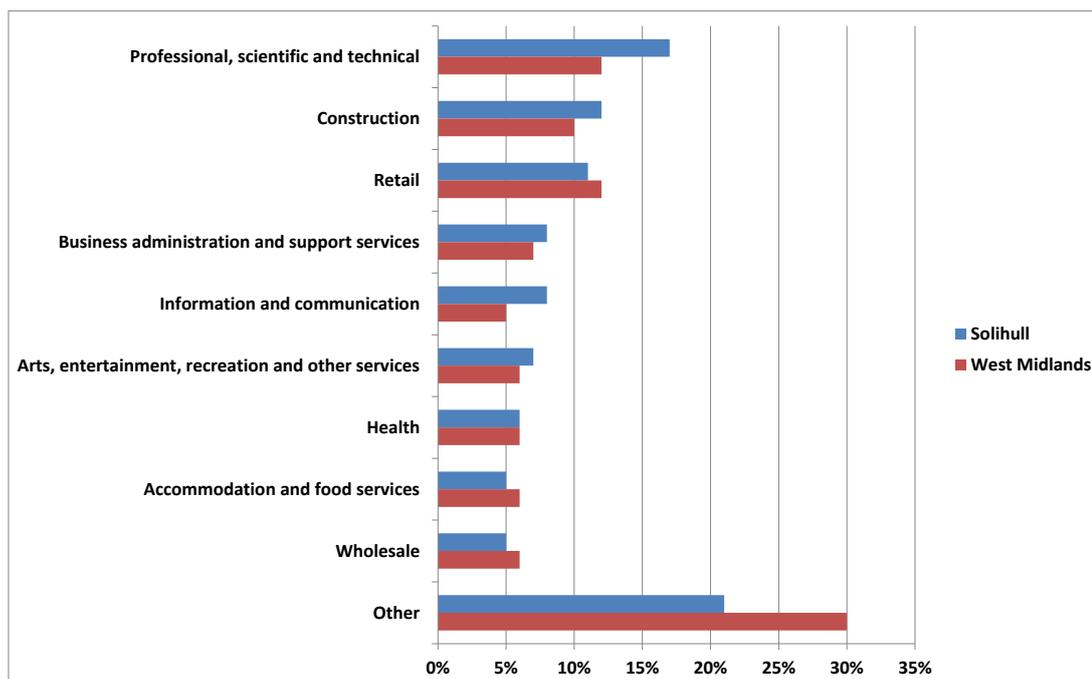
Business and labour market

- 10.3.4 Within the Solihull Metropolitan Borough area there is a wide spread of business types reflecting a diverse range of commercial activities. The professional, scientific and technical sector accounts for the largest proportion of businesses (17%), with construction as second largest (12%) followed by retail (11%) and then business administration and support services (8%). This is shown in Figure 6⁷⁵. 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 construction (10%), production (8%) and business administration and support services (7%)⁷⁶.

⁷⁴ DCA have been determined through an understanding of local context and aim to be aligned as closely as possible to groups of lower super output areas (LSOAs).

⁷⁵ The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.

⁷⁶ Office for National Statistics (ONS), (2012), *UK Business: Activity, Size and Location 2011*, ONS, London. Please note 2011 data has been presented to provide an appropriate comparison with 2011 Census data.

Figure 6: Business sector composition in Solihull Metropolitan Borough and the West Midlands^{77,78}

10.3.5 In 2011, approximately 97,000 people worked in the Solihull Metropolitan Borough. Of these, 1,700 worked in the Balsall Common and Berkswell DCA and 1,500 in Hampton-in-Arden DCA⁷⁹.

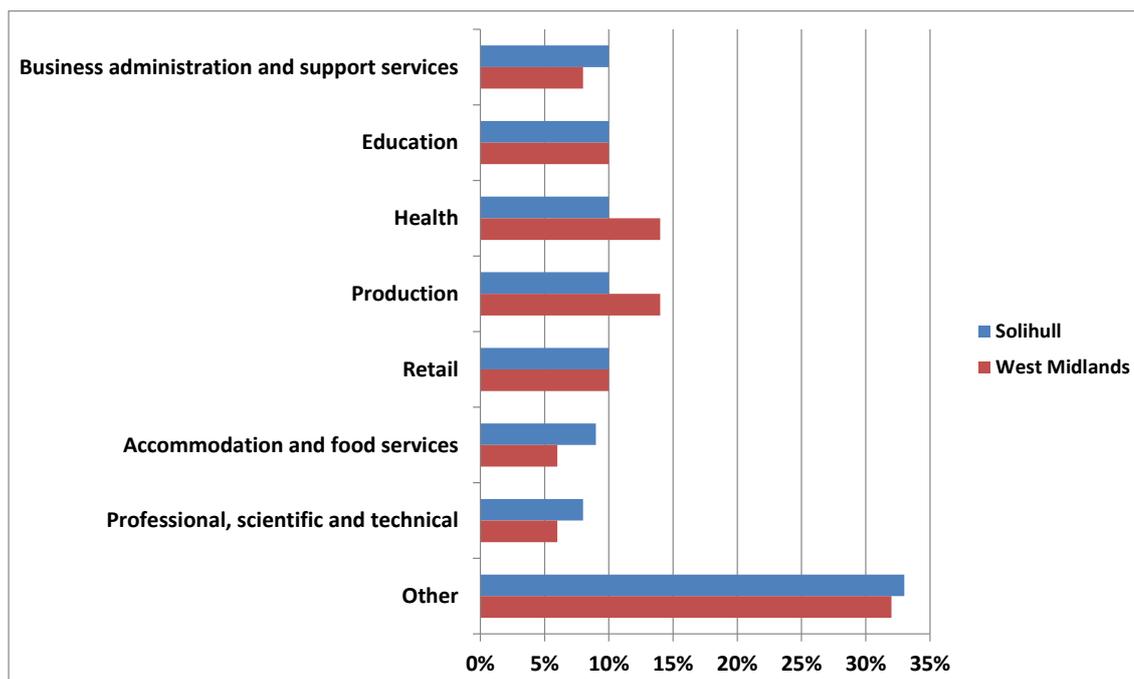
10.3.6 According to the Office for National Statistics (ONS) Business Register and Employment Survey 2011, the top five sectors in terms of share of employment in Solihull are health (10%); education (10%); retail (10%); business administration and support services (10%); and production (9%). These compare 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%)⁷⁹. This is shown in Figure 7. Within the Hampton-in-Arden DCA, the top three sectors for employment are business administration and support services (29%); professional, scientific and technical (22%) and arts, entertainment, recreation and other services (10%). Within Balsall Common and Berkswell, the top three sectors for employment are accommodation and food services (20%); retail (14%) and education (14%).

⁷⁷ "Other" includes: motor trades; transport and storage; finance and insurance; public administration and defence; and education sectors.

⁷⁸ Office for National Statistics (ONS), (2012), *UK Business: Activity, Size and Location 2011*, ONS, London.

⁷⁹ Office for National Statistics (ONS), (2012), *Business Register and Employment Survey 2011*, ONS, London.

Figure 7: Employment by industrial sector in Solihull Metropolitan Borough and the West Midlands ⁸⁰



10.3.7 According to the 2011 Census⁸¹, the employment rate⁸² within the Solihull Metropolitan Borough area was 66% (97,000 people) which is higher than that recorded for both the West Midlands (62%) and England (65%). The employment rate in the Balsall Common and Berkswell DCA was 71% and 69% in Hampton-in-Arden DCA.

10.3.8 In 2011, unemployment in the Solihull Metropolitan Borough area was 7% which was lower than the West Midlands (9%) and the same as the average for England (7%). The unemployment rate in the Balsall Common and Berkswell DCA and Hampton-in-Arden DCA was 4%.

10.3.9 According to the 2011 Census, 29% of Solihull Metropolitan Borough residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 23% in the West Midlands and 27% in England, while 23% of residents had no qualifications, which was lower than that recorded both for West Midlands (27%) and England (23%). In 2011, the Balsall Common and Berkswell DCA recorded 41% of residents aged 16 and over as being qualified to NVQ4 and above while 45% of residents in Hampton-in-Arden were similarly qualified. The proportion of residents with no qualification was 16% for Balsall Common and Berkswell and 13% for Hampton-in-Arden DCA.

⁸⁰ 'Other' includes retail, construction, wholesale, information and communication, motor trades, public administration and defence, property, financial and insurance, and agriculture, forestry and fishing sectors.

⁸¹ Office of National Statistics (ONS), (2012), *Census 2011*, ONS, London.

⁸² The proportion of working age (16-74 year olds) residents that is in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.

- 10.3.10 Both DCA have a highly skilled resident workforce likely to work in the cities of the West Midlands where opportunities for appropriate work are more likely to be found rather than in their immediate semi-rural surroundings.

Property

- 10.3.11 A review of employment land in 2011 identified a need for 3-4 ha per year for general business land in the Solihull Metropolitan Borough area and that sufficient provision existed until 2021⁸³.
- 10.3.12 Average vacancy rate for industrial and warehousing property in Solihull in July 2013 has been assessed as 15% based on marketed space against known stock⁸⁴. Overall, this suggests relatively good availability of alternative accommodation and a good supply of new development land for employment use.

Future baseline

Construction (2017)

- 10.3.13 Volume 5: Appendix CT-004-000 provides details of the committed developments which are assumed to have been implemented by 2017. Based on extant planning permissions and allocations, no material increase in employment due to development is anticipated in the area by 2017. 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)

- 10.3.14 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026. There are no additional developments identified which will have been implemented by 2026.

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 (see Volume 5: Appendix CT-003-000) includes a range of provisions that will help mitigate socio-economic effects associated with construction within this local area, including:

⁸³ Solihull Metropolitan Borough Council (SMBC), (2012), *Employment Land Background Paper*.

⁸⁴ 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).

- 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);
- contractors will be required 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).

Assessment of impacts and effects

Temporary effects

Change in business amenity value

- 10.4.3 No non-agricultural⁸⁵ businesses have been identified within the area, which are expected to experience significant amenity effects as a result of the Proposed Scheme.

Isolation

- 10.4.4 No non-agricultural businesses have been identified within the area, which are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

- 10.4.5 Construction compounds will consist of the Park Lane cutting main compound and 10 satellite compounds (excluding the A45/A45 Service Road overbridges compound). The use of these sites could result in the creation of 900 person years of construction employment opportunities⁸⁶, or approximately 90 full-time equivalent jobs⁸⁷, which, 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).

⁸⁵ Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.

⁸⁶ 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.

⁸⁷ Based on the convention that 10 employment years is equivalent to one full time equivalent job.

- 10.4.6 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

- 10.4.7 No committed developments have been identified that are considered to interact with the Proposed Scheme.
- 10.4.8 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).

Permanent effects

Businesses

- 10.4.9 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.
- 10.4.10 One business accommodation unit within the area will be directly impacted upon by the Proposed Scheme; this resource is an industrial warehouse located off Truggist Lane. However, from an employment perspective, no significant direct effects on non-agricultural employment have been identified within the area.
- 10.4.11 It is estimated that land required for the construction of the Proposed Scheme will result in the displacement or possible loss of approximately 20 jobs⁸⁸ within this area. Taking into account the availability of alternative premises and the total employed within the district (approximately 97,000), the displacement or possible loss of jobs is considered to be relatively modest compared to the scale of economic activity and opportunity in the area.

Cumulative effects

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

⁸⁸ 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.

Other mitigation measures

- 10.4.13 The above assessment has concluded that there are no significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.
- 10.4.14 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.
- 10.4.15 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

- 10.4.16 There are no significant effects identified in the assessment that will arise during construction.

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. These are considered unlikely to be accessed by residents of this area.
- 10.5.5 Direct operational employment created by the Proposed Scheme could lead to indirect employment opportunities for local businesses in terms of potentially supplying the Proposed Scheme or benefiting from expenditure of directly employed workers on goods and services.
- 10.5.6 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3).

Other mitigation measures

- 10.5.7 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 significant residual effects

- 10.5.8 There are no significant effects identified in the assessment that will arise 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 Balsall Common and Hampton-in-Arden 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 areas⁸⁹; 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'⁹⁰.

11.1.2 The assessment of likely significant effects from noise and vibration on agricultural, community, ecological or heritage receptors and the assessment of tranquillity are presented in Sections 3, 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 fence 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

⁸⁹ '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.

⁹⁰ 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).

- SMR addendum (Appendix CT-001-000/2).

11.1.7 More detailed information and mapping regarding the sound, noise and vibration assessment for Balsall Common and Hampton-in-Arden 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-002-023);
- sound, noise and vibration construction assessment (Appendix SV-003-023);
- sound, noise and vibration operation assessment (Appendix SV-004-023); and
- Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5, Sound, noise and vibration Map book).

11.2 Environmental baseline

Existing baseline

11.2.1 The existing sound environment for this area reflects the mix of usage and activity in the area ranging from the larger residential communities of Balsall Common and Hampton-in-Arden to a number of smaller communities, such as Berkswell, and relatively isolated residences and farms in country areas.

