LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA16 | Ladbroke and Southam

November 2013

VOL 2

ES 3.2.1.16

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Department for Transport

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

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Structure of the HS2 Phase One Environmental Statement

The Environmental Statement (ES) documentation comprises:

- Non-technical summary (NTS) – which provides a summary in non-technical language of the Proposed Scheme, the likely significant environmental effects of the Proposed Scheme, both beneficial and adverse, and the means to avoid or reduce the adverse effects;
- Volume 1: Introduction to the 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 on a route-wide basis;
- Volume 4: Off-route effects – provides an assessment of the off-route effects of the Proposed Scheme where it is not practical to describe these within the community forum area descriptions in Volume 2;
- Volume 5: Appendices and map books – contains supporting environmental information and associated map books; and
- Glossary of terms and list of abbreviations – contains terms and abbreviations, including units of measurement, used throughout the ES documentation.

1 Introduction

1.1 Introduction to HS2

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

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

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

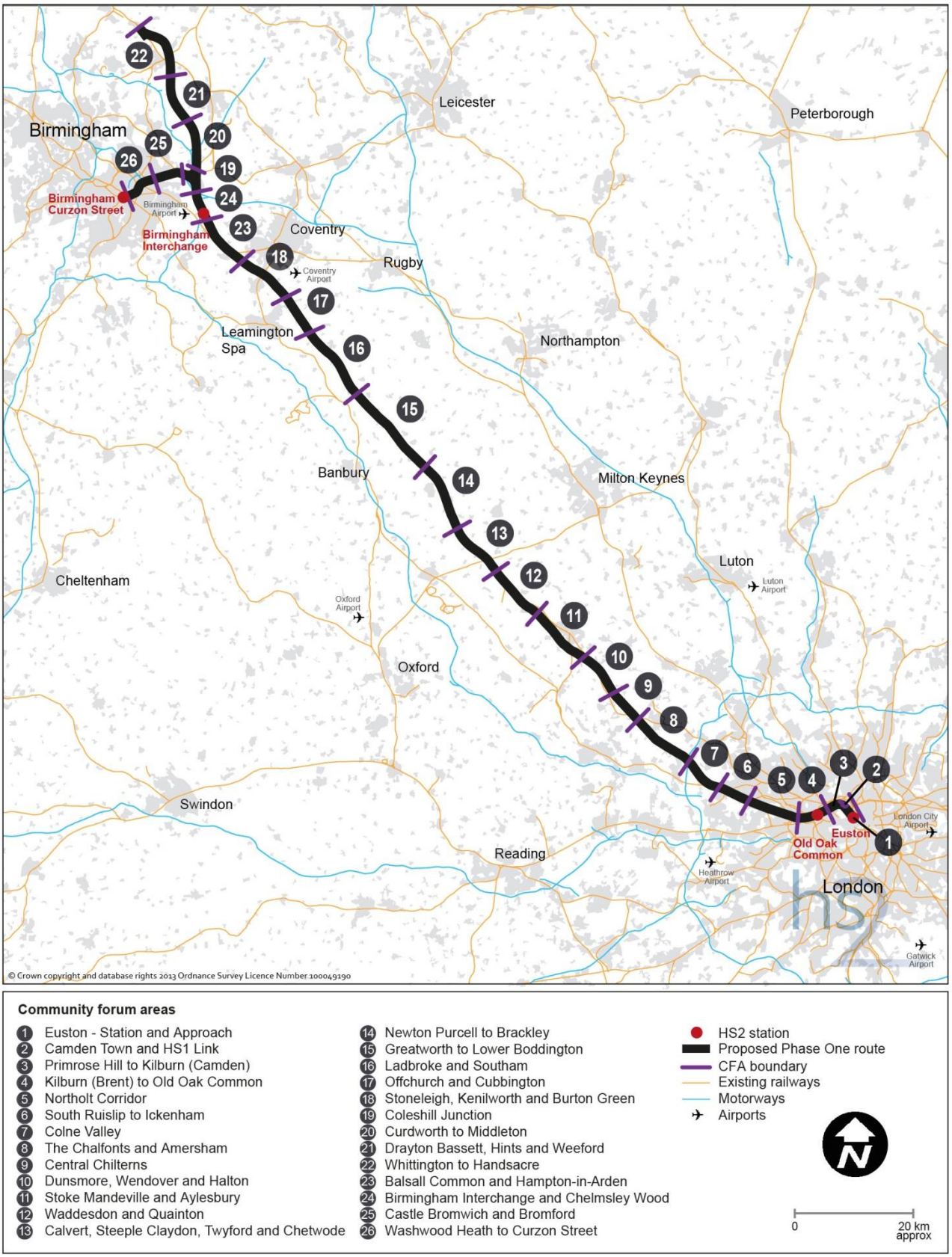
1.1.4 Phase Two will involve the construction of lines from Birmingham to Leeds and Manchester; with construction commencing approximately 2023, and planned to be operational by 2033.

1.1.5 Section 4 of Volume 1 describes the anticipated operational characteristics of HS2, including the anticipated frequency of train services. As Volume 1 shows, the frequency of trains is expected to increase over time and to increase further upon opening of Phase Two. In assessing the environmental effects of the Proposed Scheme the anticipated Phase 2 operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Ladbroke and Southam area (CFA16), 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.

Figure 1: HS2 Phase One route and community forum areas



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 CAF16 Ladbroke to Southam. The report describes the mitigation measures that are proposed for the purpose of avoiding, reducing or managing the likely significant effects of the Proposed Scheme on the environment within CFA16.

1.3 Structure of this report

1.3.1 This report is divided into the following sections:

- Section 1 – an introduction to HS2 and the purpose and structure of this report;
- Section 2 – overview of the area, description of the Proposed Scheme within the area and its construction and operation, and a description of the main local alternatives; and
- Sections 3-13 – 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 maps relevant to Ladbroke and Southam are provided in a separate corresponding document entitled Volume 2: CFA16 Map Book, which should be read in conjunction with this report.

1.3.6 The Proposed Scheme described in this report is that shown on the Map Series CT-05 (construction) (Volume 2, CFA16 Map Book) and CT-06 (operation) (Volume 2, CFA16 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.

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

2 Overview of the area and description of the Proposed Scheme

2.1 Overview of the area

2.1.1 The Ladbroke and Southam area (CFA16) covers approximately 13km of the Proposed Scheme in the Stratford-on-Avon District, where it passes to the west of Southam. It extends from Wormleighton in the south to the Grand Union Canal at the boundary with Warwick District in the north.

2.1.2 The area includes land within the parishes of Stoneton, Wormleighton, Priors Hardwick, Radbourne, Hodnells and Wills Pastures, Ladbroke, Southam, Ufton and Long Itchington.

2.1.3 Greatworth to Lower Boddington (CFA15) lies to the south and Offchurch and Cubbington (CFA17) lies to the north, as shown in Figure 2.

Settlement, land use and topography

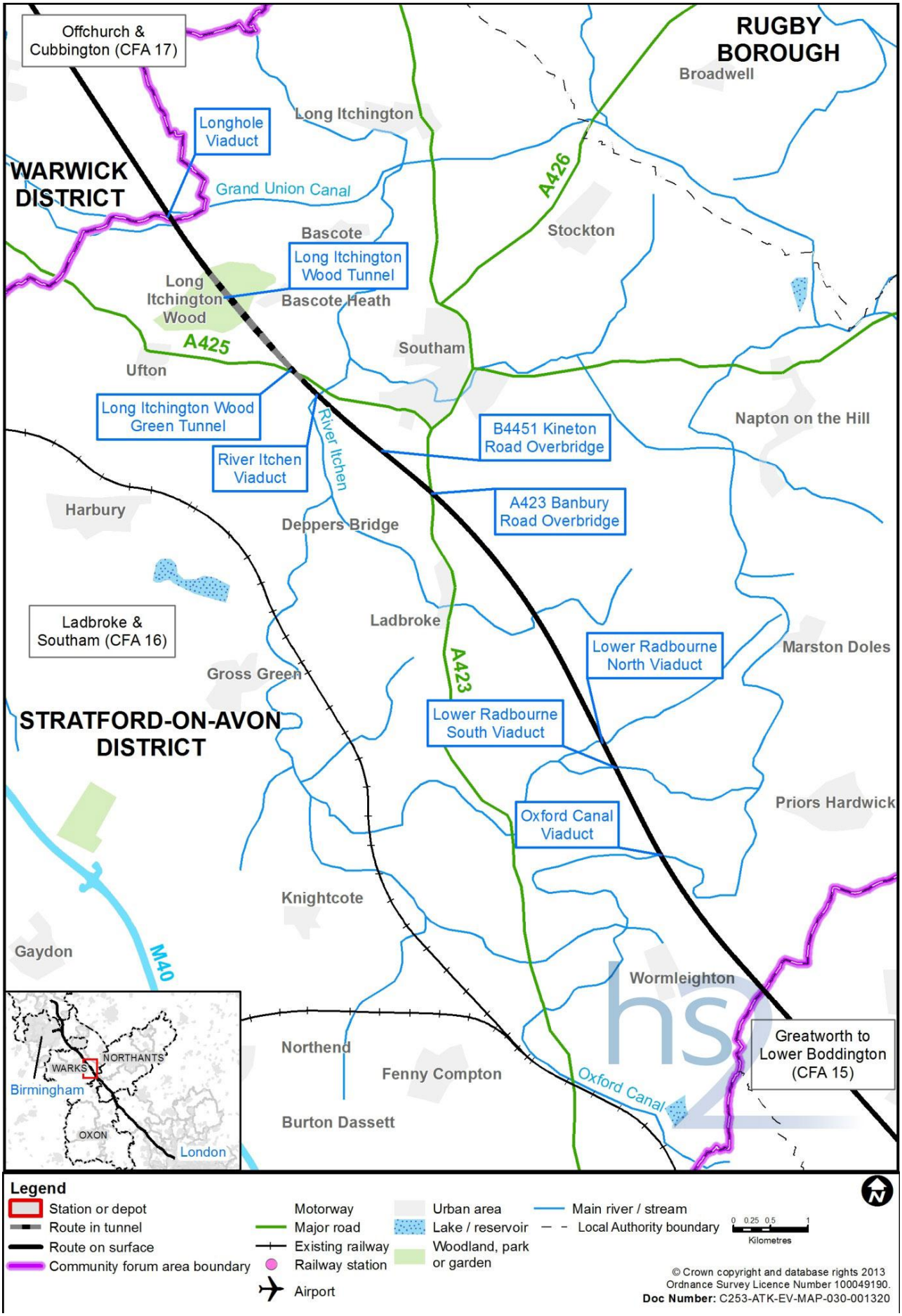
2.1.4 The area is predominantly rural in character. Southam is the principal settlement in the middle of the area and lies approximately 800m east of the Proposed Scheme. The Kineton Road Industrial Estate and the Warwick House Industrial Park on the southern edge of the town provide local employment opportunities. Within the area, Southam has been the focus for development. The smaller rural villages show little evidence of significant recent change.

2.1.5 The historic villages of Wormleighton and Ladbroke are to the south of Southam; Ufton and the small hamlet of Bascote Heath are to the west; and Long Itchington is to the north. The southern part of the area is sparsely populated, with only a scattering of isolated farmsteads between the villages. Agriculture is the main land use, with rolling pasture land giving way increasingly to more intensive arable farming further north, interspersed with parkland, woodland and some mineral working areas. The farmed landscape retains many historic features, including medieval village sites at and near Wormleighton and traditional ridge and furrow field patterns.

2.1.6 The Oxford Canal weaves through the southern part of the area, following the contours, and the east-west route of the Grand Union Canal defines the northern limit of the Proposed Scheme within this area. The River Itchen flows northwards through the area to the west of Southam, and there is an extensive network of small streams and ponds and a number of springs, particularly in the southern part of the area, flowing towards the river.

2.1.7 The area has a gently undulating landscape of low hill tops and clay vales underlain by Jurassic mudstones, with interbedded limestones common in the north-west part of the area. These hills are often characterised by pockets of ancient woodland and/or steep grassy ridges. Tree cover within the area is relatively sparse, with the exception of the ancient woodland at Long Itchington and Ufton Woods Site of Special Scientific Interest (SSSI) and a scatter of game coverts in the Ladbroke and Wormleighton area.

Figure 2: Area context map



Key transport infrastructure

2.1.8 The main transport routes through the area are the A423 Banbury Road, connecting Banbury to the south with Coventry to the north, and the A425 Leamington Road, connecting Daventry to the east with Leamington Spa to the west. Both routes intersect at Southam, which is the focus for local transport movements. In the south, narrow winding rural lanes connect farmsteads and villages. A more extensive network of busier rural routes exists to the north, providing connections with villages in the neighbouring Offchurch and Cubbington area.

2.1.9 The Coventry to Leamington Spa Line runs north-south to the west of Wormleighton and Southam, although the nearest stations are outside of the area at Banbury in the south and at Leamington Spa in the north.

2.1.10 There are a number of circular walking routes around the town of Southam, the most notable of which is the Harry Green Way, which extends for 34km and connects eight villages around the town including Ladbroke, Ufton and Bascote Heath.

Socio-economic profile

2.1.11 To provide a socio-economic context for the area, data for the demographic character area (DCA) of Southam has been used[1]. The population of the DCA is 6,570 highlighting the low population density and rural nature of the area. The area's labour market outperforms England's as a whole; unemployment at 4% is significantly lower than the national level of 7%[2].

Notable community facilities

2.1.12 Southam is the main centre in the area for day-to-day services and facilities, with three primary schools, a secondary school, two doctors' surgeries, three dental surgeries, a library and a range of shops, banks and retail and financial services, together with a small number of public houses and restaurants, a leisure centre and a number of community centres/halls.

2.1.13 Away from Southam, the villages have limited community facilities. The villages of Wormleighton, Ladbroke and Ufton each have a community hall and a church, whilst the latter two also have a public house. None of these villages has a school or a doctor's surgery, and many residents are dependent upon travel to Southam and other villages further afield to access these services. Bascote Heath is predominantly residential in character, with its community hall and chapel closing some time ago, although it does have a public house.

Recreation, leisure and open space

2.1.14 Southam is the main focus for leisure and recreation facilities in the area. The Southam United Football Club, Southam Cricket Club and Southam Rugby Football Club are all located on the south side of the town. The facilities at these sites are well used and represent the primary location for playing sports within the area. The Dallas Burston Polo Club lies almost 2km west of Southam and is set in 242ha of grounds at the Stoneythorpe estate. The club hosts regular tournaments and fixtures, drawing

[1] A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).
[2] All data comes from the 2011 Census. Unemployment percentage based on unemployed divided by total population aged 16-74.

players and supporters from a wide area, and some events attract up to 3,000 spectators.

2.1.15 There are a number of parks and open spaces in Southam. Elsewhere in the Ladbroke and Southam area there is relatively little public open space, mostly limited to small amenity green spaces in villages and churchyards.

2.1.16 There is a PRoW that runs along the edge of the Ufton Wood (also forming part of the Harry Green Way) which features in a number of local walking guides for the area. The Ufton Fields Nature Reserve lies just south of Ufton village. The reserve, which extends to about 40ha in total, includes a number of waymarked footpaths, providing access to varied habitats for observing birds, insects and wild flowers.

Policy and planning context

Planning framework

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

2.1.18 Stratford-on-Avon District Council is the local planning authority for the area. The development plan comprises the saved policies of the Stratford-on-Avon District Local Plan Review (Local Plan)[3].

2.1.19 There are a number of key planning designations in the area, which include conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens and ancient woodland. These are shown on the maps in CT-10.

2.1.20 Emerging planning policy is contained in the Stratford-on-Avon District Local Development Framework Draft Core Strategy (Core Strategy)[4], which was published for consultation in February 2012. Emerging policies are not generally considered within this report, unless a document has been submitted to the Secretary of State for approval. The Council is currently preparing the pre-submission version of the Core Strategy, which would be subject to a final period of consultation before being submitted to the Secretary of State for examination.

Committed development

2.1.21 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown on Map series CT-13 and listed in Volume 5: Appendix CT-004-000. Except where noted otherwise in this Appendix, 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 effects of the Proposed Scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic.

[3] Stratford-on-Avon District Council (2006), *Local Plan Review 1996-2011.*
[4] Stratford-on-Avon District Council (2012), *Stratford-on-Avon District Local Development Framework Draft Core Strategy 2012.*

2.1.22 The following developments are relevant to several topics assessments in this area:

- ref: 10/02780/FUL – Southam Garden Centre, Welsh Road East, Southam, CV47 1NE. Proposed construction of nine live/work units and 21 industrial units for business, industrial and warehouse use, industrial estate road and combined footpath and cycleway;
- ref: S/10/CM004 – Ufton Landfill Site, Ufton, Leamington Spa, Warwickshire. Revision to restoration profile of central part of landfill site;
- ref: 12/02602/FUL – Victor Hodges House, 2 Park Lane and Southam Library, Southam. Demolition of Victor Hodges House, Southam Library, No 2 Park Lane and No 7 High Street and the erection of a 75 unit extra care facility with associated facilities/ restaurant, replacement library and community facilities, and community office with associated landscaping, parking and substation;
- ref: 11/02870/FUL – Dallas Burston Polo Grounds, Stoneythorpe Estate, Stoneythorpe, Southam, Warwickshire CV47 2DL. The erection of a 'marquee' style events building and the retention of three existing marquees approved under ref. 02/01272/FUL;
- ref: 10/01547/FUL – Unit 4, The Cobalt Centre, Kineton Road, Southam, Warwickshire CV47 0FD. A change of use from business, industrial and warehouse to a veterinary centre, including the installation of a new glazed entrance set behind the existing loading door; and
- ref: 11/00995/FUL – Unit 14 Southfield Road, Kineton Road Industrial Estate, Southam CV47 0FB. Erection of two-storey steel framed extension to existing industrial unit to provide warehouse at ground floor and offices at first floor.

2.1.23 Where a committed development lies wholly or partly within the land required for the Proposed Scheme, it is assumed that the development will not be commenced or completed in its proposed form. In the Ladbroke and Southam area, no such developments are located within the land required for the Proposed Scheme.

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

2.2 Description of the Proposed Scheme

2.2.1 The following section describes the main features of the Proposed Scheme in the Ladbroke and Southam area. 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 Volume 2: Map series CT-06. Land that will also be required, but only on a temporary basis for construction, is set out in Section 2.3.

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:

- green bridges provided for Footpath SM101 and Windmill Lane overbridges;
- relocation of the auto-transformer station and railway balancing pond to the south side of the railway near Chapel Bank Cottage;
- positioning of the balancing pond near Harp Farm to accommodate mitigation earthworks;
- amendment of the extent of ecological mitigation at Dallas Burston Polo Club to reduce possible conflict with planned development at this location; and
- amendment of the location of the A425 Leamington Road temporary realignment over the green tunnel construction to avoid impacts on heritage assets.

Overview

2.2.5 The Proposed Scheme in the Ladbroke and Southam area will be approximately 13km in length and will commence at the existing junction of Wormleighton Road and Stoneton Lane, to the east of Wormleighton. The route then proceeds north-westwards, passing under Footpath SM101 and over Footpath SM116a.

2.2.6 The route will cross over the Oxford Canal, Bridleway SM116, Wills Pastures Road, a minor watercourse and Bridleway SM96. Crossing another minor watercourse and Footpath SM96a just to the west of Chapel Bank Cottage and Fish Ponds, the route continues north-westwards to the west of Ladbroke Grove Farm, passing under bridges for Lower Radbourne and Ladbroke Grove Farms and over a culvert for a minor watercourse.

2.2.7 The route passes to the east of Ladbroke, in cutting through Windmill Hill and under a bridge for the realigned Windmill Lane. Then continuing in a north-west direction, the route is aligned to the south-west of Southam, crossing under the A423 Banbury Road, over another minor watercourse, then under the B4451 Kineton Road. North of the B4451 Kineton Road, the route crosses over the River Itchen on a viaduct.

2.2.8 The route enters a tunnel adjacent to the Dallas Burston Polo Grounds, under the A425 Leamington Road and Long Itchington and Ufton Woods, before emerging from the tunnel approximately 15m outside the boundary of Ufton Wood and leaving the Ladbroke and Southam area as it crosses a small watercourse to the south of the Grand Union Canal.

Wormleighton Road and Stoneton Lane junction to north of Footpath SM101

2.2.9 The approximate length of this section will be 1.3km. The Proposed Scheme will enter the area on a cutting north of the Wormleighton Road realignment. Key features of this section will include (Maps CT-06-079b – CT-06-080):

- a cutting 1.3km long with a depth of up to 16m. Slope stabilisation measures

may be required on the east side of the cutting. The cutting will extend back into the Greatworth to Lower Boddington area (CFA15) and will be a total of 2.4km long;

- maintenance loops will allow trains to clear the main tracks if necessary, and enable maintenance trains to be stabled temporarily without returning to the main depot. An additional two tracks will be provided, extending for a total of approximately 1.2km, with approximately 900m in the Greatworth to Lower Boddington area (CFA15) and approximately 300m within the Ladbroke and Southam area (CFA16);
- the northern end of a new permanent realignment of Banbury Road, mostly located in the Greatworth to Lower Boddington area (CFA15), reconnecting to the existing Wormleighton Road on the west side of the route in the Ladbroke and Southam area;
- diversion of Stoneton Lane on the east side of the route to connect with the realigned Banbury Road near the green overbridge in the Greatworth to Lower Boddington area (CFA15);
- an auto-transformer station (Boddington) on the west side of the route with access from Wormleighton Road (Map CT-06-079b, C7);
- provision of an ecological mitigation area to the east along Stoneton Lane (Map CT-06-079b, D4, E5);
- a green overbridge for Footpath SM101, including hedgerow planting to provide mitigation for bats (Map CT-06-080, H4); and
- local infilling of the ground north of Footpath SM101 to the west of the route to manage land drainage; and planting on both sides of the route.

North of Footpath SM101 to Lower Radbourne Farm

2.2.10 The route in this section will be approximately 3km long. The key features of this section of the route will include (Maps CT-06-080 to CT-06-082):

- an embankment for approximately 3km, reaching a height of approximately 9m and with landscape earthworks to reduce visual impact;
- underpasses for Footpath SM116a (Map CT-06-080, D4) and Wills Pastures Road (Map CT-06-081, E5 and 6);
- a viaduct crossing the Oxford Canal;
- viaducts over two watercourses approximately 90m and 50m long at Lower Radbourne;
- three balancing ponds constructed on the west side of the railway, adjacent to the Oxford Canal, the Lower Radbourne south viaduct and Lower Radbourne north viaduct, and a further pond on the east side of the route close to Chapel Bank Cottage (Map CT-06-081);
- realignment of Bridleway SM116 around a new railway balancing pond and

beneath the viaduct over the Oxford Canal to reconnect with the existing alignment east of the route (Map CT-06-081);

- realignment of Bridleway SM96 under the Lower Radbourne south viaduct (Map CT-06-081, C6);
- realignment of Footpath SM96a under the Lower Radbourne north viaduct (Map CT-06-081, A5);
- upgrading of Wills Pastures Road to the A423 Banbury Road to the west of the route to allow HS2 maintenance access (Map CT-06-081-L1 and L2);
- provision of an ecological mitigation area to the east of the route between Lower Radbourne south viaduct and Lower Radbourne north viaduct (Map CT-06-081);
- two additional replacement floodplain storage areas east of the route for the watercourses crossed by the Lower Radbourne viaducts to offset any impacts from the Proposed Scheme;
- an auto-transformer station (Radbourne) on the west side of the route (Map CT-06-082); and
- planting on both sides of the route.