11.2.2 The major transportation sound sources in the area are the M42 and the A45 Coventry Road, the A452 Kenilworth Road, the Rugby to Birmingham line, and the overflying aircraft using Birmingham Airport. Away from these major sources the sound environment consists of local road traffic, agricultural activities and, in quieter areas, natural sounds, although few areas escape occasional aircraft noise.

11.2.3 In the vicinity of Balsall Common, baseline sound levels are mixed. Close to the A452 Kenilworth Road, sound from this road dominates and daytime sound levels are typically around 60dB⁹¹. Away from this road, local sources are more significant, including traffic on local roads and the Rugby to Birmingham line in areas around Berkswell station. During the night-time, the same sources are generally present, but night-time⁹² sound levels are approximately 10dB lower in areas away from the major roads.

11.2.4 Within Berkswell village, existing sound levels are generally low, typically 45 to 50dB, with agricultural sound sources and local road traffic being the main contributors to the soundscape.

⁹¹ Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.

⁹² Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr}$.

- 11.2.5 Near the A452 Kenilworth Road to the north of Balsall Common, sound from this road is generally dominant and typical daytime levels are around 60dB. At the numerous more isolated properties away from this road, daytime sound levels are around 10dB lower. Locations to the south west of the railway embankment carrying the Rugby to Birmingham line are generally shielded from traffic on the A452 Kenilworth Road by this embankment.
- 11.2.6 Within Hampton-in-Arden, the sound environment is dominated by distant road traffic from the A452 Kenilworth Road and M42. Typical daytime sound levels are around 55dB, with traffic on the main roads through the village (particularly the B4102 Meriden Road), also contributing. As the Rugby to Birmingham line is located in a cutting through the village, this generally only contributes significantly to baseline sound levels close to the railway itself. Aircraft approaching/departing from Birmingham Airport are also regularly audible within Hampton-in-Arden, although these are rarely the dominant sound source.
- 11.2.7 To the north of Hampton-in-Arden, existing sound levels are dominated by the major roads which run in this area, specifically the M42, the A45 Coventry Road and the A452 Kenilworth Road. Typical daytime levels at the nearest properties are around 60dB. In these areas the reduction in sound levels during the night-time is generally less than it is in more rural locations due to the continuous nature of these sound sources. Typical night-time levels in this area are around 55dB.
- 11.2.8 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-023.
- 11.2.9 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration⁹³, save for those receptors closest to existing railways. On a reasonable worst case basis, vibration from the Proposed Scheme has therefore been assessed at all receptors using specific thresholds, below which receptors will not be affected by vibration, as described in Volume 1, Section 8. No vibration baseline measurements have therefore been undertaken.

Future baseline

- 11.2.10 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth as well as expected growth on the Rugby to Birmingham rail line. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads.

⁹³ Further information is available in the Volume 5: Appendix SV-001-000, the SMR (see Volume 5: CT-001-000/1) and its Addendum (see Volume 5: CT-001-000/2).

On higher speed roads⁹⁴, tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

- 11.2.11 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)

- 11.2.12 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.
- 11.3.2 The following activities will need to be undertaken during the evening and night-time for reasons of safety, engineering practicability or to reduce the impact on existing transport:
- installation and removal of railway protection barriers in the vicinity of Carol Green Rail underbridge; and
 - Carol Green Rail underbridge wing wall and deck works.
- 11.3.3 The assessment takes account of people's perception of noise throughout the day. More stringent criteria are applied during evening and night-time periods, when people are more sensitive to noise, compared to the busier and more active daytime period.

⁹⁴ Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

- 11.3.4 In addition to the above, there will also be some night-time working during road and rail possession periods, 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.

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-002-023.

Avoidance and mitigation measures

- 11.3.6 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP (see Volume 5: Appendix CT-003-000) which are:

- Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA) will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
 - noise and vibration control at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings⁹⁵; 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.

⁹⁵ Warning signals that consist of bursts of noise.

Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and

- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.7 In addition to this mitigation, taller screening as described in the draft CoCP⁹⁶ has been assumed along edge of the construction site boundary adjacent to the residential properties at: Truggist Lane, Berkswell; Lavender Hall Lane and Park Lane, Balsall Common; Marsh Farm and Mercote Lodge, A452 Kenilworth Road; and Patrick Farm, B4102 Meriden Road and Pasture Farm, Diddington Lane. Solid cladding would be provided to the railway protection barrier proposed on each side of the existing Rugby and Birmingham line in the vicinity of the Carol Green Rail underbridge to provide noise screening.

11.3.8 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 affected⁹⁷ 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.

11.3.9 Qualification for noise insulation and temporary re-housing will be identified as part of seeking prior consent from the local authorities under Section 61 of the Control of Pollution Act. Qualifying buildings will be identified early enough so that noise insulation can be installed, or temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria. Noise insulation, where required, will be installed as early as possible to reduce internal sound levels from construction activities and also when the Proposed Scheme comes into operation.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.3.10 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, one residential building (Patrick Farm, B4102 Meriden Road) is forecast to experience noise levels higher than the noise insulation trigger levels as defined in the draft CoCP. For daytime construction the trigger level is 75dB⁹⁸ measured outdoors, or the existing ambient if this is already above this level.

⁹⁶ 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.

⁹⁷ Information is provided in the emerging National Planning Practice Guidance – Noise <http://planningguidance.planningportal.gov.uk>.

⁹⁸ $L_{pAeq,0800-1800}$ measured at the façade.

- 11.3.11 The mitigation measures, including noise insulation, will reduce noise inside all dwellings including Patrick Farm such that it does not reach a level where it would significantly affect⁹⁷ residents.

Residential receptors: direct effects –communities

- 11.3.12 The avoidance and mitigation measures in this area will avoid airborne construction noise adverse effects⁹⁷ on the majority of receptors and communities. Residual temporary noise or vibration effects are identified later in this section.
- 11.3.13 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.
- 11.3.14 In locations with lower existing sound levels⁹⁹, construction noise effects⁹⁷ 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 context¹⁰⁰ as identified in Table 15.

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.

Table 15: Direct adverse effects on residential communities and shared open areas that are considered to be significant on a community basis

Significant effect number (see Volume 5 Appendix SV-003-023)	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact and details
CSV23-Co1	Construction noise	Day and night	Berkswell. Approximately 10 dwellings off Truggist Lane, during the day, 2 of which also experience night time effects	Day: fencing, vegetation clearance, topsoil stripping, earthworks, re-soiling and works at the Balsall Common viaduct with typical and highest monthly noise levels of around 60-65dB and 68-70dB ¹⁰¹ respectively. Night: installation of the railway protection barrier at Carol Green rail underbridge with	Ranging from 1 to 16 months

⁹⁹ Further information is provided in Volume 5: Appendix SV-001-000.

¹⁰⁰ Further information is provided in Volume 5: Appendix SV-001-000 and SV-003-023.

¹⁰¹ Daytime: equivalent continuous sound level at the facade, $L_{pAeq, 0700-1900}$.

				typical and highest noise levels of around 50 and 55dB ¹⁰²	
CSV23-Co2	Construction noise	Day	Berkswell. Approximately 5 dwellings on Lavender Hall Lane	Utility diversions, site clearance, and Lavender Hall over-bridge works with typical and highest monthly noise levels of around 60dB and 70dB ¹⁰¹	6 months
CSV23-Co3	Construction noise and vibration	Day	Balsall Common. Approximately 10 dwellings on A452 Kenilworth Road, north of Balsall Common for construction noise, 2 of which also experience vibration effects	Fencing, utility diversions, vegetation clearance, watercourse diversion works, earthworks, road construction, and use of the haul route with typical and highest monthly noise levels of around 60-65dB and 69-70dB ¹⁰¹ respectively. Worst case VDV vibration levels are around 0.3m/s ^{1.75}	Ranging from 3 to 13 months

Residential receptors: indirect effects

11.3.15 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

Non-residential receptors: direct effects

11.3.16 Significant construction noise or vibration effects have been identified on a worst case basis on the following non-residential receptors:

- British Legion club, Station Road, Balsall Common (CSV23-No1). Significant noise effects¹⁰³ have been identified during the daytime with noise levels rising at times to around 65dB¹⁰¹. The duration of the impact is approximately 32 months commencing in 2017 due to a range of construction activities. However, the predicted construction noise levels are fairly low and the main usage of the club is likely to be in the evenings, therefore the adverse effect may be more limited than identified;
- Bibury House guest house on the A452 Kenilworth Road north of Balsall Common (CSV23-No2). Significant noise effects have been identified during the daytime with noise levels rising at times to around 70dB¹⁰¹. The duration of the impact is approximately three months commencing in 2018 due to utility diversions and construction of the new A452 Kenilworth Road. However, the main usage of the guest house is likely to be during the evening and night. No evening or night works are proposed in the vicinity, therefore the adverse effect may be more limited than identified;

¹⁰² Night-time: equivalent continuous sound level at the facade, $L_{pAeq, 2300-0700}$.

¹⁰³ Activity disturbance, especially for activities that require good conditions for verbal communication.

- commercial units at Patrick Farm, B4102 Meriden Road (CSV23-No3). Significant noise effects have been identified during the daytime with noise levels rising at times to around 75dB¹⁰¹. The duration of the impact is approximately six months commencing in 2017 due to earthworks and the construction of the adjacent B4102 Meriden Road underbridge; and
- The Island Project school for autistic children at Diddington Hall (CSV23-No4). Significant noise effects have been identified during the daytime with noise levels rising at times to around 60dB¹⁰¹. The duration of the impact is approximately four months commencing in 2017 due to vegetation clearance and earthworks along the route.

Non-residential receptors: indirect effects

- 11.3.17 Significant noise effects on non-residential receptors arising from construction traffic are unlikely to occur in this area.

Cumulative effects from the Proposed Scheme and other committed development

- 11.3.18 This assessment has considered the potential cumulative construction noise effects of the proposed scheme and other committed developments¹⁰⁴. 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

- 11.3.19 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 affect⁹⁷ residents.
- 11.3.20 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 along the following roads that are closest to the works:
- Truggist Lane, Berkswell;
 - Lavender Hall Lane, Berkswell; and
 - A452 Kenilworth Road, north of Balsall Common.
- 11.3.21 On a worst case basis, noise from specific construction activities has been identified as resulting in significant residual temporary effects on the following properties:
- British Legion club, Station Road, Balsall Common;

¹⁰⁴ Refer to Volume 5:Appendix CT-004-000.

- Bibury House guest house, A452 Kenilworth Road, north of Balsall Common;
- Patrick Farm, B4102 Meriden Road; and
- The Island Project school at Diddington Hall.

11.3.22 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 1¹⁰⁵. As a reasonable worst case, this assessment is based upon the service pattern for Monday to Saturday including Phase Two services. Passenger services will start at or after 05:00 from the terminal stations and in this area will progressively increase to the number of trains per hour in each direction on the main lines set out in Table 16: . This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 16.

Table 16: Train flows and speeds

Description of line	Time period for peak daytime flows	Number of trains per hour in each direction with Phase Two services (Phase One only trains per hour in each direction is set out in brackets)	Speed
Main line between London and the north	0700 – 2100 hours	18 (14)	330 kph for timetabled trains (assumed 90% of services), and 360 kph for 10% of services

¹⁰⁵ The change in noise and vibration effects between the different passenger services is assessed in Volume 1.

Avoidance and mitigation measures

- 11.4.3 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities and low in the ground. These avoidance measures have protected many communities from likely significant noise or vibration effects.

Airborne noise

- 11.4.4 HS2 trains will be quieter than the relevant current European Union specifications. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 300kph (186mph) with current pantograph designs, drawing on proven technology in use in East Asia. The track will be specified to reduce noise, as will the maintenance regime. Overall these measures would reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train operating on the new track. Further information is provided in Volume 5: Appendix SV-001-000.
- 11.4.5 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise fence barriers in the form of landscape earthworks, noise fence barriers and/or 'low-level' barriers on viaducts. Noise fence barrier locations are shown on Volume 2: Map series SV-05.
- 11.4.6 Generally, the assessment has been based on noise fence barriers having a noise reduction performance equivalent to a noise fence barrier with a top level 3m above the top of the rail, which is acoustically absorbent on the railway side, and which is located 5m to the side of the outer rail. In practice, barriers may differ from this description, but will provide the same acoustic performance. For example, where noise fence barriers are in the form of landscape earthworks they will need to be higher above rail level to achieve similar noise attenuation to a 3m barrier because the crest of the earthwork will be further than 5m from the outer rail.
- 11.4.7 The Proposed Scheme incorporates 'low-level' noise fence barriers into the design of bridges and viaducts. Where needed to avoid or reduce significant airborne noise effects, these barriers are designed to provide noise reduction that is equivalent to a 2m high absorptive noise fence barrier located on the parapet of the viaduct. Locating these 'low-level' barriers close to the rail also reduces visual impact and limits the mass of the viaduct itself.
- 11.4.8 Noise effects are reduced in other locations along the line by landscape earthworks provided to avoid or reduce significant visual effects and engineering structures such as cuttings and safety fences on viaducts (where noise fence barriers are not required). The location of these barriers is shown on Volume 5: Map series SV-05.
- 11.4.9 The Proposed Scheme also includes a taller, 4m above rail, parapet noise fence barrier on the Balsall Common viaduct on the west side only to further reduce the adverse

noise effects at Balsall Common and taller noise fence barriers (4m above rail) to further reduce the adverse noise effects at Hampton-in-Arden.