Lower Radbourne Farm to south of Ladbroke Grove Farm

2.2.11 The route in this section will be approximately 1.1km long. The key features of this section of the route will include (Maps CT-06-082 and CT-06-83):

- a 1.1km long cutting to a depth of approximately 8.5m;
- an overbridge for the existing Lower Radbourne Farm access, and upgrading of the length of the access road to Welsh Road to the east of the route, to allow HS2 maintenance access (Map CT-06-082, G7);
- a new access track for Ladbroke Grove Farm, with an overbridge to mitigate severance by the Proposed Scheme (Map CT-06-82, D7);
- realignment of Radbourne Lane around field boundaries to the west of the route (Map CT-06-82); and
- planting on both sides of the route.

South of Ladbroke Grove Farm to the A423 Banbury Road

2.2.12 The route in this section will be approximately 2.9km long. Key features of this section of the route will include (Maps CT-06-082 to CT-06-084):

- a 600m long embankment, with a height of approximately 4m, and landscape earthworks on both sides of the route;
- a 2.3km long cutting with a depth of approximately 29m as it passes through Windmill Hill. Slope stabilisation measures may be required on the east side of the cutting. North of Windmill Hill, the depth reduces significantly to between 2.8m and 0.3m. From where the depth of the cutting reduces, landscape

earthworks with raised embankments will be provided on both sides of the route;

- realignment of Windmill Lane and Footpath SM90 to the east and west of the railway and a combined green overbridge (Map CT-06-83, E5);
- hedgerow planting along the Windmill Lane green overbridge to provide mitigation for bats;
- realignment of the A423 Banbury Road up to 100m west of its existing alignment as it crosses over the route. Access will be maintained from the A423 Banbury Road to Starbold Farm (Map CT-06-84);
- an overbridge for the A423 Banbury Road;
- Ladbroke culvert to provide a crossing for an unnamed stream (Map CT-06-83);
- two railway balancing ponds constructed to the west of the route in the vicinity of two highway balancing ponds along the A423 Banbury Road realignment;
- a pumping station (Map CT-06-084) on the west side of the route to the north of the A423 Banbury Road;
- diversions of Footpath SM33 to the east and west of the route (Map CT-06-084);
- demolition of three agricultural buildings at Harp Farm and nine commercial buildings at Greenleaf Nurseries, east of A423 Banbury Road (Map CT-06-084);
- demolition of three buildings (one residential and two commercial) west of A423 Banbury Road for the overbridge (Map CT-06-084);
- provision of a replacement accommodation access route off the A423 Banbury Road adjacent to the east side of the Proposed Scheme;
- provision of an ecological mitigation area between the route and the A423 Banbury Road to the west of the route (Map CT-06-083); and
- planting on both sides of the route.

A423 Banbury Road to the River Itchen

2.2.13 The route in this section will be approximately 1.8km long. Key features of this section of the route (Maps CT-06-084 to CT-06-085) will include:

- an embankment approximately 550m long with a height of up to 2m to 3m and landscape earthworks to reduce visual impact;
- a 1.1km cutting with a depth of approximately 10.5m and landscape mitigation earthworks with raised embankments;
- an embankment approximately 100m long with a height of up to 5m and landscape earthworks to reduce visual impact;
- an overbridge for the B4451 Kineton Road and realignment of the route just

south of the existing road (Map CT-06-85, H5). Accesses to properties will be maintained on the west side of the B4451 Kineton Road;

- a culvert at Southam to provide a crossing for a dry valley (Map CT-06-85);a balancing pond on the west side of the B4451 Kineton Road and a balancing pond on the east side of the route near the River Itchen (Map CT-06-85);
- an additional replacement floodplain storage area west of the route and south of the River Itchen to offset any impacts from the Proposed Scheme (Map CT-06-85); and
- planting on both sides of the route.

River Itchen to Grand Union Canal

2.2.14 The route in this section will be approximately 3.2km long. This section of the route (Maps CT-06-085 to CT-06-088a) will include the following key features:

- a 90m long viaduct over the River Itchen;
- an embankment approximately 90m long and up to 6m high adjoining the viaduct over the River Itchen;
- a 300m cutting with a depth of approximately 7m on the approach to the south portal of the Long Itchington Wood green tunnel (Map CT-06-86);
- realignment of Footpath SM24 below the viaduct over the River Itchen (Map CT-06-85);
- a balancing pond and auto-transformer station (Stoney Thorpe) on the east side of the route just north of the River Itchen (Map CT-06-85);
- Long Itchington Wood south porous portal, approximately 100m long, connecting the route with the Long Itchington Wood green tunnel;
- Long Itchington Wood green tunnel and Long Itchington Wood tunnel, with a combined length of approximately 1.8km, taking the route under the Long Itchington and Ufton Woods SSSI, consisting of a cut and cover tunnel construction for 330m at the southern end and a bored tunnel construction for approximately 1.5km;
- Long Itchington Wood north porous portal that connects the tunnel exit with a new cutting;
- a 350m long cutting with a depth at the north portal of approximately 11m;
- a 500m long embankment with a height of approximately 8m and with landscape earthworks to reduce visual impact;
- reinstatement of A425 Leamington Road back on its existing route once the construction of the green tunnel has been completed;
- provision of tunnel service buildings at both ends of the tunnel with emergency assembly areas;
- a new access track from the A425 Leamington Road to the east of the route at

the south portal to the tunnel;

- planting on the approaches to and at both portals and on the green tunnel section;
- provision of two ecological mitigation areas, to the west of the route in the vicinity of the south tunnel entrance and to the south of Long Itchington Wood (Map CT-06-86);
- a new access track from Welsh Road to the east of the route at the north portal to the tunnel;
- provision of a balancing pond with access from Welsh Road to the north via the tunnel portal access road (Map CT-06-87);
- replacement floodplain storage areas south of the River Itchen on the west side of the route (Map CT-06-86) and south of the Grand Union Canal on the east side of the route (Map CT-06-87) to offset any impacts from the Proposed Scheme; and
- local realignment of a minor watercourse around the south approach embankment to Longhole Viaduct in the Offchurch and Cubbington area (CFA17) (Map CT-06-88a, H7).

2.2.15 The route will leave the Ladbroke and Southam area to the north on embankment at the minor watercourse to the south of the Grand Union Canal.

2.3 Construction of the Proposed Scheme

2.3.1 This section sets out the strategy for construction of the Proposed Scheme in the Ladbroke and Southam area including:

- overview of the construction process;
- description of the advance works;
- description of the engineering works to build the railway;
- construction waste and material resources;
- commissioning the railway; and
- indicative construction programme (see Figure 5).

2.3.2 The assessment presented in this ES is based on the construction arrangements as described in this section.

2.3.3 In addition to the land that will be required permanently by the Proposed Scheme (see Section 2.2), land will be required on a temporary basis for construction. Key temporary construction features are illustrated in the Volume 2: CFA16 Map Book, Maps CT-05-078b to CT-05-088a. 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; preliminary enabling works;
- civil engineering works, including: establishment of construction compounds; site preparation and enabling works; main earthworks and structure works; and site restoration;
- railway installation works, including: establishment of construction compounds; infrastructure installation; connections to utilities; and changes to the existing rail network; and
- rail system testing and commissioning.

2.3.6 General provisions relating to the construction process are set out in more detail in Volume 1: Section 5 and Section 4 of 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;
- working hours;
- the management of construction traffic; and
- the handling of construction materials.

Advance works

2.3.7 General information about advance works can be found in Volume 1, Section 6.5. Advance works will be required before commencing construction works and will typically include:

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

Engineering works

2.3.8 Construction of the Proposed Scheme will require engineering works along the entire length of the route. This will comprise two broad types of engineering work:

- civil engineering works, such as earthworks and erection of bridges and viaducts; and
- railway installation works, such as laying ballast or slabs and tracks, and installing power supply and communications features.

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

2.3.10 In the Ladbroke and Southam area there will be two main compounds and 14 civil engineering satellite compounds. There will be three material transfer stockpile areas and one roadhead, with the roadhead sharing the same area as one of the material transfer stockpile areas. Within the Ladbroke and Southam area there will also be one rail systems main compound and three railway installation satellite compounds for rail systems and auto-transformer installation works. The rail systems main compound will use a previously established materials transfer area and two of the rail satellite compounds will use compounds previously established for the civil engineering works.

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. 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; and
- office space for management staff, limited car parking for staff and site operatives, and welfare facilities.

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:

- railheads will connect with the existing railway network for the delivery of materials for the construction of the rail systems;
- construction sidings will connect with the existing railway network to enable loading and unloading to and from trains delivering material to the HS2 site or removing excavated material;
- roadheads will require an area of land 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, 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, and the likely road routes to access compounds are described in subsequent sections below.

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

Figure 3: Schematic of construction compounds for civil engineering works

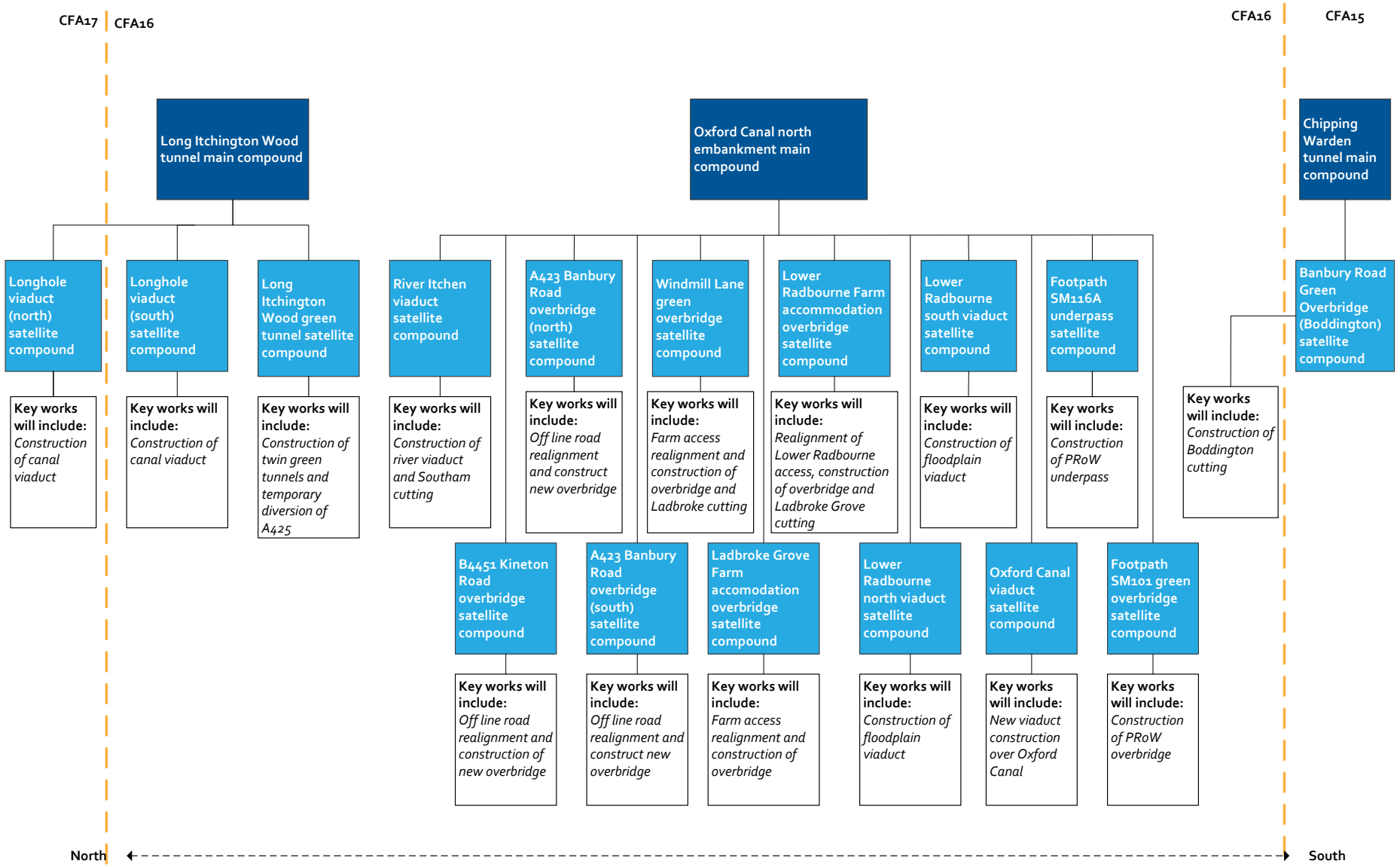
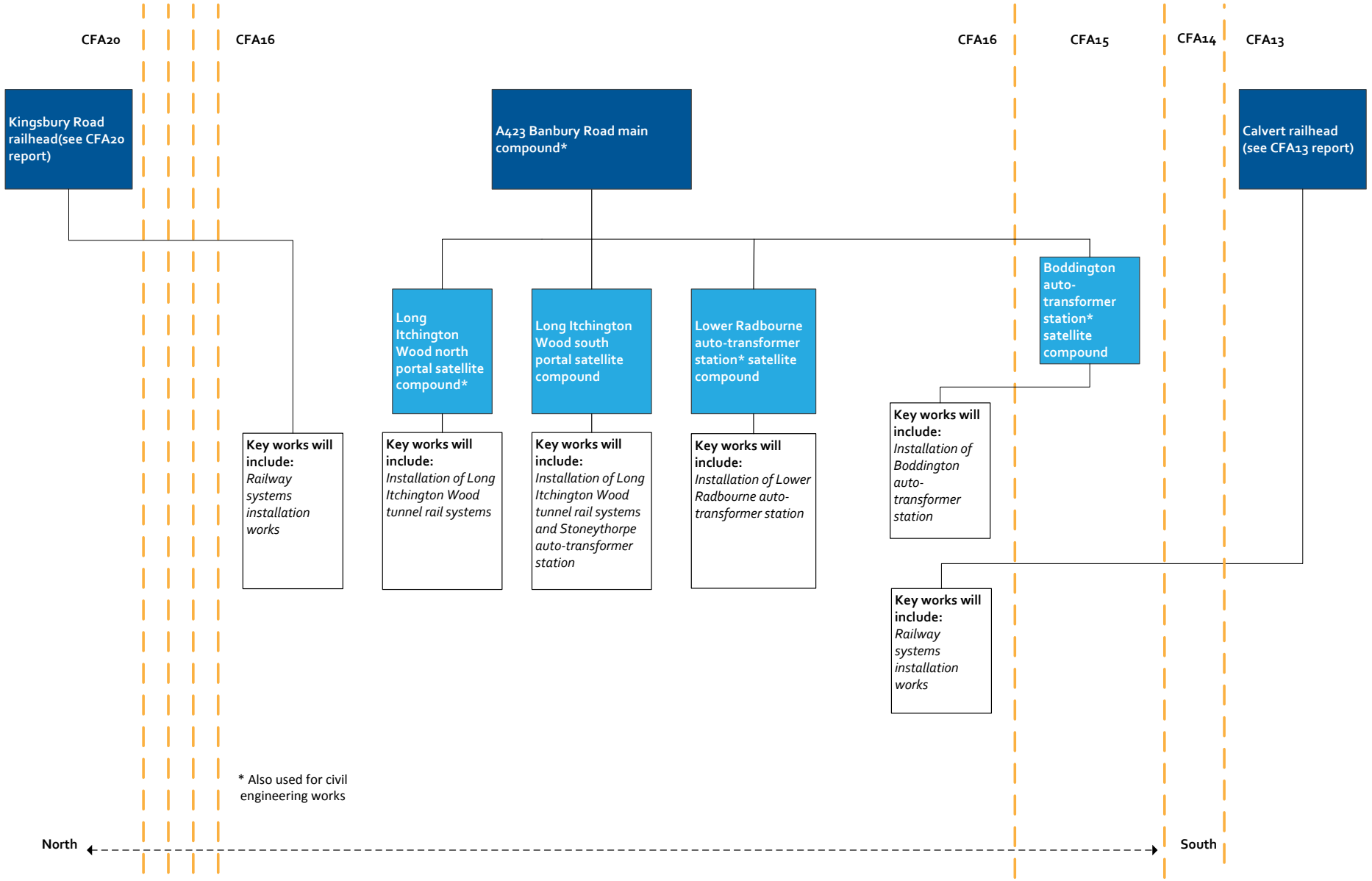


Figure 4: Schematic of construction compounds for railway installation works



Oxford Canal north embankment main compound (Map CT-05-081)

2.3.19 This compound will comprise the main area administration and support for the majority of CFA16.

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;
- building demolition;
- cuttings, embankments and landscaping earthworks;
- viaduct and bridge construction;
- retaining wall construction;
- drainage and culverts;
- highway and PRoW reinstatement; and
- topsoiling and landscape planting.

2.3.21 Oxford Canal north embankment main compound will be operational for approximately five years, and will be subject to the contractor's standard working hours. The compound will be accessed directly off a new access track constructed adjacent to the Wills Pastures Road from the A423 Banbury Road to the M40 junction 11 via the A422. Approximately 90 workers on average and 170 workers at peak times will be based at the Oxford Canal north embankment main compound.

2.3.22 The Oxford Canal north embankment main compound will provide main compound support to 12 satellite compounds, as illustrated in Figure 3.

2.3.23 In addition, it will support the following specific works:

- Wills Pastures Road underpass;
- Oxford Canal south embankment;
- Oxford Canal north embankment;
- Upper Radbourne embankment;
- Lower Radbourne embankment;
- Ladbroke Grove embankment;
- Ladbroke culvert;
- Southam culvert;
- Southam embankment;
- Mill Pond embankment;
- Leamington Road embankment; and
- Leamington Road cutting.

2.3.24 Volume 1, Section 5 describes typical embankments and cuttings (Section 5.2) and viaducts (Section 5.9), and Volume 1, Section 6 describes associated construction techniques.

Long Itchington Wood tunnel main compound (Map CT-05-087)

2.3.25 This compound will comprise the main area administration and support for the Long Itchington Wood green tunnel and the Long Itchington Wood tunnel.

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

- site clearance and enabling works;
- cuttings, embankments and landscaping earthworks;
- retaining wall construction;
- tunnel construction;
- highway and PRoW reinstatement; and
- topsoiling and landscape planting.

2.3.27 Long Itchington Wood tunnel main compound will be operational for approximately four years and will be subject to the contractor's standard working hours. The compound will be accessed from Welsh Road off the Fosse Way and the A425. A secondary temporary access route leaving the A425 Leamington Road at Ridgeway Lane will be constructed for the transportation of exceptional loads. Tunnel boring will be conducted from north to south, with one bore to follow the other.

2.3.28 This compound will provide main compound support to three satellite compounds, two of which are located within CFA16, as illustrated in Figure 3. In addition it will support the following specific works:

- Ufton Wood cutting; and
- Welsh Road embankment.

2.3.29 Reference should be made to Volume 1 for descriptions of typical embankments (Section 5.2), typical tunnel portals (Section 5.6), and viaducts (Section 5.9) and for associated construction techniques (Section 6).

Demolitions

2.3.30 The buildings that will need to be demolished in the Ladbroke and Southam area are listed in Table 1.

Table 1: Demolition works

Description of buildings	Location
Agricultural buildings at Harp Farm (total buildings – three)	East of A423 Banbury Road (map CT-05-084, E6 and E7)
Green Leaf Nursery (total buildings, including polytunnels – approximately nine)	East of A423 Banbury Road (map CT-05-084, E6 and E7)
RVS Car Sales and Café Jam, together with one dwelling (total buildings – three)	West of A423 Banbury Road (map CT-05-085, D6 and D7)

Highways and road realignments

2.3.31 Sections of the following highways and roads will be diverted or realigned in the Ladbroke and Southam area:

- permanent realignment of Wormleighton Road to the new Banbury Road green overbridge (in the Greatworth to Lower Boddington area, CFA15);
- permanent diversion of Stoneton Lane to Banbury Road green overbridge;
- permanent realignment of Wills Pastures Road and new underpass;
- permanent realignment of Lower Radbourne Farm access and new overbridge;
- permanent realignment of Radbourne Lane and diversion to Lower Radbourne Farm overbridge;
- permanent diversion of Ladbroke Grove Farm access and new overbridge;
- permanent diversion of Ladbroke Hill Farm access track;
- permanent realignment of Windmill Lane and new overbridge;
- permanent realignment of the accommodation access to the A423 Banbury Road overbridge;
- permanent realignment of the A423 Banbury Road and new overbridge;
- permanent diversion of Starbold Farm access track;
- permanent realignment of the B4451 Kineton Road and new overbridge;
- permanent realignment of access tracks to the B4451 Kineton Road; and
- temporary realignment of the A425 Leamington Road for 27 months, then permanent reinstatement over the Long Itchington Wood green tunnel.

2.3.32 In addition, temporary works associated with utility works will occur along the B4452 Bascote Heath Road.

PRoW realignments

2.3.33 The following PRoW will be diverted or realigned in the Ladbroke and Southam area:

- temporary realignment of Footpath SM101 for approximately 16 months, adding an additional 90m, then permanent reinstatement along its existing alignment and across the new Footpath SM101 green overbridge;
- maintenance of Footpath SM200 (Oxford Canal towpath) during viaduct construction (may require minor adjustments to route);
- permanent realignment of Footpath SM116a and new underpass;
- permanent realignment of Bridleway SM116 to beneath the Oxford Canal viaduct;
- permanent realignment of Footpath SM96a to beneath the Lower Radbourne north viaduct;

- permanent realignment of Bridleway SM96 to beneath the Lower Radbourne south viaduct;
- permanent diversion of Footpath SM90 to Windmill Lane green overbridge;
- permanent diversion of Footpath SM33 to the A423 Banbury Road overbridge;
- permanent stopping up of Footpath SM89 on the west side of the route to accommodate the realignment of the A423 Banbury Road; and
- permanent realignment of Footpath SM24 to beneath the River Itchen viaduct (PRoW maintained during viaduct construction).

Utilities

2.3.34 Numerous utilities will need to be diverted for the works, the principal diversions in the Ladbroke and Southam area being:

- medium and high pressure gas mains including:
  - B4451 Kineton Road overbridge (180mm medium pressure main); and
  - near Wood Farm Cottage, Ufton Wood (250mm medium pressure main);
- water mains including:
  - Windmill Lane overbridge (300mm water mains diverted across the route of the Proposed Scheme);
  - Windmill Lane (twin 300mm diameter water mains diversion along realigned Windmill Lane); and
  - two locations along the A425 between Ufton and Southam and in the Long Itchington Wood tunnel main compound (300mm water main).

Watercourse diversions

2.3.35 There will be three watercourse diversions in the Ladbroke and Southam area:

- unnamed watercourse (ordinary) (Volume 2, CFA16 Map Book, Map CT-05-083) – to be realigned to suit crossing the route and earthworks near Windmill Lane;
- unnamed watercourse (ordinary) (Volume 2, CFA16 Map Book, Map CT-05-084) – to be realigned to suit crossing the route and earthworks near Starbold Farm; and
- unnamed watercourse (ordinary) (Volume 2, CFA16 Map Book, Map CT-05-087) – to be realigned around the south abutment of Longhole viaduct.

Finalisation works

2.3.36 Finalisation works will include landscaping and planting.

Satellite construction compounds

2.3.37 A total of 14 satellite compounds will be required to construct the works in the Ladbroke and Southam area.

2.3.38 Table 2 details the principal construction activity, start date and approximate duration, number of workers and highway access route for each satellite compound.

2.3.39 The Boddington cutting works, spanning CFA15 and CFA16, will be undertaken from the Banbury Road green overbridge (Boddington satellite compound located in CFA15. Further information on this compound is available in the assessment report for the Greatworth to Lower Boddington area (CFA15).

2.3.40 Construction works for the Longhole viaduct will be undertaken from both the Longhole viaduct (south) satellite compound in CFA16 and Longhole viaduct (north) satellite compound in CFA17. Further information on the Longhole viaduct (north) satellite compound is available in the assessment report for the Offchurch and Cubbington area (CFA17).