- 11.4.10 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements (for further information see Volume 5: Appendix SV-001-000).
- 11.4.11 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996¹⁰⁶ (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations. Qualification for noise insulation under the Regulations will be identified and noise insulation offered at the time that the Proposed Scheme becomes operational.
- 11.4.12 Where required, as well as improvements to the noise insulation of windows facing the railway, ventilation will be provided so that windows can be kept closed to protect internal sound levels.
- 11.4.13 Following Government’s emerging National Planning Practice Guidance¹⁰⁷, where the noise from the use of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the WHO Night Noise Guidelines for Europe¹⁰⁸, residents are considered to be significantly affected by the resulting noise inside their dwelling. The effect on people at night due to the maximum sound level as each train passes has also been assessed¹⁰⁹. The Interim Target is a lower level of noise exposure than the Regulations trigger threshold for night noise. In these particular circumstances, where night-time noise levels for the use of new or additional railways authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55dB¹¹⁰, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion¹⁰⁹, noise insulation will be offered for these additional buildings.

Ground-borne noise and vibration

- 11.4.14 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

¹⁰⁶ Her Majesty’s Stationery Office, (1996), *The Noise Insulation (Railways and Other Guided Transport Systems) Regulations*, London.

¹⁰⁷ National Planning Practice Guidance – Noise <http://planningguidance.planningportal.gov.uk>.

¹⁰⁸ World Health Organization, Night-time Noise Guidelines for Europe, 2010.

¹⁰⁹ During the night (2300-0700) a significant effect is also identified where the Proposed Scheme results in a maximum sound level at the façade of a building at or above: 85 dB LpAFmax (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80 dB LpAFmax (where the number of train pass-bys exceeding this value is greater than 20).

¹¹⁰ Equivalent continuous level, L_{pAeq,23:00-07:00} measured without reflection from the front of buildings.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

- 11.4.15 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified approximately six residential dwellings, close to the Proposed Scheme, where noise would exceed the daytime trigger threshold set in the Regulations. It is therefore estimated that these buildings are likely to qualify for noise insulation under the Regulations. These dwellings are indicated on Volume 5: Map Book – Sound, noise and vibration, Map series SV-05:
- Wellmont House and Cherry Tree Cottage, Truggist Lane, Berkswell;
 - Patricks Farm, B4102 Meriden Road, Hampton-in-Arden (this property is also identified as being likely to qualify for noise insulation as a consequence of construction noise as described earlier in this section); and
 - Marsh Farm, Marsh Cottage and Mercote Cottage, A452 Kenilworth Road, Hampton-in-Arden.
- 11.4.16 The assessment has identified approximately five additional residential buildings close to the Proposed Scheme where the daytime forecast noise level does not exceed the threshold set in the Regulations but the forecast night-time noise level would exceed the World Health Organization’s Interim Target of 55dB¹¹⁰, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion¹⁰⁹. It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are indicated on Volume 5: Map Book – Sound, noise and vibration, Map series SV-05:
- Pasture Farm house, A45 Coventry Road, Bickenhill; and
 - Pandora, Beech Lawn, Truggist Hill and Truggist Hill Farm, on Truggist Lane, Berkswell.
- 11.4.17 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

- 11.4.18 The mitigation measures in this area will avoid airborne noise adverse effects on the majority of receptors, and at the following communities:
- Balsall Common;
 - Hampton-in-Arden (except where indicated in Table 17);
 - Berkswell (except where indicated in Table 17); and
 - Bradnocks Marsh.

- 11.4.19 Taking account of the envisaged mitigation, Volume 2:Map Series SV-05 shows the long term 40dB¹¹¹ 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 50dB daytime contour¹¹². In general, below these levels adverse effects are not expected.
- 11.4.20 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.
- 11.4.21 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 basis¹¹³ taking account of the local context¹¹⁴.
- 11.4.22 In this study area, the direct adverse effects⁹⁷ on the areas of the residential communities identified in Table 17 are considered to be significant.

Table 17: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number (see Map series SV-05)	Source of significant effect	Time of day	Location and details
OSV23-C01/OSV18-C04115	Airborne noise increase from new train services	Daytime and night-time	Beechwood ¹¹⁵ : Approximately 50 dwellings in the vicinity of Waste Lane, Old Waste Lane and Hodgett’s Lane Beechwood that are closest to the Proposed Scheme and their shared external community open spaces. Forecast increases in sound from the railway are likely to cause a moderate adverse effect on the acoustic character of the area around the closest properties, reducing to a minor effect at those further from the Proposed Scheme.
OSV23-C03	Airborne noise increase from new train services	Daytime and night-time	Berkswell. Approximately 15 dwellings in the vicinity of Truggist Lane and Baulk Lane, that are closest to the Proposed Scheme and their shared external community spaces. Forecast increases in sound from the railway are likely to cause a major or moderate adverse effect on the acoustic character of the area around the properties, dependent on the proximity to the Proposed Scheme.
OSV23-C03	Airborne noise increase	Daytime and night-	Hampton-in-Arden. Approximately 25 dwellings closest to the Proposed Scheme on Diddington Lane and their

¹¹¹ Defined as the equivalent continuous sound level from 23:00 to 07:00 or LpAeq,night).

¹¹² 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 10dB higher than the night-time sound level. The 40dB contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 50dB.

¹¹³ Further information is contained in Volume 1.

¹¹⁴ Further information is provided in SV-001-000 and SV-004-023.

¹¹⁵ Effects on properties in Beechwood are also described in Volume 2: CFA report number 18 as the community area described herein straddles the CFA boundary.

Significant effect number (see Map series SV-05)	Source of significant effect	Time of day	Location and details
	from new train services	time	associated shared community spaces. Forecast increases in sound from the railway are likely to cause a minor adverse effect on the acoustic character of the area.

Residential receptors: indirect effects

- 11.4.23 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

Non-residential receptors: direct effects

- 11.4.24 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

- 11.4.25 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

Summary of likely significant residual effects

- 11.4.26 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect⁹⁷ residents.
- 11.4.27 The mitigation measures in this area will avoid noise and vibration adverse effects⁹⁷ on the majority of receptors and communities including shared open areas.
- 11.4.28 Taking account of the avoidance and mitigation measures and the local context, the residual permanent noise effects⁹⁷ on the acoustic character around the residential areas closest to the Proposed Scheme in the following locations are considered significant:
- Beechwood (on Waste Lane, Old Waste Lane and Hodgett's Lane);
 - Truggist Lane and Baulk Lane, Berkswell; and
 - Hampton-in-Arden (on Diddington Lane).
- 11.4.29 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.

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 Balsall Common and Hampton-in-Arden area.
- 12.1.2 With regard to traffic and transport, the main issues are increased traffic as a result of the construction and the operation of the Proposed Scheme, road diversions, temporary and permanent road closures, and temporary alternative routes and permanent realignments of footpaths.
- 12.1.3 The effects on traffic and transport are assessed quantitatively, based on baseline traffic conditions and future projection scenarios.
- 12.1.4 A detailed report on traffic and transport and surveys undertaken within the area is contained in Volume 5: Appendix TR-001-000, Transport assessment.
- 12.1.5 Figure 2 shows the location of the key transport infrastructure in this area.
- 12.1.6 Engagement has been undertaken with the key transport authorities, including Solihull Metropolitan Borough Council (SMBC), Coventry City Council (CCC), Warwickshire County Council (WCC), Centro (the West Midlands Integrated Transport Authority) and Network Rail.

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 all roads affected by the Proposed Scheme; the A452 Kenilworth Road, between the A45 Coventry Road and the A4177 Meer End Road, and local roads serving Hampton-in-Arden and Balsall Common.
- 12.2.3 A number of transport modelling tools have been used to inform the assessment including the West Midlands regional transport model, PRISM (Policy Responsive Integrated Strategy Model), and the Department for Transport's Trip End Model Presentation Program (TEMPRO) for future forecast road traffic growth in the 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 this area are 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, local 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 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 May/June 2013, comprising junction turning counts and queue surveys and automatic traffic counts. This was supplemented by traffic and transport data obtained from other sources where available, including from SMBC, WCC, CCC, Centro and the regional transport model. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00.
- 12.3.3 Surveys of pedestrian and cyclist movements were undertaken in August and September 2012, and July 2013 to establish the nature of the PRoW and their usage by non-motorised users (pedestrians, cyclists and equestrians). 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 12 PRoW, five roads/roadside footways (A452 Kenilworth Road, Diddington Lane, Park Lane, Lavender Hall Lane and Truggist Lane), and the Kenilworth Greenway. Nine of the routes were used by fewer than 10 people in a day. The routes with the greatest usage were the Kenilworth Greenway with 192 users and Truggist Lane with 162 users per day. The Proposed Scheme crosses ten of the 12 PRoW affected (including Bridleway M218), five roads and the Kenilworth Greenway, which is a permissive bridleway.
- 12.3.4 There are several strategic highways that pass through the area. The A452 Kenilworth Road runs in a north-south orientation providing access to Hampton-in-Arden and Meriden, and passing through Balsall Common. The A45 Coventry Road passes to the north of Hampton-in-Arden and Meriden, and connects with the A452 Kenilworth Road at Stonebridge Island, which is in the Birmingham Interchange and Chelmsley Wood area (CFA24). The M42 is routed from north to south, and is located to the west of Balsall Common and Hampton-in-Arden. It is accessed from junction 6, which is in the Birmingham Interchange and Chelmsley Wood area (CFA24).
- 12.3.5 The main local roads affected by the Proposed Scheme are Diddington Lane and the B4102 Meriden Road which provide access to Hampton-in-Arden, and Park Lane, Lavender Hall Lane, Station Road/ Truggist Lane, and the B4101 Kelsey Lane/Waste Lane in Balsall Common. These roads connect into the A452 Kenilworth Road.

- 12.3.6 The A452 Kenilworth Road and local roads around Balsall Common and Hampton-in-Arden operate reasonably well at peak times with no major delays.
- 12.3.7 Relevant accident data for the road network subject to assessment has been obtained from SMBC, WCC and CCC for the three year period of 2009 to 2011. This has been assessed and any identified clusters have been examined. No significant accident clusters were identified within the area.
- 12.3.8 Hampton-in-Arden is served by three public bus services and one school bus. These provide connections to destinations including Solihull, Coventry, Meriden, Kenilworth, Balsall Common and Catherine-de-Barnes. These services provide a maximum combined service frequency of approximately three buses per hour.
- 12.3.9 Meriden is served by six public bus services and one school bus. These provide connections to destinations including Solihull, Birmingham, Coventry, Kenilworth, Nuneaton, Balsall Common, Hampton-in-Arden, Coleshill and Birmingham Airport. These services provide a maximum combined service frequency of approximately six buses per hour.
- 12.3.10 Balsall Common is served by six public bus services and six school bus services. These provide connections to destinations including Solihull, Coventry, Kenilworth, Hampton-in-Arden, Meriden and Dorridge. These services provide a maximum combined service frequency of approximately four buses per hour.
- 12.3.11 Local rail services are accessible via railway stations at Hampton-in-Arden, Berkswell and Tile Hill (on the eastern boundary of the area). The stations provide access to local services between Coventry and Birmingham, and national rail services via Birmingham New Street, Birmingham International and Coventry.
- 12.3.12 There are pedestrian footways in the built up areas of Hampton-in-Arden, Meriden and Balsall Common. In Balsall Common there are off road cycle paths and a number of roads identified as advisory cycle routes including Station Road/ Truggist Lane and Lavender Hall Lane. Diddington Lane, Old Station Road and part of the B4102 Meriden Road are advisory cycle routes in Hampton-in-Arden. Meriden has an advisory cycle route on Main Road.
- 12.3.13 There are no navigable waterways affected by the Proposed Scheme in this area and consequently these are not considered further in this assessment.

Future baseline

- 12.3.14 Future baseline traffic volumes for the years of assessment 2021, 2026 and 2041 have been calculated by applying growth factors based on PRISM and TEMPRO and taking account of any major planned developments.
- 12.3.15 The closest major planned developments that would affect this CFA are located in the Birmingham Interchange and Chelmsley Wood area (CFA24) including the Birmingham Airport Runway Extension, the AEC development at Birmingham

Business Park and Resorts World at the NEC. These have been allowed for in the future baseline traffic volumes.

Construction

- 12.3.16 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% by 2021 compared to 2012.

Operation (2026)

- 12.3.17 Future baseline traffic volumes in the peak hours are forecast to grow by around 18% by 2026 compared to 2012.

Operation (2041)

- 12.3.18 Future baseline traffic volumes in the peak hours are forecast to grow by around 25% 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 south to north from the neighbouring Stoneleigh, Kenilworth and Burton Green area (CFA18) to the Birmingham Interchange and Chelmsley Wood area (CFA24);
 - construction materials and equipment will be transported along the haul road adjacent to the route where reasonably practicable, to reduce lorry movements on the public highway;
 - construction of a new alignment on the A452 Kenilworth Road and Park Lane before closure of the existing roads;
 - the majority of roads crossing the Proposed Scheme will be kept open during construction resulting in minimal diversions of traffic onto alternative routes;
 - restricting road closures to overnights and weekends where reasonably practicable;
 - Heavy Goods Vehicle (HGV) routeing, as far as reasonably practicable, along the strategic road network (A452 Kenilworth Road), and using designated routes for access, as shown in Volume 5: Maps TR-03-151 to TR-03-153;
 - temporary alternative routes for 12 PRoW and the Kenilworth Greenway;
 - provision of worker accommodation for workers not normally based locally, to reduce daily travel; 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 plan¹¹⁶ 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 HGV 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.

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); 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 includes measures such as:

- carefully programming works to coincide with possessions that are required and planned for the general maintenance of the railway;

¹¹⁶ 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.

- planning of 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.

Assessment of impacts and effects

Temporary effects

12.4.7 The following section considers the impacts 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 CFA will include:

- construction vehicle movements to and from the various worksites;
- road closures and associated diversions; 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 site is shown in Table 18. 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 18: Typical vehicle trip generation for construction site compounds in this area

Compound Type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Car/LGV	HGV
Satellite	Beechwood Farm accommodation underpass satellite compound	Kenilworth Greenway off B4101 Waste Lane	Q3 2017	4 years and 3 months	12	10-20	65-66
Satellite	Carol Green Rail underbridge (south)	HGV – Kenilworth Greenway off B4101 Waste Lane, LGV/ Car	Q2 2017	4	2	20-50	11-11

Compound Type	Location	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	
						Car/LGV	HGV
	satellite compound	– access off Truggist Lane)					
Satellite	Carol Green Rail underbridge (north) satellite compound	HGV – Park Lane, LGV/ Car – access off Truggist Lane)	Q2 2017	4	2	10-20	<10-<10
Satellite	Balsall Common viaduct satellite compound	HGV – Park Lane, LGV/ Car – access off Lavender Hall Lane)	Q2 2017	2 years and 9 months	3	80-120	18-18
Main	Park Lane cutting main compound	Park Lane	Q2 2017	4 years and 3 months as office of which 2 years are compound	3	110-170	92-96
Satellite	Footpath M214 overbridge satellite compound	Park Lane	Q2 2017	1	2	10-20	19-19
Satellite	Bradnock auto-transformer station satellite compound	Kenilworth Road at Bradnocks Marsh Lane Roundabout	Q2 2017	2 years and 3 months	2	10-20	20-20
Satellite	A452 Kenilworth Road overbridge satellite compound	Kenilworth Road north of Marsh Lane	Q2 2017	4 years and 3 months as worker accommodation of which 2 years and 9 months are compound	25	80-120	201-217
Satellite	River Blythe Bypass culver, satellite compound	Kenilworth Road north of Marsh Lane	Q2 2017	1 year and 9 months	4	20-40	13-19
Satellite	B4102 Meriden Road underbridge satellite compound	Diddington Lane	Q2 2017	2	4	10-20	15-18

Compound Type	Location	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	
						Car/LGV	HGV
Satellite	Shadow Brook underbridge satellite compound	Diddington Lane	Q2 2017	3	7	50-80	8-11

- 12.4.11 Information on the indicative construction programme and methodology is provided in Section 2.3. Works will include utilities diversions, earthworks, underpass, viaduct, bridge and highway 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 The construction compounds will also be the main location for advance works including utilities. It should be noted that the activity associated with the advance works (including utilities) and rail installation works, which will follow on after the civils work, will be of a lower intensity and will generate a lower level of HGV activity.
- 12.4.13 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), which are each assessed. In Month 22 there will be 10 operational worksites and Lavender Hall Lane will be temporarily closed, in Month 27 there will be nine operational worksites, and in Month 36 there will be five 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 generally lower.
- 12.4.14 In considering effects of the Proposed Scheme, where they occur in particular months assessed this is identified. In general the effects are greatest in Month 27.
- 12.4.15 The construction assessments have also considered any impacts that arise from construction in the adjoining areas.
- 12.4.16 Month 27 represents the peak month of activity, and in this month there are estimated to be approximately 1,750 vehicle movements (in/out) per day across the study area. Around half of these will be HGVs.

- 12.4.17 It is proposed that the A452 Kenilworth Road will provide the primary HGV access routes for construction vehicles, off which HGVs will access construction compounds via local roads including Park Lane, the B4101 Kelsey Lane/Waste Lane and Diddington Lane.
- 12.4.18 There will be closures of a number of roads within the area, including the following:
- off-peak and overnight closures of the B4101 Waste Lane to construct a worksite access and for tie-in of the off-line Waste Lane overbridge in the Stoneleigh, Kenilworth and Burton Green area (CFA18);
 - weekend and overnight closures of Truggist Lane, for construction of the viaduct;
 - temporary closure of Lavender Hall Lane for 12 months, to construct a bridge over the Proposed Scheme;
 - weekend and overnight closures of the B4102 Meriden Road, to construct the overbridge, resulting in the re-routing of 250 to 350 vehicles in the peak hours; and
 - weekend and overnight closures of the A452 Kenilworth Road, for tie-in of off-line highway works.
- 12.4.19 There will also be the permanent closure of Diddington Lane as a through road.
- 12.4.20 The construction of the Proposed Scheme is likely to require temporary traffic management measures including lane restrictions on the A452 Kenilworth Road, the B4101 Waste Lane, Truggist Lane and the B4102 Meriden Road. The lane restrictions will be scheduled to minimise the impacts on traffic in the peak periods with advance notice provided to travellers.
- 12.4.21 Construction of the Proposed Scheme will result in changes in daily traffic flows due to workers and construction vehicles accessing compounds, and the temporary closure of Lavender Hall Lane.
- 12.4.22 Changes in peak hour traffic flows as a result of construction traffic and the Lavender Hall Lane closure, will lead to a significant effect on congestion¹¹⁷ and delays on the road links shown in Table 19.

¹¹⁷ In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows on a road link 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 on a road link 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 on a road link 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.

Table 19: Significant effects on congestion and delays in this area

Road Link	Effect on congestion and delay		
	Month 22	Month 27	Month 36
A452 Kenilworth Road, between Diddington Lane and Park Lane	Not significant	Minor adverse	Not significant
A452 Kenilworth Road, between Hallmeadow Road and Wootton Green Lane	Minor adverse	Minor adverse	Not significant
Park Lane	Major adverse	Major adverse	Not significant
Truggist Lane, between Hallmeadow Road and Baulk Lane	Major adverse	Minor adverse	Not significant
Truggist Lane, between Baulk Lane and Hodgett's Lane	Moderate adverse	Minor adverse	Not significant
Truggist Lane, between Hodgett's Lane and Spencer Lane	Minor adverse	Not significant	Not significant
Spencer Lane, between Lavender Hall Lane and Truggist Lane	Moderate adverse	Not significant	Not significant

12.4.23 Changes in daily traffic flows will lead to a significant effect on severance¹¹⁸ for non-motorised road users in the locations shown in Table 20.

Table 20: Significant effects on traffic severance in this area

Road Link	Effect on severance for non-motorised users		
	Month 22	Month 27	Month 36
A452 Kenilworth Road, between Stonebridge Island and Diddington Lane	Not significant	Minor adverse	Not significant

¹¹⁸ 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.

Road Link	Effect on severance for non-motorised users		
	Month 22	Month 27	Month 36
A452 Kenilworth Road, between B4102 Meriden Road and Hallmeadow Road	Not significant	Minor adverse	Minor adverse
A452 Kenilworth Road, between Hallmeadow Road and Lavender Hall Lane	Moderate adverse	Moderate adverse	Moderate adverse
A452 Kenilworth Road, between Lavender Hall Lane and Gipsy Lane	Minor adverse	Minor adverse	Minor adverse
B4101 Kelsey Lane, between A452 Kenilworth Road and Windmill Lane	Major adverse	Major adverse	Major adverse
B4101 Waste Lane, between Windmill Lane and Proposed Scheme	Moderate adverse	Moderate adverse	Moderate adverse
Windmill Lane, between Hob Lane and B4101 Waste Lane	Major adverse	Major adverse	Major adverse
Park Lane	Moderate adverse	Moderate adverse	Moderate adverse
Diddington Lane	Minor adverse	Minor adverse	Not significant
Hob Lane	Minor adverse	Minor adverse	Minor adverse

- 12.4.24 These effects are as a result of increased HGV movements, and for Park Lane there is also a substantial increase in all vehicles. The effects of the increases in traffic are generally greatest on the local roads that provide access to the construction compounds including the B4101 Kelsey Lane/Waste Lane and Park Lane, and this is in part due to the low number of HGVs that currently use these roads. There will be a major adverse effect on Windmill Lane, which facilitates access to a compound in the Stoneleigh, Kenilworth and Burton Green area (CFA 18).
- 12.4.25 The temporary closure of Lavender Hall Lane will result in traffic being diverted via alternative routes, and it is expected that this will increase the journey distance by approximately 1.4km. The diversion will have a moderate adverse effect on journey times.
- 12.4.26 The Proposed Scheme includes the permanent closure of Diddington Lane and the direct results of this are reported on in section 12.5 along with other long-term operational impacts.

- 12.4.27 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, or in combination with other works, is greater than other construction activities arising 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.
- 12.4.28 It is not expected that the construction of the Proposed Scheme will impact on parking and loading, although Berkswell station car park will be used as an occasional/emergency access route to worksites located to the south of the station, which will primarily be accessed off the B4101 Waste Lane.
- 12.4.29 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.
- 12.4.30 The temporary closure of Lavender Hall Lane will affect the following bus routes:
- school bus service 82 will be diverted via Hallmeadow Road, the A452 Kenilworth Road and Park Lane, which will increase the journey distance by approximately 1.4km. This will have a minor adverse effect on bus users; and
 - public bus services 83 and 84 will be diverted via the A452 Kenilworth Road and Park Lane, which will increase the journey distance by approximately 670m. The effect will not be significant.
- 12.4.31 The temporary closure of Lavender Hall Lane will not affect bus stop locations.
- 12.4.32 Rail possessions will be required within this area. Disruption to rail users will be minimised by limiting possessions, where reasonably practical, to overnight, off-peak or weekend periods. There are not expected to be any significant effects of rail possessions or blockades in this area. Where necessary, rail replacement services will be provided.
- 12.4.33 There will be temporary alternative routes for 12 PRow and the Kenilworth Greenway. Non-motorised users of Lavender Hall Lane will also be re-routed due to the 12 month closure. This will lead to a minor adverse effect due to increased travel distance on ten routes (Footpath M191 – south of Truggist lane, Footpath M191 – north of Truggist Lane, Footpath M192, Footpath M197, Footpath M196, Footpath M214, Footpath M216, Footpath M217, Lavender Hall Lane and the Kenilworth Greenway), and a moderate adverse effect on one route (Footpath M215). Six routes will have an increased walking distance of more than 500m, including M191 – south of Truggist Lane (730m), M191 – north of Truggist Lane (600m), Footpath M197 (960m), Footpath M215 (1.6km), Footpath M216 (770m) and Lavender Hall Lane (1.4km). The other routes will have an increased travel distance of less than 380m.

12.4.34 In addition, Footpath M198 off the B4101 Waste Lane at the southern end of this CFA crosses the Proposed Scheme and will be re-routed during construction. The effects of this re-routing are reported in the Stoneleigh, Kenilworth and Burton Green area (CFA 18).

12.4.35 There will be a minor adverse effect on journey ambience on Diddington Lane and Park Lane due to the presence of construction vehicles.

Cumulative effects

12.4.36 The assessment includes cumulative effects of planned development during construction, by taking this into account within background traffic growth and by taking into account developments at Birmingham Airport (runway extension), Birmingham Business Park (AEC) and the NEC (Resorts World) in the Birmingham Interchange and Chelmsley Wood area (CFA24).

12.4.37 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in the neighbouring Stoneleigh, Kenilworth and Burton Green area (CFA18) and the Birmingham Interchange and Chelmsley Wood area (CFA24). Daily construction traffic flows of up to 258 cars/LGV and up to 102 HGVs, as generated from compounds in the adjacent CFAs, have been assigned across various routes in this area.

Permanent effects

12.4.38 Any permanent effects of construction have been considered in the operations phase assessments for traffic and transport in Section 12.5. This is because the impacts and effects of the forecast increases in travel demand and the wider impacts and effects of the operations phase need to be considered together.

Other mitigation measures

12.4.39 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 as presented in this section, which will mean the adverse effects may be over-stated.

12.4.40 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

12.4.41 The most intensive peak periods of construction will cause increases in traffic that will from time to time cause additional congestion and/or increase delays for road users on the A452 Kenilworth Road, Park Lane, Truggist Lane and Spencer Lane.