Table 2: Satellite construction compounds

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
Wormleighton Road and Stoneton Lane junction to north of Footpath SM101					
Footpath SM101 green overbridge satellite compound (Map CT-05-080, H4)	Construction of PRoW overbridge.	2018	16 months	20 / 30	Via haul route from Oxford Canal north embankment main compound
North of Footpath SM101 to Lower Radbourne Farm					
Footpath SM116A underpass satellite compound (Map CT-05-080, D4)	Construction of PRoW underpass.	2019	9 months	20 / 30	Via haul route from Oxford Canal north embankment main compound
Oxford Canal viaduct satellite compound (Map CT-05-081, I6, I7)	New construction over Oxford Canal.	2019	15 months	20 / 30	Via haul route from Oxford Canal north embankment main compound
Lower Radbourne south viaduct satellite compound (Map CT-05-081, D6)	Construction of floodplain viaduct.	2018	23 months	20 / 30	Via haul route from Oxford Canal north embankment main compound
Lower Radbourne north viaduct satellite compound (Map CT-05-082, I7)	Construction of floodplain viaduct.	2017	11 months	20 / 30	Via haul route from Oxford Canal north embankment main compound
Lower Radbourne Farm to south of Ladbroke Grove Farm					
Lower Radbourne Farm accommodation overbridge satellite compound (Map CT-05-082, G6)	Construction of Lower Radbourne Farm/Ladbroke Grove Farm accommodation overbridges and Ladbroke Grove cutting.	2018	32 months	29 / 40	Via haul route from Oxford Canal north embankment main compound
Ladbroke Grove Farm accommodation overbridge satellite compound (Map CT-05-082, D8)	Farm access realignment and construction of new overbridge.	2018	10 months	20 / 30	Via haul route from Oxford Canal north embankment main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
South of Ladbroke Grove Farm to the A423 Banbury Road					
Windmill Lane green overbridge satellite compound (Map CT-05-083, D6)	Construction of overbridge and Ladbroke cutting.	2018	46 months	28 / 40	A423 Banbury Road / Windmill Lane
A423 Banbury Road overbridge south satellite compound (Map CT-05-084, E6)	Offline road realignment and construction of new overbridge.	2018	11 months	20 / 30	A423 Banbury Road
A423 Banbury Road overbridge north satellite compound (Map CT-05-084, E6)	Offline road realignment and construction of new overbridge.	2018	11 months	37 / 40	A423 Banbury Road
A423 Banbury Road to the River Itchen					
B4451 Kineton Road overbridge satellite compound (Map CT-05-085, G5)	Offline road realignment and construction of new overbridge.	2018	12 months	37 / 40	A425 Leamington Road / B4451 Kineton Road
River Itchen viaduct satellite compound (Map CT-05-085, C5)	Construction of river viaduct and Southam cutting.	2019	36 months	46 / 56	A425 Leamington Road
River Itchen to Grand Union Canal					
Long Itchington Wood green tunnel satellite compound (Map CT-05-086, H5)	Construction of green tunnel and temporary diversion of the A425 Leamington Road.	2018	27 months	69 / 84	A425 Leamington Road
Longhole viaduct satellite compound (south) (map CT-05-087, B7)	Construction of canal viaduct.	2018	12 months	55/80	Welsh Road / Fosse Way

Material transfer stockpile areas and roadheads

2.3.41 Material transfer stockpile areas are designated for the temporary stock piling and / or treatment of excavated materials. Roadheads are areas for the storage and loading and unloading of bulk earthworks material which is moved to and from the site on public highways.

2.3.42 There are three material transfer stockpile areas and one roadhead within the Ladbroke and Southam area:

- Material transfer stockpile area– west of the proposed route and south of the A423 Banbury Road (Volume 2: CFA16 Map Book, Map CT-05-084);
- Material transfer stockpile area– west of the proposed route and south of the A425 Leamington Road (Volume 2: CFA16 Map Book, Map CT-05-085); this site will also be used as a roadhead; and
- Material transfer stockpile area– east of the proposed route and to the south of the Grand Union Canal (Volume 2: CFA16 Map Book, Map CT-05-088a).

2.3.43 Material transfer stockpile areas are designated for the temporary stock piling and / or treatment of excavated materials. These areas will also be used to receive bulk materials (aggregates, ballast, drainage, etc) for dispersal throughout the area.

Worker accommodation sites

2.3.44 Two worker accommodation sites will be located within the Ladbroke and Southam area as detailed in Table 3. Worker accommodation sites will adhere to the requirements of the draft CoCP.

Table 3: Location of worker accommodation sites

Location	Site description	Facilities provided	Estimated duration of use	Estimated number of workers
Oxford Canal north embankment main compound	Oxford Canal north embankment workers accommodation	Living accommodation, welfare facilities, car parking	5 years	33
Long Itchington Wood tunnel main compound	Long Itchington Wood green tunnel workers accommodation	Living accommodation, welfare facilities, car parking	4 years	30

Long Itchington Wood green tunnel

2.3.45 The proposed green tunnel will be located approximately 1km west of Southam and 3km north of Ladbroke. It will be positioned 300m north from where the route crosses the River Itchen. The tunnel will pass underneath the A425 Leamington Road. Standard construction methods are presented in Volume 1, Section 6.

Long Itchington Wood tunnel

2.3.46 The Long Itchington Wood bored tunnel will be located approximately 2km west of Southam, 1km north-east of Ufton and 3.5km south-west of Long Itchington. It will pass beneath Long Itchington Wood and Ufton Wood and it will connect with the north end of the Long Itchington Wood green tunnel. Standard construction methods are presented in Volume 1, Section 6.

Calvert railhead

2.3.47 The Calvert railhead is not located within CFA16, but is situated in the Calvert, Steeple Claydon, Twyford and Chetwode area (CFA13). It will provide support to all rail installation works and rail construction compounds in CFA16 up to the Long Itchington Wood tunnel, as illustrated in Figure 4. This will provide directly for the construction of the Proposed Scheme from Wormleighton to the southern portal of Long Itchington Wood green tunnel.

2.3.48 The track will be laid in a northerly direction away from the Calvert railhead. Before the railway systems installation can commence adequate civil engineering work will need to be completed to allow a continuous track laying sequence.

2.3.49 The railway systems installation works will facilitate the following activities:

- permanent way (ballast and track) installation;
- overhead line equipment installation;

- train control;
- signalling;
- telecommunication installation; and
- traction power supply.

2.3.50 Volume 1, Section 5.18 describes typical power supply features, including auto-transformer stations, and Section 6.24 describes associated construction techniques.

2.3.51 Further information on the Calvert railhead main compound is available in the assessment report for the Calvert, Steeple Claydon, Twyford and Chetwode area (CFA13).

Kingsbury Road railhead

2.3.52 The Kingsbury Road railhead is not located within this area, but is situated in the Curdworth to Middleton area (CFA20). This will provide support for the rail systems installation and to all rail installation works from the Long Itchington tunnel to the Handsacre tie in, and Birmingham Curzon Street.

2.3.53 The railway systems installation works will include similar works to those for the Calvert railhead. The track will be laid in a southerly direction away from the Kingsbury Road railhead main compound. Before the railway systems installation can commence, adequate civil engineering work will need to be completed to allow a continuous track laying sequence.

2.3.54 Further information on the Kingsbury Road railhead is available in the assessment report for Curdworth to Middleton area (CFA20).

Rail systems satellite compounds

2.3.55 One main compound and three satellite compounds will be required for the rail systems installation works within the Ladbroke and Southam area.

2.3.56 Table 4 details the principal activity, start date and approximate duration, number of workers and highway access route for each associated compound.

Table 4: Satellite rail systems compounds

Location	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
A423 Banbury Road to the River Itchen					
A423 Banbury Road main compound	Facilitate the main management and administration of auto-transformer station installations and tunnel portal sites.	2022	33 months	30/30	A423 Banbury Road
Wormleighton Road and Stoneton Lane junction to north of Footpath SM101					
Boddington auto-transformer station satellite compound (located in CFA15)	Facilitate the Boddington auto-transformer installation	2023	13 months	26/38	Wormleighton Road

Location	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
Lower Radbourne Farm to south of Ladbroke Grove Farm					
Lower Radbourne auto-transformer station satellite compound	Facilitate the Lower Radbourne auto-transformer station installation	2023	13 months	26/38	Lower Radbourne access road
River Itchen to Grand Union Canal					
Long Itchington Wood south portal satellite compound	Facilitate the installation of the Long Itchington Wood tunnel and Stoney Thorpe auto-transformer station	2022	17 months	23/38	A425 Leamington Road
Long Itchington Wood north portal satellite compound	Facilitate the installation of the Long Itchington Wood tunnel	2022	8 months	7/10	A425 Leamington Road

Construction waste and material resources

2.3.57 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and worker accommodation site waste that will be produced during the construction of the Proposed Scheme in the Ladbroke and Southam area have been prepared and are presented in Volume 5: Appendix WM-001-000.

2.3.58 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.

2.3.59 Based on the mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Ladbroke and Southam area will be managed with the aim of contributing to overall balance of excavated material on a route-wide basis. The overall balance of excavated material is presented in Volume 3, Section 14.

2.3.60 The quantity of surplus excavated material originating from the Ladbroke and Southam area that will require off-site disposal to landfill as excavation waste is shown in Table 5. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for reuse within the Proposed Scheme.

2.3.61 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%.

2.3.62 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 5.

Table 5: Estimated quantity of waste going to off-site disposal

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for off-site disposal to landfill (tonnes)
Excavation	9,037,559	0
Demolition	16,892	1,689
Construction	40,521	4,052
Worker accommodation	106	53
TOTAL	**9,095,078**	**5,794**

2.3.63 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

2.3.64 Commissioning is the process of testing the infrastructure to ensure that it operates as expected, and will be carried out in the period prior to opening. Further details are provided in Volume 1, Section 6.26.

Construction programme

2.3.65 A construction programme that illustrates indicative periods for the construction activities in this area is provided in Figure 5.

Figure 5: Indicative construction programme

Construction activity	2017 quarters				2018 quarters				2019 quarters				2020 quarters				2021 quarters				2022 quarters				2023 quarters				2024 quarters				2025 quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Advance works																																				
Civil engineering works																																				
Chipping Warden tunnel main compound (CFA15)																																				
Boddington cutting																																				
Oxford Canal north embankment main compound																																				
Oxford Canal culvert																																				
Wills Pastures Road underpass																																				
Oxford Canal embankment																																				
Upper Radbourne embankment																																				
Lower Radbourne embankment																																				
Ladbroke Grove embankment																																				
Ladbroke culvert																																				
Southam embankment																																				
Southam culvert																																				
Mill Pond embankment																																				
Leamington Road embankment																																				
Leamington Road cutting																																				
Footpath SM101 overbridge satellite compound																																				
Footpath SM101 green overbridge																																				
Footpath SM116A underpass satellite compound																																				
Footpath SM116A underpass																																				
Oxford Canal viaduct satellite compound																																				
Oxford Canal viaduct																																				
Lower Radbourne south viaduct satellite compound																																				
Lower Radbourne south viaduct																																				
Lower Radbourne north viaduct satellite compound																																				
Lower Radbourne north viaduct																																				
Lower Radbourne Farm accommodation overbridge satellite compound																																				
Lower Radbourne Farm accommodation overbridge																																				

Construction activity	2017 quarters				2018 quarters				2019 quarters				2020 quarters				2021 quarters				2022 quarters				2023 quarters				2024 quarters				2025 quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Ladbroke Grove Farm accommodation overbridge satellite compound																																				
Ladbroke Grove Farm accommodation overbridge																																				
Ladbroke Grove cutting																																				
Windmill Lane green overbridge satellite compound																																				
Windmill Lane green overbridge																																				
Ladbroke cutting																																				
A423 Banbury Road overbridge south and north satellite compounds																																				
A423 Banbury Road overbridge																																				
B4451 Kineton Road overbridge satellite compound																																				
B4451 Kineton Road overbridge																																				
River Itchen viaduct satellite compound																																				
River Itchen viaduct																																				
Southam cutting																																				
Long Itchington Wood tunnel main compound																																				
Long Itchington Wood tunnel																																				
Ufton Wood cutting																																				
Welsh Road embankment																																				
Long Itchington Wood green tunnel satellite compound																																				
Long Itchington Wood green tunnel																																				
Longhole viaduct (south) satellite compound																																				
Longhole viaduct (south)																																				
Rail infrastructure and systems works																																				
Calvert railhead (see CFA13)																																				
Kingsbury Road railhead (see CFA20)																																				
A423 Banbury Road main compound																																				
Boddington auto-transformer station installation																																				
Radbourne auto-transformer station installation																																				
Long Itchington Wood south portal installation																																				
Long Itchington Wood north portal installation																																				
Commissioning																																				

Key: Construction works Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

2.4.1 Volume 1, Section 4.4 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 Ladbroke and Southam area in the morning and evening peak hours, and fewer during other times. The first 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 that with Phase Two in place the frequency could rise to 18 trains per hour each way during peak hours.

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.

Maintenance

2.4.5 There will be routine preventative maintenance, including grinding and milling of the rails to keep them in good condition, and more periodic heavy maintenance as necessary. Volume 1, Section 4.4 describes the maintenance regime for HS2.

2.4.6 The intention is that maintenance staff will access the railway to carry out inspections and maintenance on a regular basis. This will be at night when the railway is not operating. The Wormleighton maintenance loops to the south of Ladbroke at Wormleighton will be used to park maintenance rail vehicles securely during the day and allow maintenance work in the area at night. They could also be used in the case that a passenger train could not continue unassisted to its destination.

Operational waste and material resources

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

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

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

2.4.10 Track maintenance waste and ancillary infrastructure waste (for example waste from depots, signalling locations, operations and maintenance sites) has been estimated using an average waste generation rate per kilometre length of total track. For this

reason, both track maintenance waste and ancillary infrastructure waste has been reported for each area along the route.

2.4.11 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%.

2.4.12 On this basis, approximately 233 tonnes of operational waste will be reused, recycled and recovered during each year of operation of the Proposed Scheme in the Ladbroke and Southam area. Approximately 48 tonnes will require disposal to landfill (see Table 6).

Table 6: Operational waste forecast for the Proposed Scheme in the Ladbroke and Southam area

Waste source	Estimated quantity of waste per annum (tonnes)	Estimated waste for disposal to landfill per annum (tonnes)
Railway station and train	0	0
Rolling stock maintenance	0	0
Track maintenance	259	39
Ancillary infrastructure	22	9
TOTAL	**281**	**48**

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

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

- 26 March 2012 at Ladbroke Village Hall;
- 20 June 2012 at the Graham Adams Centre;
- 12 September 2012 at Ladbroke Village Hall;
- 7 November 2012 at Ladbroke Village Hall;
- 20 February 2013 at Ladbroke Village Hall; and
- 11 September 2013 at Ladbroke Village Hall.

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

2.5.4 The main themes to emerge from these meetings were:

- impacts associated with the movement of excavated material (see Sections 2.3 and 2.4 and Volume 3 for further information);
- impacts of tunnelling, especially with respect to Long Itchington and Ufton Woods (see Sections 7, 9 and 13 for further information);
- sufficiency of existing power supply (see Volume 1 for further information);
- the realignment ofA423 Banbury Road to the south of Southam (see Section 2.6 for further information);
- the development of future mitigation measures based on new technology (see Sections 3-13 for further information by topic);
- construction impacts including dirty roads, the location and long-term restoration of workers' accommodation, financial impacts on crops and availability of the draft CoCP (see Sections 3-13 for further information by topic);
- landscaping for visual screening (see Section 9 for further information);
- availability of the land required for the Proposed Scheme, including construction compounds and maintenance loops and the environmental impacts associated with the land required for the Proposed Scheme (see Sections 3-13 for further information by topic);
- maintenance loop design (see Volume 1 and Section 2.6 for further information);
- the impact of the Proposed Scheme on wildlife sites (see Section 7 for further information);
- water extraction rights (see Section 12 for further information);
- sound and vibration effects of the Proposed Scheme (see Section 11 for further information);
- effects of lighting (see Section 9 for further information);
- use of local roadways during construction; a request for additional cycle/footpaths; short- and long-term impacts due to road realignments (see Section 2.2 for further information);
- listed buildings and the protection of the church in Ladbroke (see Section 6 for further information); and
- design and mitigation options submitted by Community Forum members of Priors Hardwick and Wormleighton, Ladbroke, Southam, and Bascote Heath

and Long Itchington (see Section 2.2 and Section 2.6 for further information).

2.5.5 In addition to the engagement through the community forums, the draft ES and Design Refinement Consultation was launched on 16 May for a period of eight weeks and closed on the 11 July 2013. As part of these consultations, members of local communities and other interested parties were notified, provided with information and invited to engage on issues pertinent to the draft ES 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 Ladbroke and Southam area, consultations on the draft Environmental Statement and on the Design Refinement were held on Saturday 8 June 2013 at The Graham Adams Centre, Southam.

2.5.6 HS2 Ltd staff attended the events including engineers and environmental specialists, to whom members of the public were able to speak.

2.5.7 Responses from the draft ES consultation have been analysed and an overview of those received and how the Environmental Statement has taken account of responses is contained in the Draft Environmental Statement Consultation Summary Report (Volume 5, Appendix CT-001-000/3).

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 in this area are described in this section.

2.6.2 Since April 2012, as part of the design development process, a series of local alternatives has 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.

Wormleighton maintenance loops

2.6.3 A maintenance loop is required near the Warwickshire/Northamptonshire boundary to meet the requirements of the Maintenance Strategy. Ancillary rail infrastructure such as maintenance loops were not included in the January 2012 announced route. The January 2012 announced route is noted as Option A and is the baseline for assessing the options against. The following two options were considered for the inclusion of Wormleighton maintenance loops:

- Option B: locating the loops between the Oxford Canal and just north of Lower Radbourne Farm, plus changing the vertical alignment to achieve a suitable gradient of 0.2% and; and
- Option C: locating the loops between approximately Old House Farm and the Oxford Canal, plus lowering the vertical alignment to achieve a suitable gradient of 0.2%.

2.6.4 Option B would be located mainly on embankment and viaduct, with heights increased by up to 14m compared to the January 2012 announced route, and the track and viaduct width increased by about 15m. This would significantly increase landscape and visual impact and would be more difficult to accommodate within the earthworks design. A long access road would be required to connect to the highway network.

2.6.5 Option C would have most of the loops located in the cutting, although this would be significantly wider and deeper than for Option A and would adversely affect Fox Covert woodland. For Option C highways are close by and can provide easy access.

2.6.6 Therefore, Option C was taken forward within the Proposed Scheme for the Wormleighton maintenance loops due to its compliance with operational requirements and its lesser environmental impact than other options.

Line raise at Wormleighton maintenance loops

2.6.7 The January 2012 announced route, along with the adopted route changes as identified above in the areas of Wormleighton and Windmill Hill, comprises Option A and was the baseline for assessing other options against. One further option (Option B) was considered for Wormleighton maintenance loops. In this option the track design requirement for maximum grade at sidings was relaxed from 0.20% to 0.25%. The introduction of a vertical curve within the length of the loops allowed the route to be raised by approximately 6m within the Boddington cutting where the loops are located.

2.6.8 Under Option B, Boddington cutting would become a less significant engineering exercise than Option A. There would be an increase in the environmental impact of the embankment sections to either side of Boddington cutting, but this would be largely mitigated by the inclusion of false cuttings. Therefore, Option B was taken forward for further development within the Proposed Scheme for the Wormleighton maintenance loops.

Windmill Hill cutting

2.6.9 The January 2012 announced route included a crossing of a minor watercourse just south of Windmill Hill, known locally as the Lod, which did not meet the flood risk requirements at this location. The design was developed and adopted to mitigate this flood risk, the solution being a 2.3m raise in the alignment to clear the watercourse just north of Ladbroke Fox Covert (Volume 5, Map CT-01-42, H4), with minor amendments to the local farm access bridge and the earthworks design.

Line alignment at Long Itchington Wood

2.6.10 A route alignment change has been adopted in the Proposed Scheme that has resulted in an increase in height of the alignment in this area between the River Avon crossing and the northern boundary of Ladbroke and Southam area at the Grand Union Canal. Details relating to this change can be found within the Offchurch and Cubbington (CFA17) report.

Other proposals considered further

2.6.11 A number of further engineering developments to the Proposed Scheme within the Ladbroke and Southam area have been investigated and amended incorporated into the Proposed Scheme since publication of the draft ES:

- provision of green bridges for Footpath SM101 and Windmill Lane overbridges;
- relocation of the auto-transformer station and railway balancing pond to the south side of the railway near Chapel Bank Cottage;
- positioning of the balancing pond near Harp Farm to accommodate mitigation earthworks;
- the extent of ecological mitigation at Dallas Burston Polo Club has been amended to reduce possible conflict with planned development at this location; and
- the location of the A425 Leamington Road temporary diversion over the green tunnel construction has been amended to avoid impacts on heritage assets.

2.6.12 The following design refinements have also been investigated since publication of the draft ES, but did not provide sufficient benefits to offset their associated impacts and so were not taken forward:

- further consideration of the B423 Banbury Road and A425 Leamington Road crossings;
- review of arrangements at Windmill Hill cutting;
- review of the level through the Boddington cutting; and
- review of the Long Itchington Wood tunnel, with possible conversion of Long Itchington Wood tunnel into bored tunnel and a shorter green tunnel.

2.6.13 Three proposed changes to the Proposed Scheme, resulting from stakeholder engagement, were also considered:

- a 1.1km-long cut-and-cover tunnel beneath the Upper and Lower Radbourne watercourses together with open cutting 10-15m deep with the Oxford Canal on an aqueduct above;
- a variation of the above proposal with the alignment passing below the Oxford Canal then rising out of the cutting to pass on low viaducts over the two Radbourne watercourses; and
- lowering of the alignment by up to 10m between Ladbroke and Southam such that the A423 Banbury Road diversion can be lowered. This would require a cutting depth in excess of 30m at Windmill Hill, probably requiring a 600m green tunnel through the hill.

2.6.14 These three proposed options generally increase impacts and costs of construction (longer/deeper cuttings and green tunnels) which are offset by general operational benefits in visual, noise, PRoW and community effects. However, the costs of realising these net environmental benefits are considerable and therefore did not warrant their inclusion in the scheme.

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 for food and biomass production, are identified in this section but the resulting function or service provided is assessed in other sections, notably cultural heritage, ecology and landscape and visual assessments (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 the Ladbroke and Southam area, are contained in Volume 5: Appendix AG-001-016.

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 The study area for the agriculture, forestry and soils assessment covers all of the land that will be required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land, forestry land and soils; together with farm and rural holdings. The assessments of the

impacts on agricultural land quality and forestry land are made with reference to the prevalence of BMV land and forestry in the general locality, taken as a wider 2km either side of the centre line of the Proposed Scheme.

3.2.3 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.

3.3 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 the Ladbroke and Southam 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 Section 9. The local area has a gently undulating landscape of low hill tops and clay vales. The route passes over the Warwickshire/Northamptonshire boundary, near Wormleighton, cutting through a ridge where the landscape along the line of the route is at its greatest elevation of 140m above Ordnance Datum (AOD). The land then falls to a broad vale occupied by a pair of tributary valleys of the River Itchen in Radbourne parish at 100m AOD, and then rises to Windmill Hill in Ladbroke at 120m AOD. To the south of Southam the land gently undulates between 75m and 100m AOD and then rises to 110m AOD on the broadly north-west facing escarpment that passes from Ufton Wood through Long Itchington Wood to Bascote. North-west of the escarpment slope the land descends gradually to the Grand Union Canal at 65m AOD.