- 12.4.42 Similarly, there will be a temporary increase in traffic which will affect pedestrians and cyclists crossing the A452 Kenilworth Road, the B4101 Kelsey Lane/Waste Lane, Windmill Lane, Park Lane, Diddington Lane and Hob Lane. The most significant effects occur on local roads around Balsall Common, close to compounds where existing HGV traffic is low.
- 12.4.43 The temporary closure of Lavender Hall Lane will result in traffic being diverted to other existing roads, which will cause increased journey times for road users, and one school bus route.
- 12.4.44 Nine PRoW (Footpath M191 – south of Truggist lane, Footpath M191 – north of Truggist Lane, Footpath M192, Footpath M197, Footpath M196, Footpath M214, Footpath M215, Footpath M216 and Footpath M217), Lavender Hall Lane and the Kenilworth Greenway will be affected and users will be diverted at different times during the construction period.
- 12.4.45 The significant effects that result from construction of the Proposed Scheme are shown in Maps TR-03-151 to TR-03-153 (Volume 5, Map book, Traffic and Transport).

12.5 Effects arising from operation

Avoidance and mitigation measures

- 12.5.1 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users:
- reinstatement of most roads on or close to their original alignments;
 - the reconfiguration of the A452 Kenilworth Road/Marsh Lane junction;
 - the closure of Diddington Lane to through traffic; and
 - replacement/realignment of PRoW footpaths and bridleway.
- 12.5.2 A framework travel plan will set out how travel plans will be required to mitigate the impacts of traffic and transport movements associated with the maintenance and operation of the Proposed Scheme. In relation to this area, an operational station travel plan will be implemented for Birmingham Interchange station (located in Birmingham Interchange and Chelmsley Wood (CFA24)) which will seek to further mitigate travel impacts from the station by promoting the use of sustainable modes by both workers and passengers.

Assessment of impacts and effects

- 12.5.3 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Scheme (as described in Section 2.4).

- 12.5.4 The operational traffic and transport impacts within this area are:
- increase in rail capacity and reduced rail journey times between London and Birmingham;
 - passenger demands to and from the new Birmingham Interchange station, and their associated access journeys;
 - closure of roads and associated diversions;
 - realignment and reconfiguration of highways; and
 - roadside footway, footpath and PRoW diversions/realignments.
- 12.5.5 The Proposed Scheme will generate significant major beneficial effects for rail passengers in the Balsall Common and Hampton-in-Arden area in 2026 and 2041. They will benefit from an increase in rail capacity and from significantly improved journey times between Birmingham and London through convenient access to Birmingham Interchange. There will also be significant major beneficial effects to local commuters from the potential use of released capacity on the existing rail network.
- 12.5.6 With the introduction of the Proposed Scheme in 2026, it is forecast that there will be approximately 1,950 rail passengers boarding, alighting, and interchanging at Birmingham Interchange station (CFA24) in the morning peak hour and approximately 2,100 rail passengers boarding, alighting or interchanging in the evening peak hour.
- 12.5.7 These passengers are forecast to generate approximately 170 vehicle trips on the A452 Kenilworth Road, between Stonebridge Island and the B4102 Meriden Road, in the morning peak hour and 140 vehicle trips in the evening peak hour. Approximately 20 of these vehicle trips pass through Hampton-in-Arden on the B4102 Meriden Road in the morning and evening peak hour. In Balsall Common, there will be approximately 145 additional vehicle trips in the morning peak hour and 120 trips in the evening peak hour that enter on the A452 Kenilworth Road.
- 12.5.8 For 2041, with the full Phase 2 operation, it is forecast that the passenger numbers increase to approximately 3,450 passengers using Birmingham Interchange station in the morning peak hour and approximately 3,700 passengers in the evening peak hour through increased train frequency and additional national rail destinations.
- 12.5.9 These passengers are forecast to generate approximately 255 vehicle trips in the morning peak hour and 215 vehicle trips in the evening peak hour on the A452 Kenilworth Road. Most of these will enter Balsall Common, with a small proportion that will travel through Hampton-in-Arden on the B4102 Meriden Road.
- 12.5.10 Operation of the Proposed Scheme will result in changes in daily traffic flows due to staff and passengers accessing Birmingham Interchange station (CFA24), as well as the closure, realignment and/or reconfiguration of highways including the closure of

Diddington Lane to through traffic and the realignment of sections of the A452 Kenilworth Road, Lavender Hall Lane and Park Lane. The realignment of the A452 Kenilworth Road includes reconfiguring the junction with Marsh Lane to be a left in/left out arrangement.

- 12.5.11 The maintenance of the Proposed Scheme will generate limited vehicular trips and the effect will not be significant.
- 12.5.12 The increases in traffic as a result of the Proposed Scheme will be largely focused on the strategic road network (A452 Kenilworth Road), beyond which traffic from Birmingham Interchange station will become more dispersed.
- 12.5.13 The increased traffic flows will have an adverse effect on severance for non-motorised users in 2026 and 2041 at the following locations:
- A452 Kenilworth Road, between Diddington Lane and the B4102 Meriden Road (minor adverse effect);
 - A452 Kenilworth Road, between Gipsy Lane and the B4101 Kelsey Lane (moderate adverse effect);
 - A452 Kenilworth Road, between Meer End Road and Red Lane (minor adverse effect in 2026 and moderate adverse effect in 2041); and
 - B4102 Meriden Road (moderate adverse effect).
- 12.5.14 The effects of the increased traffic on severance for non-motorised users through the built up area of Balsall Common is generally not significant due to the provision of signal controlled crossing facilities, maintaining access for pedestrians. To the north of Balsall Common, up to the B4102 Meriden Road, the pedestrian demand for crossing the A452 Kenilworth Road is low, and sections of the road have a central barrier preventing crossing movements. As a result the severance effect of the increased traffic flows in this area will not be significant.
- 12.5.15 The increased traffic flows will not have a significant effect on congestion and delays.
- 12.5.16 The closure of Diddington Lane is likely to result in an increased travel distance of 1.3km. The diversion will have a moderate adverse effect on journey times.
- 12.5.17 The reconfiguration of the A452 Kenilworth Road/Marsh Lane junction will result in an increased travel distance for right turning vehicles of 1.8km or 3.1km depending on the direction of travel. The diversion will have a minor adverse effect on journey times due to the low volumes of traffic turning into Marsh Lane.
- 12.5.18 The realignment of the A452 Kenilworth Road, Park Lane and Lavender Hall Lane will increase vehicle travel distances by a maximum of 200m and will not be significant.
- 12.5.19 It is not expected that the Proposed Scheme will impact on car parking and loading.

- 12.5.20 The effect on accidents 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.
- 12.5.21 Realignment of Lavender Hall Lane will result in an increased journey distance of 20m for the school bus route 82, and the public bus routes 83 and 84. The increased travel distance will not have a significant effect on bus journey times.
- 12.5.22 The realignment of Lavender Hall Lane will not affect bus stop locations.
- 12.5.23 There will be permanent realignments or reinstatements of 12 PRow, four roads and the Kenilworth Greenway. Permanent changes to routes for non-motorised users will lead to a minor adverse effect on severance on eleven routes (Footpaths M191 – south of Truggist Lane, Footpath M191 – north of Truggist Lane, Footpath M214, Footpath M215, Footpath M216, Footpath M217, Bridleway M218, A452 Kenilworth Road, Diddington Lane, Park Lane and Lavender Hall Lane. The routes will have an increased travel distance of up to 250m.
- 12.5.24 Footpath M198 which is located close to the southern boundary of this CFA will also be realigned and the effects are reported in the Stoneleigh, Kenilworth and Burton Green area (CFA 18).

Cumulative effects

- 12.5.25 The assessment includes the cumulative effects of planned development during operation by taking this into account within the background traffic growth and by taking into account developments at Birmingham Airport (runway extension), Birmingham Business Park (AEC) and the NEC (Resorts World) in the Birmingham Interchange and Chelmsley Wood area (CFA24).
- 12.5.26 The assessment includes in-combination effects, by taking into account traffic and transport movements which pass through the area to access the proposed Birmingham Interchange station. In 2026, this equates to 167 vehicle movements from the neighbouring Birmingham Interchange and Chelmsley Wood area (CFA24) in the morning peak hour and 138 in the evening peak hour. For 2041, traffic flows of 287 (morning peak) and 238 (evening peak) have been included in the assessments.

Other mitigation measures

- 12.5.27 The strategy and opportunities for providing bus connections to the Birmingham Interchange station and how these relate to existing services, will be explored with the transport authorities nearer to the year of opening as the existing bus service provision in the local area, upon which re-routing of services will be based, is likely to change in the intervening 15 year period.
- 12.5.28 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on the outcomes of this assessment.

Summary of likely significant residual effects

- 12.5.29 The Proposed Scheme will have major beneficial effects for residents and businesses of this CFA including increased rail capacity and improved journey times between Birmingham and London. There will also be significant major beneficial effects to local commuters from the potential use of released capacity on the existing rail network.
- 12.5.30 Closure of Diddington Lane will result in increased journey times for users.
- 12.5.31 The reconfiguration of the A452 Kenilworth Road/ Marsh Lane junction will result in increased journey times for some users of Marsh Lane.
- 12.5.32 There will be an increase in traffic associated with travel demand to and from Birmingham Interchange station. The increased traffic flows will increase severance for pedestrians and cyclists on sections of the A452 Kenilworth Road, and on the B4102 Meriden Road.
- 12.5.33 Seven PRow (Footpath M191 – south of Truggist Lane, Footpath M191 – north of Truggist Lane, Footpath M214, Footpath M215, Footpath M216, Footpath M217 and Bridleway M218), and four roads (A452 Kenilworth Road, Diddington Lane, Park Lane and Lavender Hall Lane) will be/realigned or reinstated and will permanently alter the current alignments, which will for some routes extend journey times for pedestrians, cyclists and equestrians.
- 12.5.34 The significant effects that result in this area from the Proposed Scheme in 2026 and 2041 are shown in Maps TR-04-151a to TR-04-153 (Volume 5, Map book, Traffic and Transport).

13 Water resources and flood risk assessment

13.1 Introduction

13.1.1 This section provides a description of the current baseline for water resources including surface water, groundwater and the baseline conditions for flood risk. It then reports on the likely impacts and significant effects on these aspects as a result of the construction and operation of the Proposed Scheme.

13.1.2 The main environmental features of relevance to water resources and flood risk include:

- two sites of special scientific interest (SSSI), the channel of the River Blythe, extending northwards from west of Balsall Common, and east of Hampton-in-Arden is designated as a SSSI, as is Berkswell Marsh SSSI;
- the floodplain of the River Blythe and its tributaries, the Bayleys Brook and Shadow Brook. The River Blythe and Shadow Brook are main rivers, with the Bayleys Brook being an ordinary watercourse;
- Marsh Lane Nature Reserve, and two water dependent Local Wildlife Sites (LWS) – Patrick Farm Meadow and Mouldings Green Farm Meadow;
- two Secondary A aquifers, the permeable superficial deposits and the Arden Sandstone Formation; one Secondary B aquifer, the Mercia Mudstone Formation; and one Principal aquifer, the Tile Hill Mudstone Formation. The Proposed Scheme will skirt an area of outcropping Bromsgrove Sandstone Formation, which is also a Principal aquifer; and
- one licensed groundwater abstraction¹¹⁹ and three private groundwater users, which abstract from the Mercia Mudstones.

13.1.3 Key environmental aspects relating to water resources and flood risk include:

- the lowering of groundwater levels and disturbance of any existing poor quality ground or groundwater by temporary dewatering during construction and by permanent groundwater control during operation potentially affecting the Berkswell Marsh SSSI;
- the potential obstruction of groundwater flow by below ground construction and permanent structures following construction and operation;
- the potential creation or alteration of contaminant pathways during construction and operation on groundwater quality;

¹¹⁹ Environment Agency (2012), *Environment Agency abstraction licences data*.

- the realignments of; the Bayleys Brook (under Balsall Common viaduct), a tributary of Bayleys Brook (at Lavender Hall Lane); an unnamed watercourse/agricultural ditch (tributary of Bayleys Brook) near Marsh Farm viaduct; and Horn Brook; and
- construction activities taking place within floodplains including the River Blythe, Bayleys Brook and Shadow Brook.

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 Directive¹²⁰ compliance assessment; and
- a route wide Flood Risk Assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within this area are also contained in the Volume 5 Appendices. These include:

- Volume 5: Appendix WR-002-023: Water Resources Assessment report;
- Volume 5: Appendix WR-003-023: Flood Risk Assessment;
- Volume 5: Appendix WR-004-016: River Blythe catchment preliminary flow calculations technical report;
- Volume 5: Appendix WR-004-017: River modelling of the River Blythe and Bayleys Brook technical report; and
- Volume 5: Appendix WR-004-018: River modelling of Bayley's Brook (at Marsh Farm and Lavender Hall Lane), the River Blythe Bypass, Shadow Brook and Hollywell Brook technical report.

13.1.6 Map series WR-01, WR-02, WR-03, WR-05, and WR-06 show details referred to in this report and are contained in Volume 5, Map Book Water resources.

13.1.7 Discussions have been held with the Environment Agency, Natural England, the Canal & River Trust (formerly British Waterways), Solihull Metropolitan Borough Council (SMBC), and Warwickshire County Council (WCC) as Lead Local Flood Authorities (LLFA).

¹²⁰ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, European Parliament and European Council, Strasbourg.