3.3.3 Draining the broad clay vale between Wormleighton and Windmill Hill a pair of small tributary streams flows to the River Itchen, which takes a northerly route to join the River Leam at Marton. The Oxford Canal follows the contours at about 115m AOD through Wormleighton and Stoneton parishes and joins the Grand Union Canal at Napton.

Geology and soil parent materials

3.3.4 The main geological features are described in detail in Section 8 and summarised in Volume 5: Appendix AG-001-016.

3.3.5 Superficial deposits underlying the Proposed Scheme in the Ladbroke and Southam area are largely confined to Alluvium (clay, silt, sand and gravel) in river valleys. Head deposits consisting of sand and gravel with lenses of silt and clay are present to the north-west of Long Itchington and Ufton Woods. A small area of clayey Glacial Deposits lies to the south of Long Itchington Wood.

3.3.6 Mudstone and occasional limestone of the Charmouth Mudstone Formation are present from the south of the Proposed Scheme to the south of Southam. The Rugby Limestone Member (interbedded mudstones and limestones) and the Saltford Shale Member (mudstone), both of the Blue Lias Formation, are present to the south and south-west of Southam. Northwards from the valley formed by the River Itchen, the bedrock comprises the Penarth Group (interbedded argillaceous rock and limestone) including the Langport Member (limestone) as far as the northern extent of Long Itchington and Ufton Woods. Bedrock from the north of Long Itchington and Ufton Woods to the north of the Proposed Scheme comprises the Mercia Mudstone Group, including the Arden Sandstone Formation sub-unit and dolomitic siltstones.

Description and distribution of soil types

3.3.7 The characteristics of the soils are described by the Soil Survey of England and Wales[5] and shown on the National Soil Map[6]. 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 Map AG-02-016 (Volume 5). The National Soil Map shows four principal soil types within this community forum area.

3.3.8 In the south-east and centre, between the Warwickshire/Northamptonshire boundary and Southam, and to the north-west of Southam, in and around Long Itchington and Ufton Woods, the soils are of the Denchworth association on largely drift-free Jurassic clays. They have mainly stoneless to slightly stony, heavy clay loam or clay topsoil over clay subsoil which are slowly permeable and waterlogged for long periods in winter and, hence, are most commonly assessed as being of Wetness Class (WC) IV[7].

3.3.9 West of Southam there are calcareous clay soils of the Evesham 1 and 2 associations, often containing limestone fragments. Topsoils are mainly calcareous heavy clay loam or clay and subsoils are calcareous clay. They experience occasional or seasonal waterlogging (WC II to III).

3.3.10 West of the Long Itchington and Ufton Woods escarpment the soils developed in reddish Mercian Mudstone are of the Worcester association; typically with reddish heavy clay loam or clay topsoils over slowly permeable clay subsoils. They experience seasonal waterlogging (WC III).

3.3.11 On the floodplain of the valley occupied by the Grand Union Canal there are alluvial soils of the Fladbury association that are clayey throughout and wet for long periods (WC IV).

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 Agricultural Land Classification (ALC)[8] is based on the

[5] Soil Survey of England and Wales (1984), Soils and their Use in Midland and Western England, Bulletin 12.
[6] Cranfield University (2001), The National Soil Map of England and Wales 1:250,000 scale, National Soil Resources Institute, Cranfield University, UK.
[7] The Wetness Class (WC) of a soil is classified in Appendix II of Hodgson, J.M. (1977), *The Soil Survey Field Handbook*. Soil Survey and Land Research Centre, Technical Monograph No.5, according to the depth and duration of waterlogging in the soil profile and has six bands ranging from Wetness Class I (well drained) to Wetness Class VI (permanently waterlogged).
[8] Ministry of Agriculture, Fisheries and Food (1988), *Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land*.

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. The main soil characteristics within the Ladbroke and Southam area are clayey textures, with poor structure in slowly permeable subsoil on mudstones and clays, and fluctuating groundwater in alluvial soils in narrow valleys. Soil depth and chemical limitations are not encountered.

3.3.14 Climate in this part of England does not in itself place any limitation upon land quality but the interactions of climate with soil characteristics are important in determining the wetness and droughtiness limitations of the land. The influence of climate on soil wetness is assessed by reference to median field capacity days (FCD) when the soil moisture deficit is zero, soil WC and topsoil texture. Droughtiness is determined by comparing the available water capacity of the soil, adjusted for the crop, with the moisture deficit for the locality for two crops; winter wheat and potatoes.

3.3.15 The local climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at two points within the community forum area, set out in Appendix 5: Appendix AG-001-016. FCDs range from 140 to 157 days, which is around the average for lowland England (150 days). This is considered to be quite favourable for providing opportunities for agricultural cultivations and soil handling.

3.3.16 The assessment of site factors is primarily concerned with the way in which topography influences the use of agricultural machinery and, hence, the cropping potential of land. Gradient and micro relief, with complex changes of slope angle or direction over short distances, are not considered limiting. As described in Section 13, flooding is restricted to the floodplains of the River Itchen and its tributaries. However, no agricultural land within the study area is limited, in terms of its agricultural potential, by the frequency and/or duration of annual flooding during the summer or the winter.

3.3.17 The principal limiting factors determining agricultural land quality in this study area are soil wetness and soil droughtiness. Overall, the assessment of agricultural land quality in the study area indicates that there is a high proportion (87%) of agricultural land of moderate quality, Subgrade 3b, with the remainder as Subgrade 3a.

3.3.18 Land within the Denchworth soil association, with non-calcareous clay and clay loam topsoils and a slowly permeable layer typically within 40cm depth or less, is almost entirely Subgrade 3b, whether WC III or IV. Soil wetness accompanied by heavy texture is considered the main limiting factor.

3.3.19 Land occupying floodplains (Fladbury soil association) has been assessed as Subgrade 3b because of a soil wetness limitation. A small area of clayey glacial deposits south of Long Itchington Wood is also Subgrade 3b based on wetness and heavy texture. At the north-west end of the Ladbroke and Southam study area, slowly permeable soils of the Worcester association are mostly WC III, with wetness and workability limitations. With heavy clay loam topsoils they are mainly classed as Subgrade 3b, although some areas of 3a are identified where medium clay loam topsoils and upper subsoils occur.

3.3.20 West of Southam, in clays with calcareous topsoil and limestone in the subsoil (Evesham 1 and 2 soil associations), is an area of Subgrade 3a soils. To be in this grade, the soils are required to have less than 50% topsoil clay (i.e. no heavier than medium clay loams), a WC of II or III and are in a locality where the FCD value is 150 days or less.

3.3.21 Department for Environment, Food and Rural Affairs (Defra) mapping[9] shows that there is generally a low likelihood of encountering BMV land in the locality, which makes such land a resource of high sensitivity in this study area.

Other soil interactions

3.3.22 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 England[10] and The Natural Choice: securing the value of nature[11], 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.

3.3.23 Forestry resources represent a potentially multifunctional source of productive timber, landscape amenity, biodiversity and carbon storage capacity. The value and sensitivity of the resources are assessed in Section 7, Ecology.

3.3.24 The floodplain of the River Itchen represents the functional flood environment, as set out in Section 13, Water resources and flood risk assessment. Flood Zone mapping shows there to be a significant risk of flooding in this area, with the soils functioning as water stores for flood attenuation, as well providing a habitat for ecology.

3.3.25 The presence of soil-borne cultural assets is detailed in Section 6. This includes a small number of undated crop-mark sites, probably dating to prehistoric, Roman or early medieval periods and there is potential for unknown buried assets to survive. Notable known assets include the buried and earthwork remains of deserted medieval settlements, together with some extensive but isolated survivals of associated field systems.

[9] Defra (2005), *Likelihood of Best and Most Versatile Agricultural Land.*
[10] Defra (2009), *Soil Strategy for England.*
[11] Defra (2011), *The Natural Choice: securing the value of nature.*

Land use

Land use description

3.3.26 Local agricultural land use is dominated by arable crops based on wheat, barley and oil seed rape in rotation. This is a typical use of heavy land of good to moderate quality in the Midlands. Grassland for stock rearing (principally sheep and cattle) is also widespread.

3.3.27 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 7.

3.3.28 Woodland in the south of the area is limited to sparse, small stands. In the north, woodland is a much more obvious feature of the landscape, and includes the Long Itchington and Ufton Woods. Woodland is relatively sparse over the area as a whole and represents 5% of land cover, compared to the national average of 10%.Therefore the sensitivity of the forestry land resource is high.

Number, type and size of holdings

3.3.29 There are 21 holdings in the study area, as set out in Table 7. Thirteen are mainly arable enterprises, eight being purely arable and five having some grass for livestock. There are five mainly livestock farms (cattle, sheep and dairy). The remaining holdings comprise a plant nursery, a small equestrian holding and the woodland of Long Itchington. The largest holding is approximately 546ha and the smallest around 2ha. The boundaries of the holdings are shown on Map AG-01 in Volume 5, along with the location of the main farm buildings. Field drainage is common throughout the study area on all farm types, as are field water supplies and troughs for those farms with livestock. Many farms include diversified activities, including three commercial equestrian centres, two agricultural contracting businesses, and letting of surplus buildings for uses such as storage, workshops, or conversion to holiday and residential lets.

3.3.30 Table 7 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, 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) and irrigation systems 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 7: Summary of temporary effects on holdings during construction

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA16/1 The Hall Farm	Mainly arable and some livestock	546.3	Equestrian (commercial); B&B	ELS	Medium
CFA16/2 New House Farm	Mainly arable and some livestock	50.6	Equestrian (commercial); Agricultural Contracting	None	Medium
CFA16/3 Stoneton Moat Farm	Mainly arable and some livestock	323.8	Agricultural Contracting	ELS	Medium
CFA16/4* Radbourne Grounds Farm	Mainly arable	175.7	None	ELS	Medium
CFA16/5 Upper Radbourne Farm	Mixed arable and livestock	202.3	Equestrian (commercial); Residential let	ELS	Medium
CFA16/6 Hodnell Manor Farm	Mainly arable	283.3	None	Countryside Stewardship	Medium
CFA16/7* Ladbroke Grove Farm	Mainly livestock (cattle and sheep)	82.0	None	OELS	Medium
CFA16/8* Land north-east of Radbourne Lane	Grassland	29.1	Turf cutting	None	Medium
CFA16/9 Ladbroke Hill Farm	Mainly arable	109.3	Equestrian (commercial)	ELS and HLS	Medium
CFA16/10 Land associated with Grounds Farm	Mixed arable and livestock	126.3	Agricultural rental	None	Medium
CFA16/11 Starbold Farm	Mainly arable	202.3	Holiday let; Residential let; Storage; Workshops	ELS and HLS	Medium
CFA16/12 Greenleaf Nursery	Horticulture – nursery	2.2	None	None	High
CFA16/13 Brookend Farm	Mainly livestock (dairy)	98.3	Ice-cream production	OELS	Medium
CFA16/14 Wood Farm	Mainly arable	161.9	Equestrian (commercial); Holiday let; Workshops; Cattery	ELS	Medium
CFA16/15* Folly Fields Farm	Mainly arable	17.2	None	ELS	Medium
CFA16/16* Lower Farm	Mainly livestock (cattle and sheep)	32.7	None	None	Medium
CFA16/17* Home Farm, Stoneythorpe	Mainly arable	88.3	None	None	Medium
CFA16/18* Long Itchington Wood	Woodland	78.5	None	None	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA16/19* Land adjoining Woodmeadow Farm	Mainly arable	37.2	None	None	Medium
CFA16/21 Heath Farm	Equestrian (non-commercial)	2.4	None	None	Low
CFA16/22* Stoneythorpe Estate	Mainly livestock (cattle and sheep)	7.8	Woodland	None	Medium

* No farm impact assessment interview conducted; data estimated.

Future baseline

Construction (2017)

3.3.31 No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for agriculture, forestry and soils.

3.3.32 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)

3.3.33 No committed developments have been identified in the Ladbroke and Southam 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:

- Wormleighton to Stoneton footpath (Footpath SM116a) and Wills Pastures Road underpass (both widened for agricultural access);
- Lower Radbourne, Ladbroke Grove and Windmill Lane Farm accommodation overbridges;
- Banbury Road (Boddington) (in adjacent CFA15), A423 Banbury Road, B4451 Kineton Road overbridges;
- agricultural access under Oxford Canal, Lower Radbourne South and Longhole viaducts; and

- a tunnel (part green tunnel) under Long Itchington and Ufton Woods.

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 may require careful management during the aftercare period to ensure this outcome.

3.4.4 Compliance with the CoCP will avoid or reduce environmental impacts during construction. Of particular relevance to agriculture, forestry and soils are the following measures (see Volume 5: Appendix CT-003-000/1):

- 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 (draft 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 in the area to construct and operate the Proposed Scheme. This includes not only the land on which permanent works will be sited, but also that required temporarily to facilitate the delivery of those permanent works.

3.4.6 All of the land required to implement the Proposed Scheme will, therefore, be affected during the construction phase. The land required for the construction and operation of the Proposed Scheme 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 ability of affected agricultural interests to continue to access and effectively use residual parcels of land. There may also be the loss of, or disruption to, buildings and operational infrastructure such as drainage. The 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.

3.4.8 Land used for the construction of the Proposed Scheme will fall into a number of categories when work is complete, as follows:

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

Temporary effects during construction

Impacts on agricultural land

3.4.9 During the construction phase, the total area of agricultural land used will be 310.2ha as shown in Table 8. Of this total, 69.3ha will be restored and available for agricultural use following construction.

Table 8: Agricultural land required for the construction of the Proposed Scheme

Agricultural land quality	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Grade 1	0.0	0%	0.0
Grade 2	0.8	0%	0.4
Subgrade 3a	31.5	10%	3.0
BMV SUBTOTAL	32.3	10%	3.4

Agricultural land quality	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Subgrade 3b	275.9	89%	65.9
Grade 4	2.0	1%	0.0
Grade 5	0.0	0%	0.0
TOTAL AGRICULTURAL LAND	310.2	100%	69.3

3.4.10 The disturbance during construction to 32.3ha of land of BMV quality is assessed as an impact of low magnitude, comprising less than 20% of the overall agricultural land requirement. Considering BMV land in this local area is a receptor of high sensitivity, the effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme, which is significant.

3.4.11 Following completion of construction, all temporary facilities will be removed and the topsoil and subsoil will be reinstated in accordance with the agreed end use for the land. Overall, it is estimated that there will not be any significant surplus of topsoil or subsoil material arising from the Proposed Scheme in the area.

Nature of the soil to be disturbed

3.4.12 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.

3.4.13 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 Soils[12]. These principles will be followed throughout the construction period. The heavier (clayey and silty) Brockhurst 1, Fladbury 1 and Midelney associations are least able to retain their structure when moved in wet conditions or by inappropriate equipment. They are susceptible to compaction and smearing which could impede successful reinstatement unless handled appropriately.

Impacts on holdings

3.4.14 Land may be required from holdings both permanently and temporarily (i.e. the latter just 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 individual holdings will reduce, but the following assessment focuses on the combined effect during the construction phase. The residual permanent effects are described at the end of this section.

3.4.15 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period are summarised in Table 9. This table shows the total

[12] Defra (2009), *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*.

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 of the holding required rather than the absolute area of land. The holding/reference name provides a unique identifier and relates to map series AG-01 and Appendix AG-001-016, Volume 5.

3.4.16 The effects of severance during construction are judged on the ease and availability of access to severed land. For the most part these will be 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-001-016. Where the total sum of the land required by ALC grade (as shown in Table 8) differs from the total sum of the land required by holding (as shown in Table 9), 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 9: 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
CFA16/1 The Hall Farm	43.1ha – 8% Low	Medium	Negligible	Moderate Adverse	9.2ha
CFA16/2 New House Farm	2.9ha – 6% Low	Negligible	Low	Minor Adverse	2.4ha
CFA16/3 Stoneton Moat Farm	41.3ha – 13% Medium	Low	Low	Moderate Adverse	20.3ha
CFA16/4* Radbourne Grounds Farm	38.1ha – 22% High	Low	Low	Major/Moderate Adverse	6.2ha
CFA16/5 Upper Radbourne Farm	15.0ha – 7% Low	Low	Low	Minor Adverse	2.3ha
CFA16/6 Hodnell Manor Farm	0.9ha – 0% Negligible	Negligible	Negligible	Negligible	0.5ha
CFA16/7 Ladbroke Grove Farm*	21.2ha – 26% High	Low	Medium	Major/Moderate Adverse	5.0ha
CFA16/8* Land north-east of Radbourne Lane	1.8ha – 6% Low	Negligible	Low	Minor Adverse	0.0ha
CFA16/9 Ladbroke Hill Farm	36.1ha – 33% High	Low	Negligible	Major/Moderate Adverse	1.3ha
CFA16/10 Land associated with Grounds Farm	10.8ha – 9% Low	Medium	Low	Moderate Adverse	5.2ha
CFA16/11 Starbold Farm	25.1ha – 12% Medium	Medium	Medium	Moderate Adverse	2.4ha
CFA16/12 Greenleaf Nursery	2.2ha – 98% High	Negligible	High	Major Adverse	0.5ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA16/13 Brookend Farm	4.9ha – 5% Negligible	Negligible	Low	Minor Adverse	0.1ha
CFA16/14 Wood Farm	29.1ha – 18% Medium	Negligible	Medium	Moderate Adverse	6.2ha
CFA16/15* Folly Fields Farm	7.3ha – 43% High	Negligible	Low	Major/Moderate Adverse	0.6ha
CFA16/16* Lower Farm	14.5ha – 44% High	Negligible	Low	Major/Moderate Adverse	0.7ha
CFA16/17* Home Farm, Stoneythorpe	15.1ha – 17% Medium	Negligible	Negligible	Moderate Adverse	7.7ha
CFA16/18* Long Itchington Wood	1.0ha – 1% Negligible	Negligible	Negligible	Negligible	1.0ha
CFA16/19* Land adjoining Woodmeadow Farm	11.9ha – 32% High	Negligible	Negligible	Major/Moderate Adverse	4.8ha
CFA16/21 Heath Farm	0.0ha – 0% Negligible	Negligible	Negligible	Negligible	0.0ha
CFA16/22* Stoneythorpe Estate	0.4ha – 5% Negligible	Negligible	Negligible	Negligible	0.0ha

* No farm impact assessment interview conducted; data estimated.

3.4.17 Overall, it is considered that 13 holdings will experience major or moderate temporary adverse effects during construction, which are significant. All but two of these enterprises experience a significant effect because a high proportion of the holding is required for construction. Severance caused by construction triggers the major or moderate temporary adverse effect on the other two holdings.

3.4.18 There are three farm enterprises which are potentially sensitive to noise or vibration emitted during the construction phase. At Ladbroke Grove (CFA16/7) farm stock are housed close to construction whilst at both Starbold and Wood Farms (CFA16/11 and CFA16/14) diversified activities including equestrian services, holiday and residential lets that have the potential to be adversely affected by noise. However, compliance with the draft CoCP will avoid or reduce such environmental impacts during construction.

Cumulative effects

3.4.19 No significant cumulative effects on agriculture, forestry and soils have been identified for the construction of the Proposed Scheme.

Permanent effects from construction

Impacts on agricultural and forestry land

3.4.20 Land used for the construction of the Proposed Scheme will fall into a number of categories when work is complete, as follows:

- part of the operational railway and kept under the control of the operator;
- returned to agricultural use (with restoration management);

- used for drainage or flood compensation which may also retain some agricultural use; and
- used for ecological and landscape mitigation.

3.4.21 Following construction and restoration, the area of agricultural land that will remain permanently required will be 241ha, as shown in Table 10.

Table 10: Agricultural and forestry land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land
Grade 1	0.0	0%
Grade 2	0.5	0%
Subgrade 3a	28.5	12%
BMV SUBTOTAL	29.0	12%
Subgrade 3b	210.0	87%
Grade 4	2.0	1%
Grade 5	0.0	0%
TOTAL	241	100%
Forestry land	12.0	n/a

3.4.22 The permanent loss of 29ha of land of BMV quality is assessed as an impact of low magnitude, comprising less than 20% of the overall agricultural land requirement. As stated previously, BMV land in this area is a receptor of high sensitivity so that the permanent effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme, which is significant.

3.4.23 Areas proposed for ecological and landscape mitigation include land adjacent to Berryhill Plantation/Fox Covert, Lower Radbourne Fish Ponds, Windmill Hill and Long Itchington Wood. There are also areas that include landscape planting which will remove land from agricultural production adjacent to the Oxford Canal near Wormleighton (two locations), Lower Radbourne Fish Ponds, Ladbroke Fox Covert, Windmill Hill and the tunnel portal at Ufton Wood. Associated with all of these will be hedgerow improvements.

3.4.24 Areas engineered to provide additional flood compensation capacity will be subject to marginal downgrading in land quality and include agricultural land to the south of the Lower Radbourne Fish Ponds (on holding CFA16/4) and adjacent to the River Itchen (on holding CFA16/15).

3.4.25 Areas of woodland that will be permanently affected include Windmill Hill Spinney as well as woodland cover to the west of Chapel Bank Cottage. The route is tunnelled beneath Long Itchington and Ufton woods. Overall, the total amount of forestry land required to implement the Proposed Scheme will be 12ha, out of the total permanent land area required for the operation of the Proposed Scheme of 303ha (4%). The extent of the forest cover in the study area is less than the average national woodland cover and so, quantitatively, the loss of this woodland will be significant. The qualitative assessment of loss is addressed in other relevant sections of this report.

Impacts on holdings

3.4.26 The permanent residual effects from the construction of the Proposed Scheme on individual agricultural and related interests is summarised in Table 11. 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-001-016.

Table 11: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA16/1 The Hall Farm	33.9ha – 6% Low	Medium	Low	Moderate Adverse
CFA16/2 New House Farm	0.6ha – 1% Negligible	Negligible	Negligible	Negligible
CFA16/3 Stoneton Moat Farm	21.1ha – 7% Low	Low	Negligible	Minor Adverse
CFA16/4* Radbourne Grounds Farm	31.9ha – 18% Medium	Low	Negligible	Moderate Adverse
CFA16/5 Upper Radbourne Farm	12.7ha – 6% Low	Low	Negligible	Minor Adverse
CFA16/6 Hodnell Manor Farm	0.4ha – 0% Negligible	Negligible	Negligible	Negligible
CFA16/7 Ladbroke Grove Farm*	16.2ha – 20% Medium	Low	Negligible	Moderate Adverse
CFA16/8* Land north-east of Radbourne Lane	1.8ha – 6% Low	Negligible	Negligible	Minor Adverse
CFA16/9 Ladbroke Hill Farm	34.7ha – 32% High	Low	Low	Major/Moderate Adverse
CFA16/10 Land associated with Grounds Farm	5.5ha – 4% Negligible	Medium	Negligible	Moderate Adverse
CFA16/11 Starbold Farm	22.7ha – 11% Medium	Medium	Negligible	Moderate Adverse
CFA16/12 Greenleaf Nursery	1.6ha – 73% High	Negligible	High	Major Adverse
CFA16/13 Brookend Farm	4.8ha – 5% Negligible	Negligible	Negligible	Negligible
CFA16/14 Wood Farm	23.0ha – 14% Medium	Low	Negligible	Moderate Adverse
CFA16/15* Folly Fields Farm	6.7ha – 39% High	Negligible	Negligible	Major/Moderate Adverse

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA16/16* Lower Farm	13.8ha – 42% High	Negligible	Negligible	Major/Moderate Adverse
CFA16/17* Home Farm, Stoneythorpe	7.4ha – 8% Low	Negligible	Negligible	Minor Adverse
CFA16/18* Long Itchington Wood	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA16/19* Land adjoining Woodmeadow Farm	7.1ha – 19% Medium	Negligible	Negligible	Moderate Adverse
CFA16/21 Heath Farm	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA16/22* Stoneythorpe Estate	0.4ha – 5% Negligible	Negligible	Negligible	Negligible

* No farm impact assessment interview conducted; data estimated.