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), its addendum and appendices 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 2012 (July and December) and 2013 (January and July) to the proposed crossing of the River Blythe, Lavender Hall Fisheries, and the land surrounding the Berkswell Marsh SSSI and the proposed Park Lane cutting.
- 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 Archive for the study area catchments.
- 13.2.5 Water Framework Directive (WFD) classification data has been made available by the Environment Agency. For surface water bodies that do not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), the status class has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant RBMP, these are referred to as 'not assessed by the Environment Agency' in the summary of geology and hydrogeology tables in Table 22 below and Volume 5: Appendix WR-002-023.
- 13.2.6 The key assumptions for water resources and the FRA specific to this area are as follows:
- the River Blythe and its tributaries interact with and are at least in partial hydraulic continuity with groundwater; and
 - Berkswell Marsh SSSI, River Blythe SSSI, Patrick Farm Meadow LWS and Mouldings Green Meadow LWS are at least partially groundwater dependent.
- 13.2.7 The main limitations for the water resources and FRA in this area are as follows:

- no access to Berkswell Marsh SSSI was made available for site visits during the assessment period limiting the opportunity to assess the likelihood of surface and groundwater interactions, although visits were made to land adjacent to the south of the SSSI;
- no groundwater field monitoring has been undertaken in the area local to Berkswell Marsh SSSI during the assessment period although land close to the SSSI was visited; therefore baseline information and assessment is based upon publicly available data and professional judgement;
- in the absence of any existing detailed flood models for the River Blythe and its tributaries, localised hydraulic models have been developed to better understand the potential effects regarding flood risk. All limitations related to flood models are presented in the Flood Risk Assessment included as Volume 5: Appendix WR-003-023; and
- groundwater level data from the Environment Agency and other monitored locations such as private abstractions are limited in the study area. 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 generally assumed that groundwater levels are within 1m of the ground surface.

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 this study area fall within the Tame, Anker and Mease Catchment within the Humber River Basin District (RBD) as set out within the RBMP. The River Blythe is a major tributary of the River Tame and drains parts of North Warwickshire, Solihull and the surrounding rural areas. It has a total catchment of 131 km² upstream of a point on the river, 400m north of Patrick Bridge. It is a main river and the channel is designated as a SSSI. A tributary, Shadow Brook is also classified as a main river. Bayleys Brook is an ordinary watercourse. The Bayleys Brook and Shadow Brook are considered to have a receptor value of very high due to their direct connection with the River Blythe and the Bayleys Brook flows through the Berkswell Marsh SSSI.
- 13.3.2 The current surface water baseline is shown on Volume 5: Map WR-01-039 to WR-01-040 and all surface water features within the study area are assessed within Volume 5: WR-02-023. Table 21 includes features potentially affected by the Proposed Scheme.

Table 21: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (map reference)	Water course Classification ¹²¹	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value ¹²²
River Blythe (Temple Balsall to Patrick Bridge)	Approximately 385m north of Patrick Bridge (Volume 5: Map WR-01-040, F6)	Main river	(GB104028042571) Moderate	Good	Very high
River Blythe (Patrick Bridge to River Tame)	Approximately 385m north of Patrick Bridge (Volume 5: Map WR-01-040, F6) (SWC-CFA23-004)	Main river	(GB104028042572) Moderate	Good	Very high
Bayleys Brook	Approximately 150m north-west of Truggist Lane (SWC-CFA23-001), and 75m north of Marsh Farm (SWC-CFA23-002) (Volume 5: Map WR-01-039, F6, and B6)	Ordinary watercourse	No status shown in RBMP – assumed status. Moderate	No status shown in RBMP – assumed status. Good	Very high
Shadow Brook	Approximately 400m west of Diddington Hall (Volume 5: Map WR-01-040, E5) (SWC-CFA23-005)	Main river	No status shown in RBMP – assumed status. Moderate	No status shown in RBMP – assumed status. Good	Very high

¹²¹ Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a main river as a watercourse that is shown as such on a main river map. Section 72 of the Land Drainage Act 1991 defines an ordinary watercourse as 'a watercourse that is not part of a main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including 'all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by Defra on the main river map and are regulated by the Environment Agency.

¹²² For examples of receptor value see Table 43 in the SMR Addendum (see Volume 5, Appendix CT-001-000/2).

Water feature	Location description (map reference)	Water course Classification ¹²¹	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value ¹²²
Horn Brook, tributary of the River Blythe	Horn Brook, a minor tributary of the River Blythe originating to the east of the A452 Kenilworth Road. The channel splits to two channels with the channel flowing in a south-west direction referred to as the River Blythe Bypass Channel. (Volume 5: Map WR-01-039, A6 and SWC-CFA23-003)	Ordinary watercourse	No status shown in RBMP – assumed status. Moderate	No status shown in RBMP – assumed status. Good	Moderate
Lavender Hall Fisheries	Approximately 50m north of Berkswell station (Volume 5: Map WR-01-039, E6)	Not applicable	Not applicable	Not applicable	Very high
Berkswell Estate Fishing Lake	Approximately 500m north-east of the route, west of Berkswell (Volume 5: Map WR-01-039, E5)	Not applicable	Not applicable	Not applicable	Very high
Numerous small ponds within 1km of the centreline of the route.	Various locations See Volume 5: Appendix WR-002-023 for further detail.	Not applicable	Not applicable	Not applicable	Low

*year may vary in different RBMPs.

Water Framework Directive status

13.3.3 The River Blythe is the only watercourse within this study area classified under the WFD. It is designated as two separate water bodies, separated at Patrick Bridge on the B4102 Meriden Road, approximately 100m to the west of the route near Hampton-in-Arden. The upstream section is classified as Temple Balsall to Patrick Bridge, and the downstream section from Patrick Bridge to the River Tame. The current status is Moderate. The Environment Agency has set the overall status objective under the WFD for both sections of the River Blythe by 2027 to be improved to 'Good' status.

Abstractions and permitted discharges

- 13.3.4 There are no licensed surface water abstractions within the study area¹²³.
- 13.3.5 The Environment Agency reports that there are 38 licensed surface water discharges within 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 of the discharge consents are provided in Volume 5: Appendix WR-002-023.

Existing baseline – groundwater resources

Geology and hydrogeology

- 13.3.6 The location of abstractions, geological formations and indicative groundwater levels, where available, are shown in Volume 5: Map WR-02-023.
- 13.3.7 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 22. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 22: Summary of geology and hydrogeology in CFA23

Geology	Distribution	Formation description	Aquifer classification	WFD body and current overall status	WFD status objective (by 2027 ¹²⁴ as per RBMP)	Receptor Value
Superficial deposits						
Glaciofluvial sands and gravels	Across the upper slopes of the River Blythe valley, within the western extent of the study area	Poorly sorted, sand, clayey sand, pebbly sand and gravel	Secondary A ¹²⁵	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Alluvium	Along the lower slopes of the River Blythe valley, within the western extent of the study Area	An upper layer of clay or silt, underlain by several metres of pebbly sand and gravel	Secondary A	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate

¹²³ Surface water abstractions for public supply are not included.

¹²⁴ Year may vary in different RBMPs.

¹²⁵ "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 website, 2012).

Geology	Distribution	Formation description	Aquifer classification	WFD body and current overall status	WFD status objective (by 2027 ¹²⁴ as per RBMP)	Receptor Value
River terrace deposits	Isolated pockets along the River Blythe valley, within the western extent of the study area	Gravel or very clayey sand and gravel	Secondary A	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Bedrock						
Mercia Mudstone	Underlying formation in the central and western extent of the study area	Mudstone and dolomitic siltstone	Secondary B ¹²⁶	Poor ¹²⁷	Tame, Anker and Mease – Secondary Combined ¹²⁸ – Good	Moderate
Arden Sandstone (Mercia Mudstone)	Thin horizon within Mercia Mudstone. Outcrops along the River Blythe valley, in the western extent of the study area	Sandstone, siltstone and mudstone	Secondary A	Poor	Tame, Anker and Mease – Secondary Combined – Good	Moderate

¹²⁶ "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 website, 2012).

¹²⁷ Environment Agency, (2008), *The Tame, Anker and Mease Catchment Abstraction Management Strategy*.

¹²⁸ Environment Agency, (2009), *River Basin Management Plan Humber River Basin District*.

Geology	Distribution	Formation description	Aquifer classification	WFD body and current overall status	WFD status objective (by 2027 ¹²⁴ as per RBMP)	Receptor Value
Bromsgrove Sandstone Formation (Sherwood Sandstone Group)	Located within the central extent of the study area. In particular, north of Bayleys Brook and bounded by faulted inliers associated with the Western Boundary (Meriden) Fault	Sandstone	Principal	Good	Tame, Anker and Mease – Sandstone Nuneaton and Meriden – Good	High
Tile Hill Mudstone (Carboniferous Warwickshire)	Eastern part of route underlain by Tile Hill within the study area	Interbedded argillaceous rocks and sandstone.	Principal ¹²⁹	Poor	Warwickshire Group (Warwickshire Avon – Coal Measures Coventry) ¹³⁰ – Good	High

Superficial deposits

- 13.3.8 Superficial glacial deposits are present within much of the study area and consist of glacial sands and gravels. The deposits form an extensive but now dissected deposit beneath the axis of the River Blythe valley and form a significant local aggregate resource. Fluvial and alluvial deposits are present across the lower parts of the River Blythe and other stream valleys that cross the route.
- 13.3.9 The glaciofluvial deposits, river terrace deposits and alluviums are Secondary A aquifers.

Bedrock aquifers

- 13.3.10 The solid geology of the study area comprises Mercia Mudstone Group, Arden Sandstone, Bromsgrove Sandstone Formation and Tile Hill Mudstone Formation.
- 13.3.11 The Mercia Mudstone Group outcrops in a broad, down-faulted tract, and is composed mainly of blocky red mudstone with thin, dolomite-cemented, siltstone

¹²⁹ "...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 website, 2012).

¹³⁰ Environment Agency (2009) *River Basin Management Plan Severn River Basin District*.

and sandstone beds locally known as 'skerries' (BGS, 2000a¹³¹). The Mercia Mudstone Group outcrops to the west of the Western Boundary fault. The Mercia Mudstone overlies the Bromsgrove Sandstone, which is present at depth below the Mercia Mudstone along the route. In addition, the Bromsgrove Sandstone outcrops 75m to the north of the route near Berkswell Marsh. Due to the presence of the Mercia Mudstone there is unlikely to be a hydraulic connection between the Proposed Scheme and the Bromsgrove Sandstone, and as such the sandstone is not considered as a receptor.

- 13.3.12 The Arden Sandstone Formation forms the sandstone beds or skerries within the Mercia Mudstone Formation. The Arden Sandstone outcrops along the valley of the River Blythe. It forms the middle sub-division of the Mercia Mudstone Group, Unit C, and a thicker sandstone-dominated unit (BGS, 2000a).
- 13.3.13 The Tile Hill Mudstone Formation forms the uppermost red-bed unit of the Carboniferous strata within the Warwickshire Coalfield (BGS, 1997¹³²). The Tile Hill Mudstone Formation outcrops to the east of the Western Boundary fault. It consists of blocky mudstone and laminated siltstone with laterally thin beds of sandstone, locally with pebbles and conglomerate lenses (BGS, 2000a).
- 13.3.14 There are three categories of aquifer identified within the study area. The Bromsgrove Sandstone and the Tile Hill Mudstone are Principal aquifers, the Arden Sandstone is a Secondary A aquifer, and Mercia Mudstone is a Secondary B aquifer, see Volume 5: Map WR-02-023.
- 13.3.15 There are no groundwater Source Protection Zones (SPZs) located within the study area.

Water Framework Directive status

- 13.3.16 No WFD classification has been given by the Environment Agency to the superficial deposits.
- 13.3.17 The overall WFD status of the Tame, Anker and Mease – Secondary Combined and the Warwickshire Group (Warwickshire Avon – Coal Measures Coventry) groundwater bodies in the study area as summarised in Table 22 and are classified as Poor Status. The groundwater bodies are probably at risk of failing to comply with the WFD. The main pressures identified by the Environment Agency in the RBMP are high or rising nitrate concentrations and failures for pesticides and chemicals associated with disused mines.

¹³¹ British Geological Survey, (2000a), *Geology of the Birmingham area – Memoir for 1:50,000 Geological Sheet 168 (England and Wales)*; British Geological Survey.

¹³² British Geological Survey, (1997), *The physical properties of major aquifers in England and Wales – Hydrogeology Group Technical Report WD/97/34* Environment Agency R&D Publication 8; British Geological Survey.

Abstractions and permitted discharges

- 13.3.18 The Environment Agency, SMBC and NWDC reports that within the study area there is one licensed groundwater abstraction at Berkswell Quarry and three private groundwater users at Silver Birch, The Cottage and Lavender Hall, abstracting directly from the Mercia Mudstones. These abstractions are considered to be of high value. There are no licensed abstractions from the Tile Hill Mudstone or the superficial deposits. The abstraction licence details are presented in Volume 5: Appendix WR-002-023. There is potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20 cubic metres per day.

Surface water/groundwater interaction

- 13.3.19 The permeable superficial deposits underlying the River Tame bed and banks are reported to allow significant inflow of shallow groundwater¹³³. In the absence of site specific data, it is likely that this would also apply to the River Blythe, and its tributaries, and the river would allow a significant inflow of shallow groundwater. Therefore, the River Blythe, and its tributaries, are likely to act as a discharge point for converging groundwater in the Tame, Anker and Mease catchment.
- 13.3.20 Baseflow within the Carboniferous sandstones of the West Midlands forms an important component of the water balance within the study area¹³⁴. However, the base flow contribution to surface watercourses from the Tile Hill Mudstone Formation, which contains thin sandstone horizons of limited lateral extent are likely to be less significant.
- 13.3.21 Eight springs have been identified from the Ordnance Survey base mapping within the study area. These springs are considered as surface expressions of the water body. The water body is considered as a receptor and as such the springs are not considered as receptors in their own right due to their distance from relevant features of the route. The springs are located at:
- Beechwood Farm, located 515m north-east of the centreline of the route;
 - Bockendon Grange, located 260m north-east of the centreline of the route;
 - Catchems Corner, located 650m south-west of the centreline of the route;
 - Beanit Farm, located 720m south-west of the centreline of the route;
 - Wootton Green, located 415m south-west of the centreline of the route;
 - Lower Farm, located 650m north-east of the centreline of the route;

¹³³ 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.

¹³⁴ Environment Agency (2007) Groundwater Quality Review: Coventry Carboniferous Sandstones.

- Bradnocks Farm, located 490m south-west of the centreline of the route; and
- Hampton-in-Arden, north-east of Siden Hill Wood located 810m west of the centreline of the route.

Water dependent habitats

- 13.3.22 There are four groundwater dependent terrestrial ecosystems (GWDTEs) located within the study area. These are the Berkswell Marsh SSSI, River Blythe SSSI, Patrick Farm Meadow LWS and Mouldings Green Farm LWS. From a water resource perspective, the Berkswell Marsh SSSI and the River Blythe SSSI are considered to be of very high value whilst the LWS are considered to be of moderate value. Further details are provided in Volume 5: Appendix WR-002-023.
- 13.3.23 There is limited information available regarding the baseline hydrological condition of these wetlands. However, these areas are likely to be at least partially dependent on groundwater contributions from the underlying glacial sand and gravel deposits and the underlying bedrock aquifers where they are water bearing¹³⁵. Further information on the above ecological receptors is given in Ecology (Section 7).

Existing baseline – flood risk

River flooding

- 13.3.24 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping¹³⁶, see Volume 5: Map WR-01-039 and Map WR-01-040.
- 13.3.25 The Environment Agency does not have an existing river model of the River Blythe catchment. Therefore, in order to better understand the existing risk posed by the River Blythe catchment, hydraulic models were created for each watercourse crossing. The results of the baseline modelling within the flood risk assessment (FRA) confirm that river flooding will impact on areas in the vicinity of the River Blythe. Meriden Mill Farm and Mouldings Green Farm, as residential receptors, are flood receptors of high value, which are all located on the downstream side of where the route will cross the River Blythe. The B4102 Meriden Road is a flood receptor of moderate value. Otherwise the land use within the flood zones is predominantly agricultural and of moderate value. The FRA in Volume 5: Appendix WR-003-023 provides further details of receptors within the flood zones and their vulnerability and Volume 5: Map WR-05-151b to WR-05-153 illustrates areas at risk of flooding.
- 13.3.26 Shadow Brook is a tributary of the River Blythe and is a main river. Shadow Brook flows in a north-easterly direction, to the north of Hampton-in-Arden, joining the River Blythe immediately to the east of the A452 Kenilworth Road.

¹³⁵ Natural England; http://www.english-nature.org.uk/citation/citation_photo/1006055.pdf; Accessed 08 January 2013.

¹³⁶ Environment Agency; <http://www.environment-agency.gov.uk>; Accessed 8 January 2013.

- 13.3.27 The Environment Agency flood zone mapping shows the Shadow Brook flood extent for 1 in 100 annual probability (1%) of river flooding. The area shown to be at risk of flooding from Shadow Brook is approximately 50m to the north and south of the watercourse upstream where it is crossed by Diddington Lane. The land use here is agricultural (less vulnerable), of moderate value, with a transport route – Diddington Lane – also crossing the area at risk of flooding. Site specific flood mapping demonstrates that Diddington Hall is outside of the floodplain for the 1 in 100 annual probability (1%) of river flooding plus climate change event, although the access road to the Hall is only marginally outside the floodplain, as the level of the access road is slightly above the flood level.
- 13.3.28 Bayleys Brook is a tributary of the River Blythe and is an ordinary watercourse. The watercourse originates to the east of Balsall Common and flows north-west, where it flows parallel to the A452 Kenilworth Road. Bayleys Brook flows through Berkswell Estate Fishing lake, prior to entering the Berkswell Marsh SSSI. Bayleys Brook enters the River Blythe to the south-east of Hampton-in-Arden, approximately 500m after crossing the A452 Kenilworth Road and Marsh Lane and bisects the Berkswell Marsh SSSI along its alignment. The Environment Agency flood zone mapping of Bayleys Brook shows the risk of flooding with 1 in 100 annual probability (1%) of river flooding along its length from east of Balsall Common downstream to its confluence with the River Blythe. The areas at risk of flooding from the Bayleys Brook are to the east of Lavender Hall Fisheries (150m north of Berkswell station), and where the brook is crossed by the A452 Kenilworth Road, 150m north of Marsh Farm. The land use here is agricultural (less vulnerable), of moderate value in terms of flood risk. Site specific flood modelling demonstrates that Mercote Lodge and Marsh Farm Cottage, located upstream of the A452, are both elevated above the floodplain for the 1 in 100 annual probability (1%) of river flooding plus climate change event.
- 13.3.29 Additionally Horn brook, a tributary to the River Blythe, an ordinary watercourse, originates to the east of the A452 Kenilworth Road, 300m west of Horn Brook Farm. This channel then splits immediately downstream of the A452 Kenilworth Road crossing with the majority of flow being conveyed by the northern channel (Horn Brook) towards the B4102 Meriden Road. The southern channel, referred to elsewhere in this report as the River Blythe Bypass Channel, conveys a smaller proportion of flow in a south westerly direction while also functioning as a land drain.
- 13.3.30 The northern channel watercourse (Horn Brook) joins with the River Blythe approximately 200m north-west of the A452 Kenilworth Road/B4102 Meriden Road roundabout. The southern channel (River Blythe Bypass) joins with the River Blythe approximately 450m south of Patrick Bridge.
- 13.3.31 The Environment Agency flood zone mapping for the River Blythe Bypass Channel shows a significant flood extent from the River Blythe upstream on the River Blythe Bypass. Historic flood outlines for 1992 shows the backwater extent flooding for the

River Blythe continuing upstream within the outline of Flood Zone 3 shown on the Volume 5: Map WR-01-040.

Surface water flooding

- 13.3.32 The agreed data set for surface water flooding is the Environment Agency Flood Maps for Surface Water¹³⁷ (FMfSW), as shown on Volume 5: Maps WR-01-039 and WR-01-040.
- 13.3.33 According to the SMBC Level 1 Strategic Flood Risk Assessment (SFRA)¹³⁸ there are numerous existing overland flow routes and low points within the study area 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. The route crosses a number of natural overland drainage paths which form valleys in the topography.
- 13.3.34 The FRA in Volume 5: Appendix WR-003-023 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 year annual probability (0.5%) rainfall event occurring are shown on the Volume 5: Maps WR-01-039 and WR-01-040.
- 13.3.35 The Preliminary Flood Risk Assessment (PFRA)¹³⁹ reports a single historic flood event within 500m of the route, located to the east of Berkswell station. There are no specific details of the flood risk presented in the PFRA.

Sewer flooding

- 13.3.36 The agreed data set for sewer flooding is the SMBC PFRA and SMBC Level 1 SFRA.
- 13.3.37 This area is a semi-rural area outside of the settlements of Balsall Common and Hampton-in-Arden. Due to the rural location, there are only localised existing sewer networks in this area. The majority of the drainage systems will be the responsibility of Severn Trent Water and SMBC for highway drainage.
- 13.3.38 Inspection of the utility records confirms that the Proposed Scheme is in close proximity to very few public sewers within the Balsall Common and Hampton-in-Arden area. Inspection of possible flood routes from sewer capacity exceedence confirms that the general risk of flooding from sewers is minimal. There are no significant interactions between the Proposed Scheme and the existing sewerage network within this study area.

¹³⁷ Environment Agency, (2012), *The Flood map for surface water (FMfSW)*, Midlands Flood Map for Surface water GIS layers.

¹³⁸ Halcrow Group Limited, (2009), *Solihull Metropolitan Borough Council Strategic Flood Risk Assessment*.

¹³⁹ WSP, (2011), *Preliminary Flood Risk Assessment Report Solihull Metropolitan Borough Council*, Solihull Metropolitan Borough Council.

Artificial water bodies

- 13.3.39 The agreed data set for reservoirs is the Environment Agency Reservoir Inundation Map¹⁴⁰.
- 13.3.40 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 FRA (see Volume 5: Appendix WR-003-023) as being a potential source of flood risk:
- the canal system; and
 - reservoirs.
- 13.3.41 The nearest canal to the Proposed Scheme in this area is the Grand Union Canal which follows a general north to south route some 3.6km to the west of the route centre line at its closest point. The canal is predominantly in cutting or grade and is not considered to pose a significant flood risk to the Proposed Scheme.
- 13.3.42 The Environment Agency Reservoir Flood map shows the largest area that might be flooded if a reservoir were to fail. There are a number of water bodies that are listed in the Environment Agency Reservoir Inundation Flood Mapping as posing a risk to the River Blythe catchment. These are Earlswood Lakes (group of lakes), located approximately 12km from the route, Meriden No 1 and Meriden No 2 service reservoirs, located approximately 4.2km from the route, Geary's Level and Molands Lakes (see Volume 5: Map WR-01-040, F4) with the latter located less than 1km from the route.
- 13.3.43 In most areas in vicinity to the River Blythe, the extent of inundation will be less than the 1 in 100 annual probability (1%) of river flooding event. There is a small area which is a lake close to Marsh Lane (Volume 5: Map WR-01-039, B7). This area is shown at risk of reservoir inundation where there is no risk of river flooding shown. However, the data provided does not indicate flood depths, flow velocities or the time taken for onset of flooding after a breach takes place. The mapping indicates that in the event of a catastrophic failure of any of the reservoirs in the River Blythe catchment, the flood waters will flow down the river channels and extend out across the floodplain and low points in the topography. The extent of flooding within the River Blythe reach appears consistent with the River Blythe flood mapping.
- 13.3.44 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

¹⁴⁰ Environment Agency; *Reservoir flood map*; <http://www.environment-agency.gov.uk/homeandleisure/37793.aspx>; Accessed on 08 January 2013.

this assessment. Further details can be found in the FRA, Volume 5: Appendix WR-003-023.

Groundwater flooding

- 13.3.45 The agreed data set for historical incidents of groundwater flooding is the SMBC Level 1 SFRA and the PFRA.
- 13.3.46 The SMBC Level 1 SFRA¹⁴¹, SMBC and the PFRA¹⁴² state that there are no known problems with or confirmed records of flooding from groundwater within Solihull borough. Groundwater is not considered to pose a significant risk of flooding in the study area.

Future baseline

- 13.3.47 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.
- 13.3.48 All developments are required to comply with the National Planning Policy Framework (NPPF)¹⁴³ development plans and other legislation and guidance. As such committed developments should have a neutral effect on the water resources and flood risk baseline.
- 13.3.49 There are no committed developments that are likely to cause significant changes to the water resources and flood risk baseline prior to construction of the Proposed Scheme in this study area.
- 13.3.50 WFD future status objectives are set out in Table 21 and Table 22. These are not considered to result in significant changes to the reported effects from the Proposed Scheme.

Climate change

- 13.3.51 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

¹⁴¹ Halcrow Group Limited, (2009), *Solihull Metropolitan Borough Council Strategic Flood Risk Assessment*.

¹⁴² WSP, (2011), *Preliminary Flood Risk Assessment Report* Solihull Metropolitan Borough Council, Solihull Metropolitan Borough Council.

¹⁴³ Department for Communities and Local Government, March 2012, *National Planning Policy Framework*.

are not considered to result in the reported effects from the Proposed Scheme changing in significance.

- 13.3.52 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.
- 13.3.53 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 Framework. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.
- 13.3.54 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 Section 6(A) of the SMR Addendum in Volume 5: Appendix CT-001-000/2.

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 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-002-023 and Appendix WR-003-023.
- 13.4.3 Bayleys Brook will require a permanent realignment of approximately 120m under part of the Balsall Common viaduct, minimising the length of watercourse under the viaduct. The realignment of approximately 100m of a tributary of Bayleys Brook due to the Lavender Hall Lane earthworks is also proposed. There will also be the realignment of the Horn brook, a tributary of the River Blythe near to Hornbrook Farm. A further realignment of an unnamed dry watercourse/agricultural ditch (tributary of Bayleys Brook) commencing at a point approximately 280m south-east of Footpath M215 overbridge, Park Lane, for approximately 1.4km along the south-west side of the route to Marsh Farm is also proposed.
- 13.4.4 For all river realignments consideration will be given in the detailed 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 in consultation with the Environment Agency. This will

ensure that the channels and structures are sufficiently sized to avoid a permanent impact on flow.