3.4.27 Overall, it is likely that 11 holdings will experience significant permanent effects from the construction of the Proposed Scheme. The most common cause of significant permanent effect is a high proportion of the farm being required by the Proposed Scheme. One holding (Greenleaf Nursery – CFA16/12) will be rendered unviable.

3.4.28 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, and chooses, to use compensation payments to replace assets.

Cumulative effects

3.4.29 No significant cumulative effects on agriculture, forestry and soils have been identified for the construction of the Proposed Scheme.

Other mitigation measures

3.4.30 Other mitigation measures that are proposed include access provisions at CFA16/3, CFA16/7, CFA16/9, CFA16/11, CFA16/13, CFA16/14 and CFA16/16.

Summary of likely significant residual effects

3.4.31 Once the construction process is complete and land required temporarily has been restored, the residual permanent loss of agricultural land will be 241ha, of which 29.0ha is BMV. This is assessed as a moderate adverse residual effect which is significant.

3.4.32 A total of 11 holdings have been identified that will experience significant permanent effects. Of these 10 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. Greenleaf Nursery (CFA16/12) will no longer be viable as an agricultural enterprise.

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, will be controlled 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 residual significant effects

3.5.5 No residual significant 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 (NO_2), fine particulate matter (PM10 and PM2.5)[13] and dust.

4.1.2 With regard to air quality the main issues are anticipated to result from emissions of dust from demolition, the construction of new structures and earthworks and possible transfer of dust and mud on to public highways from vehicles travelling to and from construction areas. In addition, there may be changes in concentrations of NO_2 and particulate matter due to changes in road traffic emissions during the construction and operation of the Proposed Scheme.

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

- Appendix AQ-001-016;
- Map Book – Air Quality, AQ-01-016; and
- Map Book – Air Quality, AQ-02-016.

4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2: CFA16 Map Book, Map series CT-10.

4.2 Scope, assumptions and limitations

4.2.1 The assessment scope, key assumptions and limitations for the air quality assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1), the SMR Addendum (Volume 5: Appendix CT-001-000/2) and appendices presented in Volume 5: Appendix AQ-001-016.

4.2.2 The study area for the air quality assessment has been determined on the basis of where impacts on air quality might occur from construction activities, from changes in the nature of traffic during construction and operation or where road alignments have changed.

4.2.3 The assessment of impacts arising from construction dust emissions has been undertaken using the methodology based on that produced by the Institute of Air Quality Management (IAQM)[14]. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on the approximate number of receptors within close proximity to the dust-generating activities. In doing so, it assigns a lower scale of effect to cases where the number of properties is small, e.g. fewer than ten properties within 20m of dust-generating activities. Thus, a single property very close to a construction site cannot experience a

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

'significant effect' as defined by this methodology. The assessment presented here reaches a conclusion that incorporates this concept of significance being proportional to the number of people affected. However, in cases where less than 10 properties are within 20m of the construction activity, it will still be the case that mitigation in accordance with the CoCP will be applied.

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

4.3 Environmental baseline

Existing baseline

4.3.1 The environmental baseline reported in this section represents the existing air quality conditions identified within the study area. The main source of existing air pollution within the study area is emissions from road traffic using A roads, including the A425 Leamington Road and the A423 Banbury Road. The Ladbroke and Southam area is predominantly rural, with a few villages including Ladbroke and Southam.

4.3.2 Estimates for NO2, PM10 and PM2.5 concentrations have been obtained from UK-wide modelled pollution maps for 2012, published by the Department for Environment and Rural Affairs (Defra) in 2010[15]. These data provide estimates of background concentrations of NO2, PM10 and PM2.5 for 1km grid squares across the UK.

4.3.3 The Ladbroke and Southam area lies in the West Midlands region, within the administrative area of Warwickshire County Council (WCC) and the local authority area of Stratford-on-Avon District Council (SADC).

4.3.4 There are no continuous air quality monitoring sites within the Ladbroke and Southam area, nor is there any diffusion tube monitoring. On this basis the Defra background concentrations maps have been used to characterise the baseline air quality for the Ladbroke and Southam area. These maps indicate the average background pollutant concentrations across the Ladbroke and Southam area are below the relevant air quality standards.

4.3.5 There are no AQMA within the Ladbroke and Southam area.

4.3.6 Human receptors that could potentially be affected by changes in air quality as a result of the Proposed Scheme have been identified. Air quality at these receptors could potentially be affected, due to their proximity to construction activities, to roads with vehicle flows that may change or to roads that will be subject to realignment

[15] Defra; 2010 Based Background Maps for NOx, NO2, PM10 and PM2.5; http://laqm.defra.gov.uk/maps/maps2010.html; Accessed July 2013.

during the construction or operational phases of the Proposed Scheme. These locations are residential properties; at Chapel Bank Cottage in Lower Radbourne; at Ladbroke Grove Farm on Windmill Lane, Ladbroke; around Starbold Farm, A423 Banbury Road, Southam; around B4451 Kineton Road, Southam; along Warwick Road off A425 Leamington Road, Southam; on the A425 Leamington Road between Stoneythorpe and Southam; and at Wood Farm near Ufton.

4.3.7 There is one ecological receptor with a statutory designation within the Ladbroke and Southam area that could potentially be affected by changes in air quality as a result of the Proposed Scheme. This is Long Itchington and Ufton Woods site of special scientific interest (SSSI), located at Bascote Heath. The Long Itchington Wood tunnel passes under this SSSI. Further details of this site are provided in Ecology, Section 7. There are no non-statutory designated sites within the Ladbroke and Southam area that could potentially be affected by changes in air quality as a result of the Proposed Scheme.

Future baseline

4.3.8 Section 2.1, Volume 5: Appendix CT-004-000 and Volume 5: Map Book – Cross Topic Maps, Map CT-13-043 and Map CT-13-044a 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 future baseline for the assessment of effects from the construction and operation of the Proposed Scheme. In the Ladbroke and Southam area, there are no 'committed developments' that are considered to introduce new receptors requiring air quality assessment.

4.3.9 The data used for the air quality assessment take account of predicted changes in traffic, which are derived from a combination of national traffic growth factors and consideration of major locally consented schemes, as described in Section 12, Traffic and transport. In this way, the assessment accounts for cumulative effects.

Construction (2017)

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

Operation (2026)

4.3.11 Future background pollutant concentrations have been sourced from Defra background maps for 2026, which predict NO2 and PM10 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 (Volume 5: Appendix CT-003-000) includes a range of mitigation measures that are accepted by the IAQM as being suitable to reduce impacts to as low a level as reasonably practicable. It also makes provision for the

preparation of Local Environmental Management Plans (LEMP) 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 NO_2 and PM10, as well as ecological receptors sensitive to dust.

4.4.4 An assessment of construction traffic emissions has been undertaken for two scenarios in the construction period: a Without the Proposed Scheme scenario and a With the Proposed Scheme scenario.

4.4.5 In the Ladbroke and Southam area dust generating activities will comprise demolition and the construction of new structures and earthworks, as well as possible transfer of dust and mud on to public highways from vehicles travelling to and from construction areas.

4.4.6 A construction dust assessment was undertaken for the eight locations, seven locations where residential properties were present and the Long Itchington and Ufton Woods SSSI, due to their close proximity to the dust generating activities identified. The seven locations where residential properties were present are: Chapel Bank Cottage in Lower Radbourne; Ladbroke Grove Farm on Windmill Lane, Ladbroke; properties around Starbold Farm, A423 Banbury Road, Southam; properties around B4451 Kineton Road, Southam; properties along Warwick Road off A425 Leamington Road, Southam; Stoneythorpe Lodge on the A425 Leamington Road, Southam; and Wood Farm near Ufton.

4.4.7 Given the application of the mitigation measures set out within the draft CoCP, the construction dust assessment determined that of the seven locations with residential properties present the magnitude of impact at properties around B4451 Kineton Road; at properties along Warwick Road off A425 Leamington Road and at Stoneythorpe Lodge on A425 Leamington Road will be slight adverse, due to the presence of residential properties within 20m of the dust-generating construction activities. The magnitude of impact will be negligible at the other identified locations with residential properties. The magnitude of impact of will be slight adverse for the SSSI, as the boundary of the SSSI is within 20m of dust-generating construction activities and the SSSI has a national designation.

4.4.8 Overall, the construction dust assessment determined that the air quality effects will not be significant. The basis for this conclusion is presented in full at Volume 5: Appendix AQ-001-016.

4.4.9 Construction activity could also affect local air quality through the emissions associated with additional traffic generated on roads as a result of construction traffic routes, temporary road realignments and changes to traffic patterns arising from temporary road diversions. Screening was undertaken to identify locations requiring assessment.

4.4.10 Two locations within the Ladbroke and Southam area met the criteria for assessment of change in traffic emissions during the construction phase. These locations were the A423 Banbury Road and the A425 Leamington Road. The increase in construction traffic was sufficient to require assessment at receptors along the A423 Banbury Road, between Southam and Watergall, and there will be a temporary diversion of the A425 Leamington Road as well as an increase in construction traffic which required assessment at receptors along the A425 Leamington Road. The assessment found that the magnitude of impact will be negligible at all receptors assessed for NO2 and PM10 at these locations.

4.4.11 Therefore, the effect on air quality due to construction traffic will not be significant. The basis for this conclusion is presented in full in Volume 5: Appendix AQ-001-016.

Permanent effects

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

Cumulative effects

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

Other mitigation measures

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

Summary of likely residual significant effects

4.4.15 The methods outlined within the draft CoCP to control and manage potential air quality effects are considered effective in this location and no residual significant 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. Indirect emissions from sources such as rail wear and brakes have been assumed to be negligible.

4.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data includes the additional traffic from future committed developments.

4.5.4 Traffic data for the Ladbroke and Southam area have been screened to identify roads that required an assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026.

4.5.5 Two locations within the Ladbroke and Southam area met the criteria for an assessment of emissions from traffic during the operational stage, following completion of the Proposed Scheme. These locations were the A423 Banbury Road, Southam and the B4451 Kineton Road, Southam. There will be permanent road realignments of the A423 Banbury Road and the B4451 Kineton Road which required a more detailed assessment at receptors around these roads. The assessment at receptors around these roads found that the magnitude of impact will be negligible at all receptors assessed for NO_2 and PM_{10}.

4.5.6 Therefore, the effect on air quality due to traffic following completion of the Proposed Scheme will not be significant. The basis for this conclusion is presented in full in Volume 5: Appendix AQ-001-016.

Cumulative effects

4.5.7 There are no cumulative effects anticipated to arise during operation of the Proposed Scheme.

Other mitigation measures

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

Summary of likely residual significant effects

4.5.9 No residual significant 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:

- impacts on residents living close to the route of the Proposed Scheme and associated temporary construction compounds and construction traffic routes;
- impacts on people using promoted recreational routes in the area which are crossed by the Proposed Scheme, including the Oxford Canal and the Harry Green Way;
- loss of land from recreation facilities and open spaces on the edge of Southam; and
- disruption to local roads due to construction works and increased construction traffic in the area and how this will impact on day-to-day access to community facilities and services.

5.1.3 Further details of the community assessments and the results of recreational public right of way (PRoW) surveys undertaken within this area are contained in the Volume 5: Appendices (CM-001-016). Community assessment maps are provided in Volume 5: Maps CM-01-101 to CM-01-105.

5.1.4 The assessment draws on information gathered from a combination of desk top studies, site surveys and through engagement with local organisations, including parish councils and sports clubs.

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 Appendix CT-001-000/2) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

5.2.2 Construction worker accommodation will be located at the Oxford Canal north embankment main compound and the Long Itchington Wood tunnel main 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 other 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 construction worker accommodation.

5.2.3 The assessment of isolation effects focuses on where the construction of the Proposed Scheme will impact on routes used to access community facilities on a regular basis and from identifiable geographic catchments. On this basis, no assessment of isolation effects on facilities in Southam town centre has been

undertaken as the catchments for these facilities are mostly drawn from the urban area itself. Similarly, community halls and churches within the villages of Ladbroke and Ufton are assumed to serve relatively local catchments, given the existence of similar facilities in other nearby villages. Tourism based facilities such as camp sites and recreational facilities with more than local catchments are assumed unlikely to experience isolation effects except where construction of the Proposed Scheme will disrupt access to their specific sites. On this basis, no isolation assessment has been carried out for the Dallas Burston Polo Club or the Withy Tree Farm Camp Site, both of which are located on the edge of Southam.

5.2.4 The construction and operation of the Proposed Scheme requires access rights over land at a number of locations within the Ladbroke and Southam area, both temporarily and permanently. Whilst the limits of land identified as required for the construction of the Proposed Scheme include these areas, it is assumed that there will be no loss of land from any residential property or community resource as a result. A small area of land at the entrance to Southam Rugby Football Club is identified as being required permanently for highway tie in works with B4451 Kineton Road. However, as the works in this area are temporary in nature, and the area of land affected small, the effects on the club have been assessed as being temporary only.

5.3 Environmental baseline

Existing baseline

5.3.1 Baseline data on community resources was collected up to 1km from the centre line 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 routeing 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 Ladbroke and Southam area is predominantly rural in character. Southam is the principal settlement, with its range of day-to-day services and facilities serving a wide rural catchment encompassing much of the study area. The historic villages of Wormleighton and Ladbroke are in the south, whilst the hamlet of Bascote Heath and the village of Ufton are in the north.

Wormleighton

5.3.4 The small village of Wormleighton is situated approximately 750m to the west of the route of the Proposed Scheme. The village has few facilities, namely St. Peter's Church and a village hall. It lies within the catchment area for the primary school and GP surgery at Fenny Compton and for the Kineton High School. All of these facilities are situated to the west of the village and the roads used to access them will not be crossed by the Proposed Scheme. The Oxford Canal passes about 1km to the north of

the village and is a key recreational route in the area, with a towpath running alongside the canal.

5.3.5 Wormleighton is included within the study area because the boundary of the land required for the construction and operation of the Proposed Scheme includes a strip of land along the eastern edge of the village, where it follows the route of an existing farm access trackway.

Ladbroke

5.3.6 The village of Ladbroke is situated about 700m to the west of the route of the Proposed Scheme. The village has a small range of facilities, including the Church of All Saints, a village hall, a public house and a small village green with play equipment. The village has no school or GP surgery and falls in the catchment area for facilities at Southam, to the north.

5.3.7 The Harry Green Way (SM90), which is a 34km circular walk linking eight villages around Southam, passes through Ladbroke and is crossed by the Proposed Scheme near Ladbroke Hill Lane.

5.3.8 There is a scattering of farmsteads and residential properties in the countryside to the south-east of Ladbroke, including in the vicinity of Upper and Lower Radbourne, some of which are situated close to the Proposed Scheme or construction traffic routes and are therefore included within the study area.

5.3.9 As Ladbroke itself lies beyond the area of land required for the construction and operation of the Proposed Scheme, it has been included within the study area only for the assessment of potential isolation effects on residents accessing facilities elsewhere.

Southam

5.3.10 The town of Southam is the main centre in the Ladbroke and Southam area for day-to-day services and facilities, with three primary schools, a secondary school, two GP surgeries, three dental surgeries, a library and a range of shops, banks, retail and financial services. The town also has a small number of public houses and restaurants, a leisure centre and a number of community centres/halls. The centre of Southam is beyond the study area for this assessment.

5.3.11 There is a cluster of open spaces on the southern edge of the town, which have been included within the study area as being either partly within or close to the land required for the construction of the Proposed Scheme, including Southam United Football and Bowls Club and Southam Rugby Football Club. The Dallas Burston Polo Club, which is set within over 200ha of grounds at the Stoneythorpe estate about 1.5km west of Southam, also falls partly within the area of land required for the construction of the Proposed Scheme. The club hosts regular tournaments and fixtures, drawing players and supporters from a wide area. Some events are understood to attract up to 3,000 spectators. Some of the club's pavilions and other buildings are also used for weddings and special events and the clubs recently completed IXL Events Centre caters for events for up to about 4,000 people.

5.3.12 St Wulfstans GP surgery is located to the southern edge of Southam. This facility serves Southam and a number of surrounding villages including Bascote, Bascote

Heath, Ladbroke, Long Itchington, Ufton and Radbourne. The surgery offers a range of services such as minor surgery clinic, travel clinics, diabetes clinic, smoking cessation and chiropody. As the surgery lies well beyond the area of land required for the construction and operation of the Proposed Scheme, it has been included within the study area only for the assessment of potential isolation effects.

5.3.13 There are also a number of properties dispersed along the roads radiating out of Southam which fall within the study area for Ladbroke and Southam. A number of these properties to the south of the town, along both the A423 Banbury Road and the B4451 Kineton Road, are close to or within the boundary of land required for the Proposed Scheme.

Bascote Heath

5.3.14 The small residential hamlet of Bascote Heath is situated to the north-west of Southam. It lacks any community facilities with the exception of the Fox and Hen public house close to the junction of Welsh Road. The hamlet falls within the catchment area for the Long Itchington Primary School and for GP surgeries and the secondary school at Southam. The A425 Leamington Road, which is one of two routes used to access facilities at Southam, is crossed by the Proposed Scheme near the Dallas Burston Polo Club. The hamlet also falls within the ecclesiastical parish boundary for St. Michael and All Angels Church at Ufton.

5.3.15 The Harry Green Way PRoW (SM90) passes through Bascote Heath and runs partly within an area of land required for the Proposed Scheme to the north of the Dallas Burston Polo Club. A war memorial and cemetery are situated to the south of residential properties at Bascote Heath but are outside of the boundary of land required for the Proposed Scheme.

5.3.16 The Proposed Scheme passes beneath Bascote Heath in a 1.5km long bored tunnel which commences at the A425 Leamington Road and emerges to the north of Long Itchington Wood. The boundary of land required for the construction and operation of the Proposed Scheme runs along the B4452 Bascote Road in the centre of the hamlet to facilitate works to existing utilities within the highway verge. It also includes an area of land to the south of Featherbed Lane, which is proposed for ecological mitigation measures.

5.3.17 The entire hamlet has been included within the study area for the assessment of potential isolation effects.

Ufton

5.3.18 The village of Ufton is located approximately 3.5km west of Southam. The village has a small number of facilities, including a village hall, St. Michael and All Angels Church, The White Hart public house and some allotments, but lacks a school or GP surgery. It falls within the catchment for the primary school at Long Itchington and for Southam College and GP surgeries at Southam, Harbury and Bishops Itchington.

5.3.19 The Centenary Way long distance path passes through Ufton. This is a 158km route that runs from Shipston-on-Stour in the south of Warwickshire to Kingsbury in the north. The route heads north out of Ufton to cross the Grand Union Canal at Longhole

Bridge. Part of the route of the Centenary Way falls within the boundary of land required for the construction and operation of the Proposed Scheme.

5.3.20 Ufton village is approximately 1km from the centre line of the Proposed Scheme. However, as routes between the village and schools at Long Itchington and Southam will be affected during construction, the entire community has been included within the study area for the assessment of potential isolation effects.

5.3.21 The Grand Union Canal defines the northern limit of the Ladbroke and Southam area. The effects on users of the canal, its associated towpath and the Centenary Way at Longhole Bridge are addressed within the assessment for the neighbouring Offchurch and Cubbington area (CFA17).

Future baseline

Construction (2017)

5.3.22 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. Within the scope of this assessment, very little change is anticipated to the baseline conditions along the route of the Proposed Scheme in this area over the next four years.

Operation (2026)

5.3.23 The review of future baseline conditions has not identified any additional committed developments within the study area which will give rise to a change in conditions 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 reduce the environmental impacts during construction:

- redesigning the profile of earthworks to reduce the amount of land that will be required from residential properties, particularly in the A423 Banbury Road area;
- positioning the south portal for the Long Itchington Wood tunnel so as to minimise permanent impacts on the Dallas Burston Polo Club and adjacent properties;
- routing construction traffic away from the centres of Wormleighton, Ladbroke and Southam to limit the volume of construction traffic on minor rural roads and through residential neighbourhoods as far as practicable;
- siting the Oxford Canal north embankment main compound and the Long Itchington Wood tunnel main compound away from residential areas;
- providing a temporary diversion for the A425 Leamington Road to the west of Southam to maintain traffic flows along this route for a period of about two years during the works;
- designing road realignments to the south of Southam so that their

construction can be carried out whilst avoiding the need for lengthy road closures;

- phasing or designing works to maintain the Oxford Canal and its associated towpath and the Harry Green Way recreational PRoW during construction;
- designing utilities diversions to reduce impacts on residential properties and other spaces, such as Southam United Football and Bowls Club as far as practicable; and
- provision of temporary solid noise fence barriers alongside the construction works to reduce impacts on nearby residential properties, including those situated near the Lower Radbourne north viaduct site, in the vicinity of Harp Farm off the A423 Banbury Road at Southam, in the vicinity of the B4451 Kineton Road overbridge site at Southam and at two locations on the A425 Leamington Road to the west of Southam.

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 reduce nuisance (draft CoCP, Section 5);
- where reasonably practicable, 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 reasonably practicable, the avoidance of large goods vehicles operating adjacent to schools during drop off and pick up periods (draft CoCP, Section 14).

Assessment of impacts and effects

5.4.3 Details of all assessments of community resources are included in Volume 5: Appendix CM-001-016. Each assessment form presents information that explains the rationale for determining the rating for the sensitivity of the affected community resource, the magnitude of impact and the assessment of significance.

Wormleighton and surrounding area

Temporary effects

Residential properties

5.4.4 The village of Wormleighton is situated about 750m from the route of the Proposed Scheme and on this basis residents of the village are unlikely to experience significant amenity effects due to works to build the railway. Works to upgrade an existing trackway, which passes just to the east of the village, to enable its use as a permanent access to the proposed balancing ponds will entail some widening and the provision of passing places. These works will be short in duration are not expected to involve disruptive engineering operations and on this basis will not impact significantly on the amenities of local residents. The works will not encroach into any residential garden land.

Recreational PRoW

5.4.5 The Proposed Scheme crosses the Oxford Canal approximately 1km to the north of Wormleighton and approximately 150m of the canal and the associated towpath are within the area identified as being required for the construction and operation of the Proposed Scheme. *I*t is anticipated that both the canal and towpath will be maintained during the construction of the Oxford Canal viaduct and will not be subject to any permanent realignment. On this basis, the inclusion of a short section of these recreational routes within the area required for the Proposed Scheme will have a negligible effect on their use and function.

Permanent effects

5.4.6 No permanent effects on residential or community facilities have been identified in this area as a result of construction of the Proposed Scheme.

Ladbroke

Temporary effects

Residential properties

5.4.7 The residents of a group of five properties situated along an access track leading from Welsh Road (east) to Upper and Lower Radbourne Farms to the south-east of Ladbroke, will be affected by a change in amenity during the construction works. This farm road is identified as a route for construction traffic delivering materials to the Lower Radbourne Farm accommodation overbridge worksite and the associated satellite compound. These works are scheduled to take about 12 months to complete. During this time, the occupiers of residential properties along this track will be affected by a combination of significant adverse visual effects due to the construction of the Proposed Scheme and an increase in HGV traffic on the road. On this basis, the construction works are assessed as giving rise to a major adverse amenity effect on the residents of five residential properties at Upper Radbourne, which is significant. The properties that are likely to be affected are:

- Paxhall Farmhouse;
- Courtyard House;
- The Hall; and

- nos. 1 and 2 Upper Radbourne Cottages.

5.4.8 Residents of Ladbroke village as a whole, who are dependent upon travelling to Southam to access community facilities on a daily basis, including primary and secondary schooling, will be affected by works to realign the A423 Banbury Road and the B4451 Kineton Road and the diversion of PRoW Footpath SM33. As explained in the traffic and transport section of this report (Section 12) no significant increases in congestion or delays to journeys are predicted on either of these routes as a result of construction works. Both of the roads will remain open during the construction period except for overnight or weekend closures to tie-in the newly built carriageways. Overall, recognising the high dependency on access to community facilities at Southam on a daily basis, the phasing of the works and the limited nature of any disruption likely to be caused by the works, the isolation effects on the community of Ladbroke are assessed as minor and not significant.

Recreational PRoW

5.4.9 The Proposed Scheme crosses the route of the Harry Green Way PRoW (SM90) to the east of Ladbroke village at Windmill Hill. The Proposed Scheme makes provision to divert the footpath permanently to cross the Proposed Scheme route via the realigned Ladbroke Hill Lane. As a recreational route, the increased journey length is assessed as having a negligible effect on the function and value of the PRoW. During the construction period, it is envisaged that the works can be phased in such a way as to maintain a route through or around the construction area, thus avoiding the need for any temporary closures of this recreational route.

5.4.10 It is recognised that during construction, given the proximity of the route to the works, users will be affected by noise impacts and significant adverse visual effects. However, given the transitory nature of this recreational route, the noise impacts are not considered to give rise to a significant effect on users. On this basis, no combined amenity effects on users of the Harry Green Way have been identified during the construction period.

Permanent effects

5.4.11 One residential property in this part of the study area will be affected by permanent loss of land due to construction of the Proposed Scheme, namely Chapel Bank Cottage at Lower Radbourne. The loss of land from a single property in this area is assessed as a minor adverse effect and is not significant at a community level.

Southam

Temporary effects

Residential properties

5.4.12 The residents of six properties situated at Starbold Farm, Banbury Road, Southam are likely to experience temporary isolation effects during the construction of the Proposed Scheme and the realignment of the A423 Banbury Road to the west of its current position. The route for the realignment of the A423 Banbury Road will cross the access track serving all of the properties at Starbold Farm. Whilst access will be maintained throughout the works, some minor rerouting through the construction area is likely to be necessary at times during the overall 11 month construction period.

The Proposed Scheme also requires rights to use the farm access track to access some of the work sites, including the proposed balancing pond to the south of the railway. PRoW SM33, which presently connects this group of properties directly with the facilities on the edge of Southam about 1km to the north will also need to be diverted, adding about 250m to the current journey length. Its routeing along the A423 Banbury Road will reduce the attractiveness of this PRoW as an alternative to travelling by car. Given that the residents are highly dependent upon access to Southam for day-to-day needs and the lack of alternative access arrangements, the construction works are assessed as giving rise to a moderate adverse and temporary isolation effect on the residents of the six properties at Starbold Farm, which is significant. The properties that will be affected are:

- Starbold Farm, The Stone House and The Loft which are situated at the farm; and
- Starbold Cottage, Field End and Field View, which are situated just to the west of the farm, and which share the same access track from the A423 Banbury Road.

Open space

5.4.13 The Southam Rugby Football Club is situated to the south of the route of the Proposed Scheme, on the west side of the B4451 Kineton Road. Works to realign the B4451 Kineton Road will encroach slightly in to the entrance and car parking area for the rugby club site, to form the tie-in between the existing and newly aligned carriageways. Access will be maintained during the works and this area is likely to be affected for a short period of time within the overall 12 month construction period. In addition, a narrow strip of land along the club's boundary with the B4451 will be required to allow for any reinstatement of the hedgerow if affected during the highway alignment works. This will not encroach on to the playing pitches at the Club. Whilst the disruption at the entrance to the Club and to some of its car parking spaces will be inconvenient for users of the Club, the areas affected are small and the duration of impact limited. On this basis, the effects on the rugby club are assessed as minor and not significant. As no significant congestion or delays are predicted on the B4451 Kineton Road during the construction works and given the frequency of visits by players and members, isolation effects on the club will be negligible. As an active sports facility, changes in amenity during the works will not give rise to a significant effect on players and other users of the club.

5.4.14 The Dallas Burston Polo Club, which is located midway between the village of Ufton in the west and Southam in the east, will be affected temporarily by a loss of land during works to construct the Proposed Scheme. The Proposed Scheme makes provision for a tunnel at this location to pass beneath the Polo Club and Long Itchington Wood to the north, with the tunnel entrance being sited just to the south of the A425 Leamington Road. To reduce disruption to traffic at this location during the two year construction period, the Proposed Scheme diverts the A425 temporarily to the north of its current alignment and onto land used by the Polo Club. The area affected includes the main access to the Polo Club, together with about one quarter of an international grade polo pitch, the corner of a second and an adjoining area used for training purposes. The temporary loss of these areas will impact on the functioning of

the Club and the facilities it is able to offer. Sustained use of the site during the construction period will therefore necessitate some reconfiguration of the pitches and training areas on the remaining part of the Polo Club estate and modifications to the site access arrangements to maintain a comparable offer. Conferencing and events facilities located elsewhere within the Polo Club Grounds will not be affected directly by the Proposed Scheme, except for their access arrangements.

5.4.15 Given the length of time over which the land is required and that the Club is a well-used facility with a programme of regular tournaments and training activities during the season, the impact is assessed as giving rise to a moderate adverse temporary effect on the Club and its players and visitors, which is significant. After completion of the works, the land will be returned to the Club for continued polo use. A narrow strip of land along the Club's boundary with the A425 Leamington Road will be required to provide new landscape mitigation, but this will not encroach into areas currently set out as playing pitches and the permanent effects on the Club will be negligible. As an active sports facility, any noise impacts associated with construction works in the vicinity of the Polo Club have not been assessed as giving rise to a significant adverse effect on the amenity of this resource.

Permanent effects

Residential properties

5.4.16 Construction of the Proposed Scheme will require the demolition of one residential property in the Southam area, namely The Bungalow at Banbury Road. The loss of a single residential property is assessed as a minor adverse effect, which is not significant at a community level.

5.4.17 In addition, a total of five residential properties in the Southam area will be affected by a permanent loss of land as a result of the construction of the Proposed Scheme. Given the number of properties affected at each location, the loss of land from these properties is assessed as a minor adverse effect in each case, which is not significant at a community level. The properties that will be affected are:

- Harp Farm, the Oaks and Archers Rest, which are situated to the south of the Proposed Scheme at the A423 Banbury Road, Southam;
- The Old Coach House, which is situated to the south of the Proposed Scheme at the B4451 Kineton Road, Southam; and
- Stoneythorpe Lodge, which is situated to the on the north of the Proposed Scheme at the A425 Leamington Road, Southam.

Community facilities, recreation, open space and recreational PRoW

5.4.18 The construction of the Proposed Scheme will require the permanent loss of small areas of land from Southam United Football and Bowls Club, which is situated to the south of the town adjacent to the A423 Banbury Road. The slight loss of land from the boundary of the Club along the A423 Banbury Road and on the south-west corner of the site will not affect areas marked out for playing pitches or training. However, the diversion of PRoW Footpath SM33 between the main pitch and the training and junior pitches to the south, will constrain the flexibility the club currently enjoys for organising and arranging the pitches and activities across its site. Recognising that

this is a well-used site with limited space to meet the demand for places, fixtures and training activities, this will cause some inconvenience to the Club and has been assessed as giving rise to a minor adverse effect. This is not significant overall.

Bascote Heath

Temporary effects

Residential properties

5.4.19 One residential property, namely Lock Cottage at Welsh Road, which is located on the banks of the Grand Union Canal about 1.5km north of Bascote Heath, will be affected temporarily by a loss of land during works to divert utilities in the area. The loss of land from a single residential property is assessed as having a minor adverse effect, which is not significant at a community level.

5.4.20 Utility works along the B4452 Bascote Road at Bascote Heath will be necessary during construction of the Proposed Scheme. These works will not encroach upon or affect the War Memorial and residential properties fronting the road and access to properties the will be maintained during the works.

5.4.21 Bascote Heath falls within the catchment area for the Long Itchington Church of England Primary School and Southam College and residents with school age children are therefore highly dependent upon routes to the north and east of the hamlet for daily journeys. As explained in the traffic and transport section (Section 12) significant disruption to journeys to access these facilities is not predicted and the isolation effect on residents of this hamlet is assessed as negligible.

Recreational PRoW

5.4.22 The route of the Harry Green Way passes to the south of the hamlet of Bascote Heath. Part of the route east of the B4452 and south of Featherbed Lane falls within an area of land required for the provision of ecological habitat mitigation. No temporary or permanent disruption to the route is anticipated as a result of these proposed environmental measures.

Permanent effects

5.4.23 The construction works for the Proposed Scheme will not give rise to any permanent effects on community resources in this area.

Ufton

Temporary effects

Residential properties

5.4.24 Ufton is situated approximately 3.5km west of Southam and about 1km from the centre line of the Proposed Scheme. On this basis, the construction works will not give rise to significant amenity effects on the residents. The A425 which runs through the centre of the village has been identified as a construction traffic route for the Proposed Scheme. As explained in the traffic and transport section (Section 12) this will not substantially increase daily flows on this section of road, and as no significant congestion or delays are anticipated, the isolation effects on the community and its access to schools and other facilities at Southam and Long Itchington will be negligible.

Recreational PRoW

5.4.25 During the construction of the Proposed Scheme, it is likely that a very limited amount of materials will need to be transported to the work sites for the Long Itchington Wood north portal and the Longhole viaduct via a purpose built construction access road in the vicinity of Wood Farm, to the north of Ufton. This construction access route will initially run along the existing access track serving Wood Farm, from the A425 at Ufton Hill, the first 350m of which also forms part of the Centenary Way long distance footpath. The inclusion of this section of the Centenary Way within the boundary of land required temporarily for the construction of the Proposed Scheme will therefore impact on people walking this route.

5.4.26 Whilst the route will remain open during the construction works, the shared use of the track for a period of about three years by a limited number of construction vehicles will impair the functional value, ambience and enjoyment of this section of the route. The inclusion of the route within the boundary of land required for the construction of the Proposed Scheme is therefore assessed as giving rise to a minor adverse effect on people using this section of the Centenary Way.

Permanent effects

5.4.27 The construction works for the Proposed Scheme will not give rise to any permanent impacts on community resources at Ufton.

Cumulative effects

5.4.28 No cumulative or community wide effects on community resources have been identified in the Ladbroke and Southam area.

Other mitigation measures

5.4.29 No further mitigation has been identified. HS2 Ltd will work closely with Dallas Burston Polo Club to identify further reasonably practicable measures, which might help to mitigate effects during construction of the Proposed Scheme.

Summary of likely residual significant effects

5.4.30 Construction of the Proposed Scheme will give rise to a limited number of residual significant effects on community resources within the Ladbroke and Southam area, all of which will be temporary in nature. At Southam, the construction of the Proposed Scheme will result in a significant effect on the Dallas Burston Polo Club due to the A425 Leamington Road being temporarily diverted through its grounds. A small group of properties at Starbold Farm, to the south of Southam will also experience some temporary isolation effects during the construction works.

5.4.31 In the Ladbroke area, a small group of residents at Upper Radbourne, in the vicinity of Paxhall Farm will be affected by changes in amenity during the works.

5.4.32 The community resources that will be subject to significant effects during construction are shown in Volume 5: Maps CM-01-101 to CM-01-105.

5.5 Effects arising from operation

Avoidance and mitigation measures

5.5.1 As part of the design development process for the Proposed Scheme, the following measures have been incorporated within the proposals, to avoid or reduce environmental effects during operation:

- the provision of raised earthworks and/or landscaping along the route to provide screening and help integrate the Proposed Scheme within the wider landscape, including to the east of Wormleighton, at Windmill Hill to the east of Ladbroke, on the south side of Southam and in the vicinity of both portals for the Long Itchington Wood tunnel; and
- the provision of earthworks to reduce noise and visual effects on the occupiers of nearby residential properties, including 1.9km of raised earthworks extending from Windmill Hill cutting to Kineton Road, in the vicinity of Harp Farm and Starbold Farm to the east of Ladbroke.

Assessment of impacts and effects

5.5.2 The operation of the Proposed Scheme will not give rise to significant effects on community resources in this area, except where the route passes close to a number of residential properties on the A423 Banbury Road, to the south of Southam. These properties are shown in Volume 2: Map CM-01-103.

5.5.3 The residents of five properties at Harp Farm and Starbold Farm, which are situated immediately to the south of the Proposed Scheme will be affected by a combination of significant noise and visual effects during the first year of operation. These are assessed as giving rise to a major adverse amenity effect on the occupiers of these properties, which is significant. The properties that will be affected are:

- Harp Farm and The Oaks, which are situated on the east side of Banbury Road; and
- The Stone House, The Loft and Starbold House Farm which are situated on the west side of Banbury Road.

Cumulative effects

5.5.4 No cumulative or community wide effects have been identified within any part of the Ladbroke and Southam area during operation.

Other mitigation measures

5.5.5 No further mitigation measures have been identified.

Residual significant effects

5.5.6 The operation of the Proposed Scheme will give rise to a significant amenity effect on the residents of five properties in the vicinity of Harp Farm and Starbold Farm, at Banbury Road, Southam. No significant community effects have been identified within any other part of the Ladbroke and Southam area.

6 Cultural heritage

6.1 Introduction

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

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

6.1.3 Maps showing the location of the key environmental features can be found in Volume 2: Community Forum Area (CFA) map books. Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5: Map Book – cultural heritage. Detailed reports on the cultural heritage character and surveys undertaken within the local area are contained in the Volume 5 Appendices. These include:

- Appendix CH-001-016 – Baseline report;
- Appendix CH-002-016 – Gazetteer of heritage assets;
- Appendix CH-003-016 – Impact assessment table; and
- Appendix CH-004-016 – Survey reports.

6.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, LBSXXX; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-016.

6.1.5 Engagement has been undertaken with the Warwickshire County Council planning archaeologist 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, the SMR (Volume 5: Appendix CT-0001-000/1) and the SMR Addendum (Volume 5: Appendix CT-0001-000/2). This report follows the standard assessment methodology.

6.2.2 The setting of all designated heritage assets up to 2km of the centre line 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 LiDAR[16] data examined did not encompass the full extent of the study area; and
- not all areas of survey as identified in the archaeological risk model were available for survey[17].

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

6.3 Environmental baseline

Existing baseline

6.3.1 In compiling this assessment, documentary baseline data was collected from a variety of sources as set out in Volume 5: Appendix CH-001-016.

6.3.2 In addition to collating 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-004-016); and
- a programme of non-intrusive surveys including geophysical surveys (see Volume 5: Appendix CH-004-016).

Designated assets

6.3.3 The grade II listed Stoney Thorpe Lodge Gates (LBS096) is the only designated heritage asset located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme (see Volume 5: Map Book – Cultural heritage, Maps CH-001-040 to CH-001-044).

6.3.4 The following designated assets are located within the 2km study area (see Volume 5: Appendices Map Book – Cultural heritage, Maps CH-002-025 through CH-002-027):

- four scheduled monuments: Wormleighton Deserted Medieval Village (LBS013); Priors Hardwick medieval settlement (LBS015); Hodnall Manor Deserted Medieval Settlement (LBS038); and Holy Well (LBS066);

[16] Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.
[17] 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.

- four conservation areas: Wormleighton (LBS012); Priors Hardwick (LBS014); Ladbroke (LBS048); and Southam (LBS063);
- three grade I listed buildings: the Church of St Peter in Wormleighton (part of LBS012), the Church of All Saints in Ladbroke (part of LBS048), and the Church of St James in Southam (part of LBS063);
- three grade II* listed buildings: Wormleighton Manor House and Wormleighton Manor Gatehouse (both within the conservation area LBS012) and the Church of St Michael (LBS079); and
- 83 grade II listed buildings, concentrated largely in the historic settlements of Southam (LBS063), Ladbroke (LBS048), and Wormleighton (LBS012) and including the Holy Well (LBS066) that is also designated as a scheduled monument; and
- four areas of ancient woodland: Nuns Bushes (LBS057); Thorpe Rough (LBS076); Ufton and Long Itchington Woods (LBS082); and Print Wood (LBS094).

Non-designated assets

6.3.5 The Lower Radbourne deserted medieval settlement (LBS035) is the only non-designated asset of moderate value that lies wholly or partially within the land required, temporarily or permanently, for the construction of the Proposed Scheme.

6.3.6 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. They are listed in the gazetteer in Volume 5: Appendix CH-002-016 and identified on Maps CH-001-040 to CH-001-044. They comprise:

- twelve archaeological assets (LBS002, LBS003, LBS009, LBS024, LBS045, LBS049, LBS055, LBS058, LBS071, LBS072, LBS078 and LBS084);
- two built heritage assets: Church Farm Barns (LBS023) and Field Cottage (LBS061); and
- one area of historic landscape: Ladbroke open fields (LBS100).

6.3.7 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 in Volume 5: Appendix CH-002-016 and identified on Maps CH-001-040 to CH-001-044. There are a number of built heritage assets the settings of which have been considered, for example:

- LBS004: Barn No.1, off Leisure Drive;
- LBS005: Barn No.2, off Leisure Drive;
- LBS008: Stoneton Manor and gardens;
- LBS016: Farm building approximately 500m north east of Wormleighton village;
- LBS017: Farm building approximately 300m east of Windmill Spinney;

- LBS018: Farm building approximately 400m south east of Stoneton Farm;
- LBS021: Stoneton Farm;
- LBS030: Glebe Farm shed;
- LBS031: Former farm building north of Glebe Farm;
- LBS034: Chapel Bank Cottage;
- LBS036: Lower Radbourne Farm;
- LBS041: Barn 250m north of Woodlands Farm;
- LBS042: The Bungalow, Windmill Lane;
- LBS043: Barn 100m north of Withy Tree Farm;
- LBS047: Ladbroke Hill Farm, Windmill Lane;
- LBS048: Ladbroke Conservation Area;
- LBS050: Bungalow Farm, east side of A423, Southam;
- LBS051: Barn east of Southam Road north of Ladbroke;
- LBS056: Starbold Cottage, west of Starbold Farm;
- LBS060: Fields Farm;
- LBS065: Hill Cottage, Leamington Road, Southam;
- LBS073: Thorpe Bridge;
- LBS074: Stoneythorpe Home Farm;
- LBS075: Monkey Barn Farm;
- LBS080: Bascote Heath;
- LBS087: Wood Farm and Wood Farm Cottage;
- LBS088: Farm building 500m west of Wood Farm, on Ridgeway Lane;
- LBS089: Woodmeadow Farm; and
- LBS093: Lower Print Farm.

Cultural heritage overview

6.3.8 The underlying bedrock geology of the study area is dominated by Lower Lias clays and Charmouth mudstones in the south and central area, and Mercian mudstones in the north. Little superficial geology is recorded in the study area but isolated patches of Pleistocene glacial till and glacio-fluvial deposits cap some of the low hills, while narrow bands of Holocene alluvium are recorded within stream and river valleys. This area is generally associated with clayey soils.

6.3.9 The topography of the study area is variable. In the north the study area is made up of low ridges and valleys, former heathland, associated with the low plateau of glacial

deposits, and a gently rolling tableland. In the south the study area lies within the Northamptonshire Uplands, an area dominated by rounded undulating hills with many long, low ridgelines. In between is an area of rolling hills, dissected by small streams flowing west into the River Itchen.

6.3.10 The majority of heritage assets within the Ladbroke and Southam area date to the medieval and post medieval periods with very few assets dating to earlier periods.

6.3.11 There are no known archaeological heritage assets dated to the earlier prehistoric period (i.e. the Palaeolithic, Mesolithic, and Bronze Age). However, sites dating to these periods are known to survive across the West Midlands and Warwickshire with a small number of local examples outside of the 500m study area e.g. Neolithic polished stone axes found at Cubbington and Napton-on-the-Hill, Bronze Age barrows along the Jurassic ridge to the south and the lower Itchen valley to the north, and a possible Bronze Age settlement site on the western edge of Ufton parish. These sites indicate a low level of potential for currently unknown buried assets to survive within the study area and possibly within the land required for construction.

6.3.12 There are also no known archaeological assets dating from the Iron Age and Roman-British periods in the study area. Again, sites are known across the region, with an Iron Age hillfort to the north at Wappenbury and a Roman town to the north-west at Chesterton on the Fosse Way. More locally, within areas close to the study area, there is good evidence from cropmarks and surface finds of pottery and metalwork for rural settlements of both periods (e.g. at Long Itchington, Burton Dasset and Radford Semele). These sites indicate a moderate potential for currently unknown buried assets to survive within the area and possibly the area of land required for construction. Significantly, there are a number of cropmark sites, identified from aerial photographs. Although these are undated, comparison with similar dated sites from Warwickshire and adjacent counties suggests these represent settlement/agricultural sites of Iron Age or Roman date. There is a concentration of these crop mark assets in the Wormleighton/Stoneton area (e.g. LBS001 and LBS003), with a single cropmark also located to the north of Ufton Wood at Wood Farm (LBS084).

6.3.13 There is a single asset tentatively dated to the early medieval period, the Salt Way trackway (LBS024) running along the boundary between Wormleighton and Radbourne. Its given date is based on documentary evidence – it is referenced in an Anglo-Saxon charter. It is possible that buried deposits of Anglo-Saxon date may survive at some points along its length but the continued use, upgrading and maintenance of the trackway up to the present day suggests that archaeological deposits may have been heavily disturbed or wholly removed in many locations. Sites of Anglo-Saxon date survive across the region and locally as barrows e.g. Long Itchington and Stockton (LBS095) and with occasional settlement sites e.g. Snowford Farm in Long Itchington (outside of study area). This suggests a low to moderate potential for unknown buried sites to survive within the study area and possibly within the area of land required for construction.

6.3.14 As set out above the study area contains little evidence for prehistoric, Roman and early medieval activity. This may indicate a lack of activity during these periods but perhaps more likely reflects a lack of previous research. The greatest potential for

archaeological remains from these periods is likely to be in areas of lighter soils within the Itchen valley and in general within stream valleys where alluvium may be present and may mask and protect any archaeological remains (see Volume 5: Appendix CH-001-016).

6.3.15 Relative to other periods there are a large number of assets of medieval date within the study area and wider locality. Principal amongst these are the surviving historic settlements and, in particular, Wormleighton (LBS012), Priors Hardwick (LBS014), Ladbroke (LBS048), Southam (LBS063) and Ufton (LBS079). None of these lie within the land required for construction and only at Ladbroke does part of the historic core lie within the 500m study area. Within the villages a small number of medieval buildings survive, including the listed village churches and secular buildings with a medieval origin.

6.3.16 Elsewhere medieval assets have been identified as earthworks or buried archaeological remains. These are relict features of a once more extensive and complex pattern of settlement. Deserted settlements are located at Stoneton (LBS007), Wormleighton (LBS013), Watergall (LBS027), Hodnell (LBS041), Priors Hardwick (LBS015), Radbourne (LBS035) and Stoney Thorpe (LBS069). The remains at Radbourne (LBS035) are partially within the land required to construct the Proposed Scheme.

6.3.17 Surviving earthworks of medieval ridge-and-furrow cultivation strips and possible field boundaries survive throughout the study area, with particular concentrations to the east of Ladbroke and between the River Itchen and Ufton Wood. Areas of ancient woodland survive within the study area at Nuns Bushes (LBS057), Thorpe Rough (LBS076), Ufton and Long Itchington Woods (LBS082) and Print Wood (LBS094). Sections of important hedgerow are present along many of the parish boundaries and may have their origins in this period.