13.4.5 For the watercourse crossing points at Bayleys Brook and the River Blythe the route will be on viaduct, thus minimising impacts on the floodplain. Additionally with the route being on viaduct, crossing the River Blythe channel, impacts, such as the shading of natural light, on the River Blythe SSSI will be minimised.

13.4.6 Where new culverts will be installed, culvert length will be minimised wherever possible and will be designed with invert levels below the firm bed of the watercourse to negate the impact on flows and sediment transfer. Where possible, consideration will be given to provide mitigation for the loss of open channel by means of sensitive design at either end of the culvert in order to retain and, if possible, enhance the overall quality of the watercourse. Where there is loss of length due to straightening, the aim, where possible, will be to offset this by increasing channel length up or downstream of the culvert to at least match the lost length of channel. Culverts will be designed in line with Construction Industry Research and Information Association (CIRIA)¹⁴⁴ and Environment Agency guidance and in consultation with the Environment Agency. The mitigation specifically for the ecology of the watercourses is considered in Section 7, Ecology.

13.4.7 The drainage design will take into account the principles of Sustainable Drainage Systems (SuDS). It is currently envisaged that nine balancing ponds will be provided (as shown on the Volume 2: Maps series CT-06), located as follows:

- two south-west of Beechwood Farm;
- south of Truggist Lane;
- north-west of Marsh Farm;
- north-west of the A452 Kenilworth Road;
- south of Patrick Farm;
- south and north of Shadow Brook; and
- south of Stonebridge Island (partially located within the Birmingham Interchange and Chelmsley Wood area, CFA24).

13.4.8 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

¹⁴⁴ Construction Industry Research Information Association (CIRIA), (2001), *C689 Culvert Design and Operation Guide*.

existing run-off rates and will accommodate for events up to and including the 1 in 100 annual probability (1%) including an allowance for climate change.

- 13.4.9 The Park Lane cutting will be located approximately 300m north of Top Lodge as shown on Volume 2: Map CT-06-102. This cutting requires the construction of a ditch, 1.5km in length (see Volume 2: Map CT-06-102), to divert the flow path of an existing ditch which is shown to outfall towards the Berkswell Marsh SSSI. The diverted ditch will ensure that the flow paths are maintained and flood risk is not increased.
- 13.4.10 Measures to ensure the minimisation of any effects on groundwater and GWDTEs during the construction of cuttings and excavations, utility diversions and permanent groundwater effects due to the presence of cuttings, such as the Park Lane, Horn Brook and Diddington cuttings and the proposed utility diversion under the Bayleys Brook near Marsh Farm are included within the draft CoCP (Section 16). Further details of the cuttings and excavations are summarised in Volume 5: Appendix WR-002-023. The following measures will reduce adverse potential permanent effects on groundwater flow, such as at Berkswell Marsh SSSI, 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; and
 - 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 or underground structures, without a rise in groundwater levels on the upstream side.
- 13.4.11 The design includes measures to mitigate any increase in flood risk. The FRA has been used to estimate the storage required within five floodplain replacement storage areas in consultation with the Environment Agency. These are required due to a loss of storage within the floodplain from the embankments and other structures. These will be located as follows:
- in close proximity to Lavender Hall Fisheries, north-west of Truggist Lane (see Volume 2: Map CT-06-101, D7);
 - north-east of Lavender Hall Lane overbridge (see Volume 2: Map CT-06-101, B4);
 - beneath Marsh Farm viaduct (see Volume 2: Map CT-06-103, D7);

- between River Blythe and B4102 Meriden Road (see Volume 2: Map CT-06-104, D8); and
- west of the Shadow Brook underbridge (see Volume 2: Map CT-06-105a, G7).

13.4.12 These replacement floodplain storage areas will mitigate an increase in flood risk elsewhere.

13.4.13 Environment Agency river network GIS data notes a possible culvert from a tributary of the Bayleys Brook to the River Blythe Bypass Channel, this is shown on Volume 5: Map WR-01-040 . The culvert is denoted as assumed in the Environment Agency data and the presence of this culvert is currently unconfirmed. The flows that would pass through this culvert have been included in the flood modelling and assessment for Bayleys Brook at the Marsh Farm viaduct. The existence of this culvert will be confirmed during the detailed design stage and should a diversion be required this will be developed in consultation with the Environment Agency and Lead Local Flood Authority.

13.4.14 The draft CoCP, (Volume 5: Appendix CT-003-000) sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. It will provide effective management and control of the impacts during the construction period.

13.4.15 The following measures in the draft CoCP will reduce potentially significant adverse effects arising during construction on water resources and flood risk:

- implementation of all the relevant measures defined in the draft CoCP. This will include method statements for surface water crossings and realignments, 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 water quality or flows associated with construction in all areas and in particular in the vicinity of the Berkswell Marsh SSSI;
- preparing site-specific flood risk management plans for those construction areas at risk of flooding, i.e. works in the River Blythe floodplain;
- 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, e.g. River Blythe culvert satellite compound, for the storage and control of oils and chemicals and to mitigate against accidental spillages.

13.4.16 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.

13.5 Assessment of impacts and effects

- 13.5.1 This section describes the significant effects following the implementation of avoidance and mitigation measures.
- 13.5.2 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-002-023 and FRA in Appendix WR-003-023.
- 13.5.3 An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within the route-wide Water Resources appendix (Volume 5: Appendix WR-001-000).
- 13.5.4 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, groundwater and water dependent habitats (see Volume 3: Route-wide Effects Assessment for further information).

Temporary effects

Surface water

- 13.5.5 The assessment shows that there will be no significant temporary adverse effects on surface water resources during the construction period.
- 13.5.6 As no significant effects on surface water features have been identified, no significant adverse effects on abstractions or discharges will arise.

Groundwater

- 13.5.7 The assessment shows that by adopting the measures and guidance included in the draft CoCP will be no significant adverse effects on groundwater and GWDTEs, during the construction period.
- 13.5.8 An assessment of the potential impact of the Proposed Scheme on the GWDTEs is provided in Volume 5: Appendix-002-023. Following mitigation, impact on GWDTEs is assessed as being not significant. Similarly, the impact on springs is also assessed as being not significant.
- 13.5.9 There are no anticipated pathways for the route to affect groundwater in the Bromsgrove Sandstones, as no construction will take place within this aquifer. Therefore no potential impacts of the Proposed Scheme on this receptor have been considered here.
- 13.5.10 A detailed impact assessment of the Proposed Scheme on the Berkswell Marsh SSSI has been undertaken. The nearest construction element to the Berkswell Marsh SSSI is the proposed Park Lane cutting with approximate length of 2,100m and maximum

depth to approximately 12m below ground level. A summary of the assessment is provided in Volume 5: Appendix WR-002-023.

- 13.5.11 The impact assessment concluded that the Berkswell Marsh SSSI is likely to be at least partially groundwater dependent, but that the potential impact for the Proposed Scheme to alter groundwater flow to Berkswell Marsh SSSI is not significant. This is because the Park Lane cutting will be positioned on a surface water divide to the south-west, limiting the interception of groundwater flow, and Berkswell Marsh SSSI is likely to receive the majority of its groundwater flow from the opposite, north-east, side of Bayleys Brook valley from the Tile Hill Mudstone and Bromsgrove Sandstone Principal aquifers. More detail is presented in Volume 5: Appendix WR-002-023.

Flood risk

- 13.5.12 The assessment has identified no significant increase in risks resulting from all sources of flooding during the construction process and therefore no significant temporary adverse effects.

Cumulative effects

- 13.5.13 There are no committed developments that have been identified which will result in significant cumulative temporary effects.

Permanent effects

Surface water

- 13.5.14 The existing drainage ditch which will be severed by the Park Lane cutting does not have any permanent flow and is predominantly dry. The flow route for this ditch will re-join the Bayleys Brook downstream near Marsh Farm. Theoretical calculations of the low flow within the ditch indicate it to be dry for at least 95% of the time. This is in accordance with field observations as during the winter (January 2013) when flows would typically be expected to be high, the ditch was dry. The realignment is therefore unlikely to reduce water flow to the Berkswell Marsh SSSI. This is considered to have a negligible impact and no significant adverse effect.
- 13.5.15 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.

Groundwater

- 13.5.16 An assessment of the impacts of the Proposed Scheme, including the Park Lane cutting, on Berkswell Marsh SSSI has been undertaken. The potential impact for the Proposed Scheme to alter groundwater flow to Berkswell Marsh is considered to be low and not significant (see Volume 5: Appendix WR-002-023 for further details).

Flood risk

- 13.5.17 In the vicinity of the Balsall Common viaduct and Lavender Hall Lane crossings, and the Marsh Farm viaduct, the FRA reports that under the 1 in 100 annual probability

(1%) event including an allowance for climate change there will be a localised increase in flood levels on agricultural land due to the Proposed Scheme and a relatively small change in flood extent distributed around the perimeter of the existing flood plain. In accordance with the assessment methodology and reporting criteria this will be a significant effect. However, it should be noted that the Proposed Scheme will not significantly change the frequency or the duration of flooding at this location. Given that this land is already subject to flooding under the current baseline conditions and that the Proposed Scheme will not significantly change the frequency or duration of flooding, it is considered that this does not represent a significant increase in flood risk.

13.5.18 Flood depths on Meriden Road are predicted to increase as a result of the Proposed Scheme by up to 60mm under the 1 in 100 annual probability (1%) event including an allowance for climate change, with a small increase in flood extent. The current baseline conditions show that the Meriden Road already experiences flood levels of approximately 300mm. The frequency and duration of flooding will not change as a result of the Proposed Scheme. In accordance with the assessment methodology and reporting criteria this will be a significant adverse effect. Application of Environment Agency flood risk guidance hazard assessment criteria (FD2320) indicates an existing classification of “Danger to most” under the 1 in 100 annual probability (1%) event including an allowance for climate change and “No Hazard” under the 1 in 20 annual probability (5%) event including an allowance for climate change. The site specific modelling indicates that there will be no change in flood hazard classification as a result of the Proposed Scheme. Therefore, given that the road is already subject to flooding under the current baseline conditions and that the Proposed Scheme will not significantly change the frequency or duration of flooding or the hazard rating, it is considered that the increases to flood level and extent reported in the FRA do not represent a significant increase in flood risk.

13.5.19 For the River Blythe viaduct crossing and the associated Patrick embankment, the FRA reports that under the 1 in 100 annual probability (1%) event including an allowance for climate change there will be a moderate increase in flood levels and a marginal change to flood extent due to the Proposed Scheme and, in a localised area adjacent to the Patrick embankment, there is a small area where a large increase in flood levels occurs. The increase in extent is distributed around the perimeter of the existing floodplain and in total represents an increase of approximately 1%. This land already floods under current baseline conditions and the Proposed Scheme will not significantly change the frequency or the duration of flooding at this location. In accordance with the assessment methodology and reporting criteria this would be reported as a significant adverse effect. Upstream of Meriden Road, the FRA reports that there will be a moderate increase in flood levels on agricultural land and a marginal change to flood extent due to the Proposed Scheme. These increases represent relatively small changes in flood level, and an increase in flood extent of

approximately 0.3%. This land already floods under current baseline conditions and the Proposed Scheme will not change the frequency or the duration of flooding at this location. In accordance with the assessment methodology and reporting criteria this would be reported as a significant adverse effect. However, given that this land is of a moderate vulnerability, is already subject to flooding under the current baseline conditions and that the Proposed Scheme will not change the frequency or duration of flooding, it is considered that the increases to flood level and extent reported in the FRA do not result in a significant increase in flood risk.

Cumulative effects

- 13.5.20 There are no committed developments that have been identified which will result in significant cumulative permanent effects.

Other mitigation measures

- 13.5.21 The closure of Diddington Lane has the potential to impact on emergency access and egress routes during flood events. Alternative access routes will be available. During the detailed design stage consultation will be held with the Environment Agency and the LLFA to agree suitable flood warning and evacuation plans to mitigate this closure and ensure that emergency access routes are maintained.
- 13.5.22 No further mitigation measures are considered necessary for surface water, groundwater and flood risk.

Summary of likely significant residual effects

- 13.5.23 Following mitigation, including the application of the measures outlined within the draft CoCP, no significant residual adverse effects to water resources and flood risk have been identified within the assessment.

13.6 Effects arising from operation

Avoidance and mitigation measures

- 13.6.1 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 operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.
- 13.6.2 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, 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 River Blythe SSSI, and Bayleys Brook, which flows through Berkswell Marsh SSSI.

13.6.3 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.

13.6.4 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-003-023.

Assessment of impacts and effects

13.6.5 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

13.6.6 There are considered to be no further measures required to mitigate adverse effects on water resources or flood risk.

Summary of likely significant residual effects

13.6.7 There will be no significant residual adverse effects to water resources and flood risk arising from operation.

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