6.3.18 Most of the built heritage assets within the area date from the post medieval period and are located within conservation areas or historic village cores in the study area, in particular Wormleighton (LBS012), Ladbroke (LBS048), and Southam (LBS063), with small groups at Priors Hardwick (LBS014), Ufton (LBS079), Bascote Heath (LBS080) and Bascote (LBS081). These include the village churches and a range of secular structures including manorial buildings at Wormleighton and Ladbroke and designed landscapes with houses at Ladbroke and Stoney Thorpe Hall. Beyond the village centres, isolated farms and agricultural buildings are present. The date and significance of these structures varies, although many are of 18th and 19th century date and are locally significant. Also of note are assets associated with communication, e.g. toll roads such as the A423 Banbury Road, A425 Leamington Road, and B4451 Kineton Road, and the Oxford (LBS019) and Grand Union (LBS092) canals, and craft / industry, e.g. the brick making site at Harp Farm (LBS055). More recent features are also present, principally defensive structures of World War II date, such as the Priors Hardwick bombing range (LBS022).

6.3.19 Examples of well-preserved and highly legible surviving historic landscapes that retain the pattern of medieval open fields can be seen at Ladbroke (LBS100) where ridge and furrow earthworks, and field patterns of piecemeal enclosure, survive with minimal loss to their integrity. Areas of former woodland that illustrate a pattern of woodland

assarting[18] and later encroachment into common land can be seen at Long Itchington Wood and Print Wood (LBS101). Both assets represent important periods of change within this area of Warwickshire, where a loss of woodland and the enclosure of former open fields altered the landscape during the medieval and post medieval periods.

Future baseline

Construction (2017)

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

Operation (2026)

6.3.21 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 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-003-000/1):

- management measures that will be implemented for assets that are to be retained within the land required for the construction of the Proposed Scheme (draft CoCP, Section 8);
- the preparation of project wide principles, standards and techniques for works affecting heritage assets (draft CoCP, Section 8);
- a programme of archaeological investigation and recording to be undertaken prior to/or during construction works affecting the assets (draft CoCP, Section 8); and
- a programme of historic building investigation and recording to be undertaken prior to modification or demolition of the assets (draft CoCP, Section 8).

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

- bored tunnel under Ufton and Long Itchington Woods (LBS082) to reduce the potential impact on the ancient woodland;
- temporary construction works designed to avoid the need to demolish the grade II listed Stoney Thorpe Lodge Gates (LBS068);
- extensive false cutting earthworks and planting to east/north-east of Wormleighton (LBS012) to reduce potential impacts on the setting of

[18] Assarting is the term for the act of clearing woodland for agricultural use. The resulting field is known as an 'assart'.

settlement and designated assets;

- additional planting, predominantly for ecological benefit, at Windmill Hill which also improve the integration of the Proposed Scheme into the character and form of the wider historic landscape;
- planting blocks and false cutting to east and south-east of the Grade II listed building The Fields House (LBS062) to reduce the impact on its setting;
- design of Proposed Scheme to south-west of Stoney Thorpe parkland (LBS068) to minimise change to its character and setting; and
- in common with other sections of the Proposed Scheme, general landscape earthworks and planting to reduce impacts on the setting of designated assets within the 2km study area. Examples include the conservation area at Wormleighton (LBS012), Stoney Thorpe Hall (LBS067) and the Hodnall Manor scheduled monument (LBS038).

Assessment of impacts and effects

Temporary effects

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

6.4.4 The following significant effects will occur as a result of temporary impact on the setting of designated or non-designated heritage assets:

- the Oxford Canal (LBS019), an asset of moderate value, will be crossed by the Proposed Scheme. Construction works will occur around the canal for approximately four years. These temporary activities will substantially change the rural setting of the asset. This setting is an important aspect of the asset's significance. The works will result in a temporary medium adverse impact and moderate adverse effect;
- Church Farm barns (LBS023), an asset of low value, will be situated at the base of an embankment and approximately 160m from the Oxford Canal north embankment main compound, which will be used for approximately four years. Construction activity in the vicinity of the asset will considerably change the rural setting of the asset and its relationship to its immediate landscape resulting in a high adverse impact and moderate adverse effect;
- Chapel Bank Cottage (LBS034), an asset of low value, lies approximately 50m from the Proposed Scheme. During construction in this area, which will occur for approximately two years, the rural setting of the asset will be severely disrupted. This will result in a temporary high adverse impact and moderate adverse effect;
- Field Cottage (LBS061), an asset of low value, will be situated adjacent to the Proposed Scheme at the point where the B4451 Kineton Road overbridge

crosses the rail cutting. During construction in this area, which will occur for approximately one year, the asset will be subject to considerable disruption to its local rural setting. This will result in a temporary high adverse impact and moderate adverse effect;

- The Fields House (LBS062), a grade II listed building of moderate value, will be approximately 70m from the Proposed Scheme. During construction in this area, which will occur for approximately one year, the asset will be subject to considerable disruption to its local rural setting. This will result in a temporary high adverse impact and moderate adverse effect;
- the ancient woodland at Ufton and Long Itchington Woods (LBS082), an asset of high value, will not be physically affected during construction; however, the rural setting of the woodland will be disrupted by construction activity at both ends of the tunnel that passes beneath the woodland. This will continue for approximately six years. This will result in a temporary medium adverse impact and major adverse effect;
- Wood Farm and Wood Farm Cottage (LBS087), an asset of low value, will be adjacent to the land required temporarily for the construction of the Proposed Scheme. During construction the rural setting of the asset will be disrupted by construction activity at the northern end of the Long Itchington Wood tunnel. This will continue for approximately six years. Due to the scale and proximity of the works there will be a temporary high adverse impact and moderate adverse effect;
- Woodmeadow Farm (LBS089), an asset of low value, will overlook a major construction area, which will continue for approximately six years. During construction the asset's rural setting will be fundamentally altered by the works and the presence of major compounds. This will result in a temporary high adverse impact and moderate adverse effect; and
- construction works and highway diversions, which will continue for approximately three years, in the area of the grade II listed Stoney Thorpe Lodge Gates (LBS096), an asset of moderate value, will temporarily substantially change the setting of this asset by severing it from its roadside location and relationship with the main hall. This will result in a medium adverse impact and moderate adverse effect.

Cumulative effects

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

Permanent effects

6.4.6 The following significant effects will occur as a result of physical impacts on heritage assets within the land required, temporarily or permanently, for the construction of the Proposed Scheme:

- the Lower Radbourne deserted medieval settlement (LBS035), an asset of moderate value, lies partially within the land required for the construction of the Proposed Scheme. Construction of the Proposed Scheme will result in the

loss of the western portion of this asset. This will constitute a high adverse impact and major adverse effect;

- an area of ridge and furrow at Wormleighton/Stoneton (LBS002), an asset of low value, will be largely removed to facilitate construction of a cutting resulting in almost total loss of the asset. This will constitute a high adverse impact and moderate adverse effect;
- a cropmark enclosure near Stoneton (LBS003), an asset of low value, will be crossed by a cutting resulting in almost total loss of the below ground remains. This will constitute a high adverse impact and moderate adverse effect;
- the Wormleighton/Stoneton parish boundary (LBS010), an asset of moderate value, will be partially removed to enable construction of a cutting and new landscaping. This will result in a medium adverse impact and moderate adverse effect;
- the Wormleighton/Stoneton parish boundary (LBS020), an asset of moderate value, will be partially removed to enable construction of a cutting and new landscaping. This will result in a medium adverse impact and moderate adverse effect;
- the Wormleighton/Radbourne parish boundary (LBS025), an asset of moderate value, will be severed by a cutting, this and areas of landscaping will require removal of a considerable proportion of the identified length of this asset. This will result in a medium adverse impact and moderate adverse effect;
- the Hodnell and Wills/Radbourne parish boundary (LBS037), an asset of moderate value, will be partially removed to enable landscaping works. This will result in a medium adverse impact and moderate adverse effect;
- the Radbourne/Ladbroke parish boundary (LBS040), an asset of moderate value, will be partially removed to facilitate a cutting and landscaping. This will result in a medium adverse impact and moderate adverse effect;
- an area of ridge and furrow at Ladbroke (LBS046), an asset of low value, will be removed by construction of the Proposed Scheme. This will constitute a high adverse impact and moderate adverse effect;
- an area of ridge and furrow at Ladbroke (LBS049), an asset of low value, will be removed by construction of the Proposed Scheme. This will constitute a high adverse impact and moderate adverse effect;
- the Ladbroke/Southam parish boundary (LBS054), an asset of moderate value, will be partially removed to enable construction of a cutting and new landscaping. This will result in a medium adverse impact and moderate adverse effect;
- the Harp Farm brickworks (LBS055), an asset of low value, will be crossed by the Proposed Scheme's embankments resulting in almost total loss of the below ground remains. This will constitute a high adverse impact and moderate adverse effect;

- an area of ridge and furrow at Thorpe Bridge (LBS071), an asset of low value, will be crossed by the Proposed Scheme resulting in an almost total loss of the asset. This will constitute a high adverse impact and moderate adverse effect;
- an area of ridge and furrow at Lower Farm (LBS072), an asset of low value, will be crossed by the Proposed Scheme resulting in an almost total loss of the asset. This will constitute a high adverse impact and moderate adverse effect;
- the Ufton/Long Itchington Parish boundary (LBS083), an asset of moderate value, will have a substantial portion removed to enable construction of a cutting and new landscaping. This will result in a medium adverse impact and moderate adverse effect;
- a group of cropmark enclosures at Wood Farm (LBS084), an asset of low value, will be removed by the construction of a cutting and construction compounds. This will constitute a high adverse impact and moderate adverse effect; and
- a large area of coherent former medieval open fields near Ladbroke (LBS100), an asset of low value, will be crossed by the Proposed Scheme resulting in loss of large portions of the surviving elements and severe disruption to the legibility, coherency and form of the asset. This will result in a high adverse impact and moderate adverse effect.

6.4.7 The following significant effects will occur as a result of permanent impacts on the setting of heritage assets:

- The Barn off Leisure Drive (LBS004), an asset of low value, lies approximately 150m from the Proposed Scheme. The Proposed Scheme will run in a large deep cutting and will substantially change the current rural setting of the asset and its relationship to the wider landscape. This will constitute a high adverse impact and moderate adverse effect;
- the Wormleighton deserted medieval settlement (LBS013), a scheduled monument and asset of high value, lies approximately 700m from the Proposed Scheme. The Proposed Scheme will be visible as it switches from cutting to embankment. The Proposed Scheme includes landscape embankments to reduce visual intrusion and this and intervening topography will reduce visual intrusion, although the Proposed Scheme will still affect the rural character of the asset's wider setting. This will constitute a low adverse impact resulting in a moderate adverse effect;
- a farm building approximately 500m north-east of Wormleighton village (LBS016), an asset of low value, will be located at the base of landscaping earthworks and will have its visual setting substantially altered, and its relationship to the wider historic landscape diminished. This will constitute a high adverse impact and moderate adverse effect;
- a farm building approximately 300m east of Windmill Spinney (LBS017), an asset of low value, will lie within the land required for the Proposed Scheme. The proximity of the Proposed Scheme will disrupt the rural setting of the farm building both visually and with noise impacts during construction. This will constitute a high adverse impact and moderate adverse effect;

- the Oxford Canal (LBS019), an asset of moderate value, will lie adjacent to the Proposed Scheme. The Proposed Scheme incorporates landscape earthworks to reduce visual impacts on the canal but there will still be a noticeable change to its setting and its relationship to the wider landscape. This will adversely affect a limited section of a much larger asset, resulting in a medium adverse impact and moderate adverse effect;
- Church Farm Barns at Wormleighton (LBS023), an asset of low value, is located within the land required for the Proposed Scheme. It will be located at the base of an embankment and approximately 160m from a large main construction compound. Overhead lines will also be redirected past the property. The works will result in a comprehensive change to the asset's setting and relationship to the wider landscape. This will constitute a high adverse impact and moderate adverse effect;
- Chapel Bank Cottage (LBS034), an asset of low value, is located approximately 50m from the Proposed Scheme which will run on an embankment at this point. There will be a major change to the asset's setting and relationship to the wider landscape. This will represent a high adverse impact and moderate adverse effect;
- Ladbroke Hill Farm on Windmill Lane (LBS047), an asset of low value, will be situated approximately 100m from an access road and area of landscape planting. The cutting for the Proposed Scheme will be approximately 480m from the asset. There will be a very noticeable change to the asset's setting and its relationship to the wider landscape, with key approaches to the asset being severed by the Proposed Scheme. This will constitute a high adverse impact and moderate adverse effect;
- Field Cottage (LBS061), an asset of low value, will be situated adjacent to the Proposed Scheme at the point where the B4451 Kineton Road overbridge crosses the rail cutting. The Proposed Scheme will very noticeably change the asset's setting. This will constitute a high adverse impact and moderate adverse effect;
- The Fields House (LBS062), a grade II listed building of moderate value, will be approximately 70m from the Proposed Scheme which will run in a substantial cutting to the north of the building. The asset frontage faces away from the Proposed Scheme but the principal approaches are to the rear. The scale of the Proposed Scheme will considerably alter the setting of the asset. This will result in a high adverse impact and major adverse effect;
- the Ufton and Long Itchington Woods (LBS082), an area of ancient woodland of high value, is located above the bored tunnel. The Proposed Scheme emerges at the tunnel portal adjacent to the northern edge of the wood. There will be a noticeable change to the setting of the wood and its relationship to the wider landscape at this point, although the major part of the asset will not be affected. This will constitute a low adverse impact and moderate adverse effect; and
- Wood Farm and Wood Farm Cottage (LBS087), an asset of low value, lies

approximately 50m from the Proposed Scheme at the point where the Proposed Scheme exits the Long Itchington Wood tunnel and runs on embankment to the Longhole viaduct. There will be a very noticeable change to the setting of the asset and its relationship to the wider landscape. This will constitute a high adverse impact and moderate adverse effect.

Permanent cumulative effects

6.4.8 There are no inter-project effects on cultural heritage.

Other mitigation measures

6.4.9 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.

Summary of likely residual significant effects

6.4.10 The residual effects are the same as those reported above.

6.4.11 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 forms part of the setting of assets. The physical impacts of construction on heritage assets are permanent and not reversible, heritage assets will be removed. There will also be a permanent residual effect on the setting of heritage assets due to the presence of the constructed Proposed Scheme.

6.4.12 A number of archaeological assets will be permanently lost due to the construction of the Proposed Scheme; these include a deserted medieval settlement at Lower Radbourne, numerous areas of medieval ridge and furrow, several cropmark sites, and a post-medieval brickworks. A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.13 The Proposed Scheme will result in the demolition of a farm building approximately 300m east of Windmill Spinney. A programme of built heritage works will be prepared to investigate, analyse, report and archive this asset.

6.4.14 The Proposed Scheme will sever elements of the historic landscape, including seven lengths of important hedgerows and an area of former open fields near Ladbroke. In addition, elements of the Proposed Scheme such as cuttings and embankments will affect the setting of historic settlements, buildings and other assets including the Wormleighton deserted medieval settlement, the Oxford Canal, the grade II listed Fields House, and several non-designated buildings and groups of buildings. Further consideration will be given to the historic vegetation and landscapes as part of the detailed planting and landscape design stage.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 The following 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 scheme design to reduce potential impacts on identified assets; and
- landscape planting will increasingly reduce impacts on the setting of the designated assets within the study area as it matures during the operational phase. Examples include the conservation area at Wormleighton (LBS012), Stoney Thorpe Hall (LBS067) and the Hodnall Manor scheduled monument (LBS038).

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 permanently 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 environmental effects will occur as a result of permanent changes to the setting of the following assets arising from the impacts of the operation of the Proposed Scheme:

- a farm building approximately 500m north-east of Wormleighton village (LBS016), an asset of low value, will experience increases in noise levels as a result of the operation of the Proposed Scheme (Volume 5: Map SV-001-040). The visibility of passing trains will change the rural nature of the asset. These changes will constitute a medium adverse impact. In combination with the more notable permanent construction impacts the Proposed Scheme will result in a high adverse impact and moderate adverse effect;
- the Oxford Canal (LBS019) lies adjacent to and will be crossed by the Proposed Scheme. Once operational the Proposed Scheme will considerably alter the rural nature of the canal with increases in noise levels along this length. Trains will also be visible along the embankments. This will alter the rural setting of the canal which is integral to its significance and remains in a similar form to that present at the time of its construction. The operation of the Proposed Scheme will result in a medium adverse impact. The combined presence and operation of the Proposed Scheme increases the overall impact of the Proposed Scheme on this asset. The dominant presence of the embankments and crossing coupled with the substantial changes in noise and visual environment will result in a high adverse impact and major adverse effect;
- Church Farm Barns at Wormleighton (LBS023), an asset of low value, is located

within the land required for the Proposed Scheme. Noise levels around this rural complex will increase as a result of the operation of the Proposed Scheme. The visibility of passing trains will also change the rural nature of the asset. These changes will constitute a medium adverse impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect;

- Chapel Bank Cottage (LBS034), an asset of low value, is located approximately 50m from the Proposed Scheme. There will be very increases in noise greater than 10dB (Volume 5: Map SV-02-041) and trains would be readily apparent. This will notably alter the rural setting of the asset resulting in a high adverse impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect;

- Lower Radbourne Farm (LB036), an asset of low value, will be subject to rises in noise levels of 6dB to 10dB (Volume 5: Map SV-02-41) and trains will be visible in some views. Given the rural nature of the property these changes will constitute a medium adverse impact. The combined presence and operation of the Proposed Scheme will notably affect visual relationships, views from key facades and the rural character of the asset. This will result in a high adverse impact and moderate adverse effect;

- Ladbroke Hill Farm, Windmill Lane (LBS047), an asset of low value, will experience rises in noise levels of 6dB to 10dB (Volume 5:–Map SV-02-41). This will affect its rural character and setting changes resulting in a medium adverse impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect;

- Field Cottage (LBS061), an asset of low value, will experience increases in noise levels of greater than 10dB (Volume 5: Map SV-02-043) which will degrade the character and setting of this road side building. Cars, and potentially trains, will also be visible. The operation of the Proposed Scheme will have a medium adverse impact on the setting of this asset. The combined presence and operation of the Proposed Scheme will severely degrade the setting of the building. The Proposed Scheme will have a high adverse impact and moderate adverse effect;

- Fields House (LBS062), a grade II listed building of moderate value, will experience a change in noise levels of 6 to 10dB increase (Volume 5: Map SV-02-43). Its immediate environs will also experience changes in noise (Appendix 5: Map SV-01-43). This will degrade the setting and rural character of the building resulting in a medium adverse impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and major adverse effect;

- the Ufton and Long Itchington Woods (LBS082), an area of ancient woodland of high value, is located above the bored tunnel. A small area of the woods will experience an increase in noise levels (Volume 5: Map SV-01-043) and there will be views of trains from the northern fringes of the wood. This will affect the rural character and setting of the woodland and will result in a low adverse impact. The combined presence and operation of the Proposed Scheme will

result in a low adverse impact and moderate adverse effect;

- Wood Farm and Wood Farm Cottage (LBS087), an asset of low value, lies approximately 50m from the Proposed Scheme. This rural complex will experience changes in noise levels of greater than 10dB (Volume 5: Map SV-02-044) and trains will be visible in many views from within the complex. The Proposed Scheme will have a high adverse operational impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect;
- Woodmeadow Farm (LBS089), an asset of low value, lies around 150m from the Proposed Scheme. Noise levels at the farm will increase by 6dB to 10dB (Volume 5: Map SV-002-044). There will also be views of the trains along the Proposed Scheme. These changes will materially affect the rural setting and context of the asset resulting in a medium adverse impact. The combined presence and operation of the Proposed Scheme will see notable changes to the visual and auditory setting of the asset, with its local setting being dominated by major infrastructure. This will constitute a high adverse impact and moderate adverse effect; and
- Ladbroke Open fields (LBS100), an asset of low value, will be traversed by the Proposed Scheme. The operation of the Proposed Scheme will be audible and visible from many areas of the asset. This will alter the essential rural character of the asset resulting in a medium adverse impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect.

Cumulative effects

6.5.4 During the operational phase of the Proposed Scheme, cumulative development projects described in Section 2.1 and Volume 5: Appendix CT-004-000 include construction of HS2 Phase Two. Assessment of inter-project effects on cultural heritage assets arising from the interaction of the Proposed Scheme with cumulative development projects has been undertaken. No significant cumulative effects have been identified in relation to cultural heritage

Other mitigation measures

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

Summary of likely residual significant effects

6.5.6 The setting of several historic settlements, buildings and landscapes will be affected visually and by noise once the Proposed Scheme becomes operational. This includes the grade II listed Fields House, Oxford Canal, ancient woodland at Ufton and Long Itchington Woods and non-designated buildings and groups of buildings. In due course some visual effects will reduce as planting matures and the new railway assimilates into the landscape. Operational noise will also be controlled through noise barriers and landscaped earthworks built up alongside the tracks.

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: construction of Long Itchington Wood tunnel beneath and adjacent to Long Itchington and Ufton Woods Site of Special Scientific Interest (SSSI); loss and severance of habitat, including broadleaved woodland at Windmill Hill Spinney in Ladbroke and an unnamed tributary watercourse of the River Itchen; and loss of habitat used by bats and by barn owls.

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

- results of ecological surveys (Appendices EC-001-003, EC-002-003, EC-003-003, and EC-004-003);
- register of local/parish level effects which are not described individually in Volume 2 (Volume 5: Appendix EC-005-003; and
- data obtained from bat trapping/radio tagging study (EC-006-003).

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: Warwickshire County Council (Warwickshire Biological Records Centre); Warwickshire Wildlife Trust; the Environment Agency; Banbury Ornithological Society; and Butterfly Conservation (Warwickshire Branch). Natural England also provided results of vegetation surveys for Long Itchington and Ufton Woods SSSI.

7.2 Scope, assumptions and limitations

7.2.1 The scope and methodology of the ecological assessment are introduced in the SMR (Volume 5: Appendix CT-001-000/1) and SMR Addendum (Volume 5: Appendix CT-001-000/2). Further detail, including the study area for individual surveys, is provided within the SMR Addendum. 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: AppendicesEC-001-003, EC-002-003, EC-003-003, EC-004-003 and EC-006-003.

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-001-000.

7.2.3 As well as the standard range of surveys described in the SMR and associated technical notes, radio-tracking surveys of several species of bat were undertaken in the vicinity of Long Itchington and Ufton Woods SSSI. This work was conducted under a licence from Natural England and was focused on barbastelle bat. The aim of the surveys was to ascertain how bats utilise the habitats and whether there are

important roosts, commuting routes and foraging areas present which would be affected by the Proposed Scheme. Further details are provided in Volume 5: Appendix EC-006-003.

7.2.4 Access was not obtained to all of the land area where general habitat survey (Phase 1 habitat survey) was proposed. Locations with the potential to support key ecological receptors where access could not be gained for survey include: Berryhill Plantation; the fish ponds at Lower Radbourne near Chapel Bank Cottage, which are fed by a tributary of the River Itchen; Ladbroke Fox Covert; and buildings at Harp Farm and Stoney Thorpe Hall (internal inspections for bats). The unnamed tributary watercourse of the River Itchen, the unnamed tributary watercourse of the River Leam and parts of the River Itchen were not accessible for aquatic surveys (macro-invertebrates and fish). Further details are provided in Volume 5: EC-001-003, EC-002-003, EC-003-003, EC-004-003 and EC-006-003.

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

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

7.3 Environmental baseline

Existing baseline

7.3.1 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in this area. Further details are provided in the reports and maps presented in Volume 5 (Appendix EC-001-003 to EC-004-003 and EC-006-003 and Volume 5: Map Book – Ecology, Maps EC-01 to EC-12). Statutory and non-statutory designated sites are shown on Volume 5: Map Book – Ecology, Maps EC-01.

7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists mainly of large arable fields bounded by hedgerows and tree lines with pasture land replacing arable in the south of the area. The majority of the area is sparsely populated with a number of isolated farmsteads; the two main areas of development are the village of Ladbroke and the town of Southam. There are sizeable areas of improved and amenity grassland, particularly around the Dallas Burston Polo Club north of Southam and scattered areas of broadleaved woodland throughout the area including Berryhill Plantation, Ladbroke Fox Covert, Windmill Hill Spinney, and Bascote Heath Wood, with the largest woodland in the area being Long Itchington and Ufton Woods SSSI. The Oxford Canal, the River Itchen, and two unnamed tributary watercourses of the River Itchen and an unnamed tributary watercourse of the River Leam are crossed by the route of the Proposed Scheme.

Designated sites

7.3.3 There is one statutory designated site located within 500m of the land required for the construction of the Proposed Scheme: Long Itchington and Ufton Woods SSSI, which is of national value. The route of the Proposed Scheme passes beneath the SSSI in tunnel. The SSSI is oak-dominated ancient semi-natural woodland and is designated

on the basis of being one of the best oak-hazel coppice woodlands in the Midlands that is still managed along traditional lines. The wood is predominantly pedunculate oak high forest over a species rich shrub layer. It is situated on poorly drained clay soils overlying a white lias limestone ridge in central Warwickshire. The rich ground and shrub flora exhibits a range of species composition related to these soils. The woodland is important for many breeding birds such as warblers, stock dove, nuthatch and woodpeckers. Tawny owl and woodcock are also known to breed in the wood[19].

7.3.4 There are two types of woodland within the SSSI. On the higher slopes to the south the woodland is predominantly pedunculate oak – ash – hazel woodland on damp heavy soils, with an understorey and field layer dominated by bramble and tufted hair grass with abundant rush and sedge species. The lower northern slopes of the woodland support an uncommon form of calcareous ash – wych elm woodland on heavy soils[20].

7.3.5 No Local Wildlife Sites (LWS) are considered to be relevant to the assessment.

7.3.6 In addition to the area of ancient woodland at Long Itchington and Ufton Woods SSSI, the only ancient woodland relevant to the assessment is Thorpe Rough ancient semi-natural woodland. Thorpe Rough is situated near Heath Farm south-east of Long Itchington and Ufton Woods SSSI and lies adjacent to the land required for construction of the Proposed Scheme. Ancient woodlands represent an irreplaceable resource.

Habitats

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

Woodland

7.3.8 Long Itchington and Ufton Woods SSSI contains ancient semi-natural woodland that is lowland mixed deciduous woodland, a habitat of principal importance identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[21]. National Vegetation Classification (NVC)[22] surveys carried out in support of the assessment found the majority of the woodland consists of tall pedunculate oak and ash standards over hazel coppice, with field maple, common hawthorn, Midland hawthorn and holly in the understorey. The NVC community was principally the ash woodland W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis*, with three sub-communities recorded. This woodland community is particularly associated with coppice management and generally distributed in the south-east of England[23]. The woodland habitats within the SSSI are of national value.

7.3.9 Thorpe Rough was not accessible in time for NVC surveys but contains mature ash and oak, along with field maple, hawthorn and a dense understory including brambles and bluebells. Almost 8ha of the woodland is ancient semi-natural woodland and forms part of continuous woodland habitats between Long Itchington and Ufton Woods

[19] Natural England (date unknown), *Long Itchington and Ufton Woods SSSI citation*.
[20] Natural England (1983), *Phase I habitat survey of Long Itchington and Ufton Woods* (survey sheets).
[21] *Natural Environment and Rural Communities Act 2006* (Chapter 16), London. Her Majesty's Stationery Office.
[22] NVC is a detailed survey and classification system that is used to compare plant communities with a range of defined community types.
[23] Hall, J E, Kirby, K J & Whitbread, A M (2001), *National Vegetation Classification: Field guide to woodland*. Joint Nature Conservation Committee, Peterborough.

SSSI and the River Itchen. This woodland is considered to be up to county/metropolitan value.

7.3.10 Bascote Heath Wood is 2.3ha of broadleaved woodland which is not listed as ancient woodland on the Natural England inventory. Surveys were not possible of this woodland, although the woodland appears to contain abundant rhododendron and lacks any native shrub layer. However, Bascote Heath Wood is directly across the B4225 Bascote Heath Road from Long Itchington and Ufton Woods SSSI and is connected by mature hedgerows to Thorpe Rough ancient semi-natural woodland, forming part of continuous woodland habitats between Long Itchington and Ufton Woods SSSI and the River Itchen. In the absence of survey information, this woodland is considered to be of district/borough value.

7.3.11 Two adjacent areas of broadleaved secondary woodland are close to the border between the Ladbroke and Southam area and the adjacent area, directly east of Wormleighton: Fox Covert (in the Greatworth to Lower Boddington area, CFA15) also known as Glyn Davis Wood; and Berryhill Plantation. A small section of Fox Covert is within the area of land required for the construction of the Proposed Scheme; Berryhill Plantation is adjacent to the area of land required for the construction of the Proposed Scheme. Berryhill Plantation was not surveyed due to lack of access but appears to be a recent plantation and is likely to support lowland mixed deciduous woodland, a habitat of principal importance. Fox Covert (Glyn Davies Wood) is dominated by ash and oak with a bramble, hawthorn and elder understorey. These woodlands are each of district/borough value.

7.3.12 A section of woodland close to the fish ponds at Lower Radbourne, along an unnamed tributary of the River Itchen, was not surveyed due to lack of access but potentially includes recently planted wet woodland, a habitat of principal importance. This woodland is within the area of land required for the construction of the Proposed Scheme and is likely to be of district/borough value.

7.3.13 Ladbroke Fox Covert near Woodlands House Farm, south-east of Ladbroke, is adjacent to the land required for construction of the Proposed Scheme. The woodland is not listed as ancient woodland on the Natural England inventory but is well established, showing on Ordnance Survey maps of 1887[24], and is likely to support lowland mixed deciduous woodland, a habitat of principal importance. No surveys were possible of this woodland due to lack of access but it is likely to be of district/borough value.

7.3.14 Directly east of Ladbroke is Windmill Hill Spinney containing secondary woodland and scrub on a north-facing slope situated on a limestone escarpment on the west side of Ladbroke Hill, within the land required for construction of the Proposed Scheme. This site includes lowland mixed deciduous woodland, a habitat of principal importance, which is well established, showing on Ordnance Surveys maps of 1887. The woodland also includes an area of scrub to the west that has remnants of calcareous grassland, also a habitat of principal importance. The woodland is a relatively young and species-poor form of the ash woodland W8 *Fraxinus excelsior-Acer campestre-Mercurialis*

[24] Ordnance Survey (1887), County Series Map of Warwickshire, 1:2,500 scale.

perennis woodland. The Warwickshire notable plant[25] hairy violet was identified within the woodland during surveys. The vegetation community reflects a transition from tall scrub to woodland. On the southern edge of the woodland, at the top of the escarpment slope, there is a clear delineation between mature woodland and adjoining mature scrub, identified from field observations as the hawthorn community W21 *Crataegus monogyna-Hedera helix* scrub. West of the spinney, there is an area of neglected grassland, with numerous mature stands of hawthorn scrub that have grown to exclude much of the grassland. In between the scrub blocks is a false oat grassland community MG1 *Arrhenatherum elatius* grassland. The woodland and associated edge habitats have district/borough value.

7.3.15 Hill Farm Wood is divided into three parts: adjacent to the southern verge of the A425 Leamington Road near to Thorpe Bridge, north of the A425 Leamington Road near to Thorpe Bridge and along the River Itchen. The woodland along the southern verge of the A425 Leamington Road is within the land required for the construction of the Proposed Scheme to which access for survey was not available. The woodland contains lowland mixed deciduous woodland, a habitat of principal importance. NVC surveys carried out on the woodland north of the A425 Leamington Road recorded the ash woodland communityW8 *Fraxinus-excelsior-Acer campestre-Mercurialis perennis* and, although plants notable in Warwickshire were recorded (spurge laurel, broad-leaved helleborine and early-purple orchid), the woodland species and structural diversity was reduced towards the eastern end of the woodland where the canopy is dominated by Scots pine with sycamore, and elder. The woodland contains a number of large ponds with no emergent vegetation. Hill Farm Wood, with associated ponds, is considered to have district/borough value.

7.3.16 There are other small strips of secondary woodland which generally follow unnamed tributary watercourses such as the unnamed tributary of the River Itchen near Ladbroke, which is contiguous with Ladbroke Fox Covert. These woodlands have local/parish value.

Hedgerows

7.3.17 There are 17 hedgerows within the land required for the construction of the Proposed Scheme that meet the wildlife and landscape criteria under the Hedgerow Regulations 1997[26]. Of these, four also qualify under the archaeological and historical criteria defined in the Hedgerows Regulations 1997 as explained in Section 6. There are also eight species-rich hedgerows within the land required for construction of the Proposed Scheme. Important and species rich hedgerows qualify as a habitat of principal importance; these hedgerows are not abundant and have district/borough value.

7.3.18 The remaining hedgerows surveyed were species poor and are common within the arable landscape; these have local/parish value. However due to the wildlife corridors that they create, the hedgerow network within the land required for construction of the Proposed Scheme is considered to be of district/borough value.

[25] Warwickshire notable plants are indicative of good quality habitats within the county including some ancient woodland indicators, as identified by the Warwickshire Flora Group, although they are not rare or scarce in the county.
[26] *The Hedgerows Regulations 1997* (1997 No. 1160), London. Her Majesty's Stationery Office.

Watercourses

7.3.19 The Oxford Canal, the River Itchen, two unnamed tributary watercourses of the River Itchen and an unnamed tributary watercourse of the River Leam will be crossed by the route of the Proposed Scheme. These watercourses support typical bank side vegetation and occasional wet woodland species. The Warwickshire, Coventry and Solihull Local Biodiversity Action Plan (LBAP)[27] lists rivers, streams and canals as priority habitats.

7.3.20 NVC surveys on the Oxford Canal recorded tall ruderal stands of wetland species such as meadowsweet and great willowherb. The co-dominant communities were the meadowsweet mire M27 *Filipendula ulmaria-Angelica sylvestris* and the great willowherb open habitat OV26 *Epilobium hirsutum* community, which form a complex mosaic. The Oxford Canal includes eutrophic standing water, a habitat of principal importance which is declining at a national level. Habitat surveys were not carried out on the River Itchen due to a lack of access.

7.3.21 The Oxford Canal and the River Itchen form wildlife corridors through the landscape and are each considered to be of district/borough value. Whilst minor watercourses (tributaries) are likely to provide wildlife corridors and habitats for aquatic species, these are considered unlikely to be of more than local/parish value.

Water bodies

7.3.22 There are 24 water bodies within the area of land required for the construction of the Proposed Scheme of which 11 have been surveyed for amphibians and three have had detailed habitat surveys. None of the three ponds which have had detailed habitat surveys are likely to meet the Warwickshire LWS selection criteria[28] and the majority of the small field ponds within the land required for the construction of the Proposed Scheme are of local/parish value. The exceptions are:

- a pond immediately south of the Southam Industrial Estate and adjacent to the B4451 Kineton Road, which acts as a drainage lagoon and supports the nationally scarce and Warwickshire scarce[29] aquatic plant water soldier. The pond supports a good range of animals and plants, including fifteen macro-invertebrate families, and is within the land required for the construction of the Proposed Scheme. This pond qualifies as a habitat of principal importance and has district/borough value; and

- a large ornamental pond within Dallas Burston Polo Club south-east of Bascote Heath Wood, which supports a rich macro-invertebrate assemblage (including twenty-two families) indicative of very good water quality, and an aquatic plant assemblage including sea clubrush, a Warwickshire rare plant[30]. This pond is approximately 30m from the land required for construction of the Proposed Scheme and is above the proposed Long Itchington Wood tunnel. Barbastelle bat and a number of other bat species have been recorded foraging along the edges of this pond and, along with the presence of sea

[27] *Warwickshire, Coventry and Solihull Local Biodiversity Action Plan (L BAP)* at http://heritage.warwickshire.gov.uk/ecology/lbap/.
[28] *Guidance for the selection of non-statutory SINCs in Warwickshire* (Warwickshire Wildlife Sites Project, 1998).
[29] Warwickshire scarce plants are those found in four to ten sites in the county.
[30] Warwickshire rare plants are those found in three sites or less in the county.

clubrush, would qualify the pond as a habitat of principal importance. This pond has district/borough value.

7.3.23 As a precautionary assessment, ponds that have not been accessed for either Phase 1 habitat or detailed habitat assessment are assumed to be up to district/borough value. The ponds which have had a Phase 1 habitat survey and which have been scoped out of further detailed habitat survey are assessed as having local/parish value.

Grassland

7.3.24 Grassland occurs more frequently between Ladbroke and Long Itchington and Ufton Woods SSSI. This includes a mixture of small improved and semi-improved grassland fields, likely used for grazing livestock. Although there are outcrops of lias limestone across Warwickshire, there is no evidence of large areas of notable calcareous grassland. There is anecdotal information[31] of remnant calcareous grassland near Windmill Hill Spinney. However, recent scrub encroachment and nutrient enrichment along the adjacent field margins has reduced the ecological value of this habitat. There are sections of semi-improved grasslands and a large area of amenity grassland within the Dallas Burston Polo Club near Stoney Thorpe Farm. The amenity grassland is very species poor, intensively managed and regularly mown to provide a surface for polo matches and training.

7.3.25 There are no known notable grasslands within the land required for the construction of the Proposed Scheme and grasslands recorded are of no more than local/parish value.

Other habitats

7.3.26 There is a veteran oak tree within the land required for the construction of the Proposed Scheme on the north verge of the Stoneton Lane and Banbury Road, near Fox Covert (Glyn Davis Wood). There are also scattered patches of scrub and buildings within the land required for the construction of the Proposed Scheme. None of these features are more than of local/parish value.

7.3.27 The Phase 1 habitat data from aerial photography and surveys show that the study area is mostly large arable fields with occasional hedgerows and trees. The large majority of land surveyed during Phase 1 habitat surveys was intensively cultivated and bordered by hedgerows with narrow field margins. Arable land is found across the area and in the wider countryside. This habitat has negligible value.

Protected and/or notable species

7.3.28 A summary of the species relevant to the assessment is provided in Table 12.

[31] Personal communication with Warwickshire plant recorder and Butterfly Conservation representative at Warwickshire recorders meeting 05 November 2012.

Table 12: Protected and/or notable species

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Bats	Up to regional	Population of barbastelle bat using the habitats around the Dallas Burston Polo Club and north toward the Grand Union Canal[32], including Woodmeadow Farm, Long Itchington and Ufton Woods SSSI and Thorpe Rough	Low levels of commuting and foraging activity recorded during static and transect surveys of barbastelle bat which is a nationally rare Annex II[33] species. No known roost sites for this species are nearby. Habitats between Long Itchington and Ufton Woods SSSI and the Grand Union Canal are also particularly suitable and it is assumed that the species could use these habitats although this was not confirmed during surveys.
	County/ metropolitan	Assemblage of bats using the habitats around the Dallas Burston Polo Club and north toward the Grand Union Canal, including Woodmeadow Farm, Long Itchington and Ufton Woods SSSI and Thorpe Rough	Minimum of eleven bat species recorded (excluding the barbastelle population which has been valued as regional level) including whiskered, Brandt's, serotine, Leisler's, Daubenton's, noctule and Natterer's. Leisler's bat is a rare species within Warwickshire. Noctule is considered to be a rarer bat in the UK and is uncommon for Warwickshire. Noctule is a species of principal importance identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[34]. There is a collection of tree roosts within and around Thorpe Rough supporting a breeding population of Natterer's bat, Daubenton's bat and individual brown long-eared and noctule bats. A record of a maternity roost for brown long-eared bat is at Bascote Heath, located close to the southern boundary of the SSSI. Brown long-eared bat is a species of principal importance.
	County/ metropolitan	Population of brown long-eared bat using one residential building roost south of Southam, west of the A4451 Kineton Road	Survey evidence suggested the presence of a brown long-eared maternity roost within one building located within 100m of land required for the construction of the Proposed Scheme. One brown long-eared bat was found during inspection survey and approximately 1000 droppings recorded within the building. Brown long-eared bat is a species of principal importance.

[32] The Grand Union Canal lies to the north of this area, falling within the adjoining area, Offchurch and Cubbington (CFA17).
[33] Species listed on Annex II of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the Habitats Directive). This is the means by which the European Community meets its obligations as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). In the UK the Directive has been transposed into national laws by means of the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended) as consolidated by The Conservation of Habitats and Species Regulations 2010 (as amended – the Habitats Regulations). Annex II species are rare/threatened on a European level.
[34] *Natural Environment and Rural Communities Act* 2006 (Chapter 16), Her Majesty's Stationery Office.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Up to district/borough	Bat assemblage associated with roosting, foraging and commuting habitat around Stoneton and Wormleighton, particularly associated with the Oxford Canal and several of the hedgerows that form habitat links between the village of Wormleighton, the Oxford Canal and Newfield Pool	Surveys undertaken in 2011 to inform the EIA for the proposed Stoneton Wind Farm near Wormleighton[35] identified common pipistrelle, soprano pipistrelle and noctule within land required for the construction of the Proposed Scheme with additional bat passes identified as *Myotis* sp. and noctule/serotine/Leisler's. Several trees with high bat roost potential were also identified within land required for the construction of the Proposed Scheme in addition to one building roost found to support a summer (non breeding) roost for common pipistrelle. Soprano pipistrelle and noctule are species of principal importance. Moderate levels of activity by an assemblage of bat species including noctule, *Myotis* sp. and low levels of Leisler's bat have been identified during static surveys to support the assessment of the Proposed Scheme near Wormleighton Grange Farm which is assumed to belong to the same assemblage as that at Stoneton and Wormleighton.
	District/borough	Bat assemblage associated with foraging and commuting habitat surrounding a farm near Windmill Hill Spinney (mainly woodland and arable field boundaries), and potential roosting habitat within trees in this area	Surveys surrounding Ladbroke Hill Farm and Windmill Hill identified moderate levels of activity by commoner bat species including common pipistrelle and soprano pipistrelle. Occasional passes for noctule and *Myotis* sp. were confirmed. Soprano pipistrelle and noctule are species of principal importance. There was also low level of activity confirmed for Leisler's recorded during static surveys, a species rare for Warwickshire. One pass by serotine was recorded during static surveys in May 2013, an uncommon species within Warwickshire. No roosts were confirmed but many trees were recorded with high and medium bat roost potential.
	Local/parish	Bat assemblage associated with foraging and commuting habitat surrounding a farm south-west of the A423 Banbury Road, Southam	Low levels of activity recorded within habitats required for the construction of the Proposed Scheme by commoner bat species including common pipistrelle and soprano pipistrelle. Occasional passes for noctule and *Myotis* sp. were confirmed. Soprano pipistrelle and noctule are species of principal importance.
	Local/parish	Bat assemblage associated with foraging and commuting habitat surrounding habitats west of Radbourne Lane, adjacent to Ladbroke Fox Covert	Moderate levels of activity recorded along field boundaries (hedgerows) within land required for the construction of the Proposed Scheme. Species include common pipistrelle and soprano pipistrelle. Individual passes by noctule and *Myotis* sp. were also recorded. Soprano pipistrelle and noctule are species of principal importance.

[35] AECOM (2012), *Stoneton Wind Farm: Technical Appendices 4*. AECOM, Newcastle upon Tyne. Submitted in support of Planning Application reference 12/01500/FUL.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Population of common pipistrelle within a residential property along the A423 Banbury Road, Southam	One building within land required for the construction of the Proposed Scheme found to support a likely summer (non breeding) roost for common pipistrelle. Common pipistrelle is a common species both within Warwickshire and in England. Roost confirmed through inspection survey only and the numbers of droppings found and potential roost features identified are suggestive of a summer (non-breeding) transient roost.
	Local/parish	Population of common pipistrelle within a building associated with a farm, south-east of Long Itchington and Ufton Woods SSSI	One building within 100m of land required for the construction of the Proposed Scheme found to support a summer non breeding roost with a peak emergence of one. Common pipistrelle is a common species both within Warwickshire and in England.
Notable plants	National	Assemblage of plants within Long Itchington and Ufton Woods SSSI	Plants recorded from desk study include: bird's-nest orchid, on the Near Threatened Red list[36] and lesser butterfly-orchid, on the Vulnerable Red list and a species of principal importance. Surveys also found the Warwickshire rare plants: wild pear, hairy wood-rush and water avens, and the Warwickshire notable species: small-leaved lime, wild service tree, wood meadow grass, early purple orchid, common twayblade, wood millet and spindle. This range of species is associated with the ancient woodland habitat within Long Itchington and Ufton Woods and is part of the reason for designation of the SSSI.
	District/borough	Population of water soldier in a drainage lagoon near the B4451 Kineton Road	This plant, identified during surveys, is a Warwickshire Scarce and Nationally Rare species[37] and is restricted to aquatic habitats. The drainage lagoon is within the land required for construction of the Proposed Scheme.
	Up to district/borough	Population of spreading hedge-parsley at Bascote Heath, field south of Welsh Road, north of Long Itchington Wood	This plant, known only from desk study records, is a Nationally Scarce (BSBI, 2012) and a Warwickshire Scarce species. The record is within the land required for construction of the Proposed Scheme.

[36] IUCN. IUCN Red List Categories and Criteria: Version 3.1. 2001. IUCN Species Survival Commission, England, Switzerland and Cambridge, UK.
[37] Botanical Society of Britain and Ireland (2012), *Official list of Nationally Rare and Scarce species in the UK*. Online at www.bsbi.org.uk/resources.html. Accessed: September 2013.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Amphibians	County/ metropolitan	Assumed great crested newt metapopulation (AMP)[38]: AMP1, near Windmill Hill Spinney east of Ladbroke	AMP1 has a total of three water bodies, one of which has been fully surveyed; the other two water bodies did not have access permission for survey. The water body surveyed has a confirmed breeding population of great crested newts of medium population size class (peak count 11). This metapopulation also supports other amphibians (smooth newt and palmate newt). This metapopulation is partially within the land required for construction of the Proposed Scheme. Given the records provided from Warwickshire Biological Records Centre it appears that great crested newt is abundant within Warwickshire and, given the results collated, it is likely that great crested newts are widespread within the area. However, ponds which support breeding populations of great crested newt meet the criteria for LWS selection in Warwickshire[39].
	County/ metropolitan	AMP2, east of A425 Southam Road to the north of Ladbroke	AMP2 has a total of ten water bodies, eight of which have been surveyed. This metapopulation has confirmed breeding population of great crested newts of medium population size class. This metapopulation also supports other amphibians (smooth newt and common toad). This metapopulation is partially within the land required for construction of the Proposed Scheme.
	County/ metropolitan	AMP5, south-east of Bascote Heath to the south of Welsh Road	AMP5 has a total of two water bodies, both of which have received incomplete surveys. Both water bodies have confirmed breeding populations of great crested newts and the metapopulation supports a medium population size class. This metapopulation also supports other amphibians (smooth newt, palmate newt, common frog and common toad). This metapopulation is outside of the land required for construction of the Proposed Scheme.
	County/ metropolitan	AMP4, north of Leamington Road, A425, west of Southam	AMP4 has a total of two water bodies, both of which have received incomplete surveys. This metapopulation has a medium population size class of great crested newts (peak count of 12) in one of the water bodies and it is assumed that this species is breeding. This water body also supports other amphibian species (common frog and common toad). This metapopulation is partially within the land required for construction of the Proposed Scheme.

[38] A great crested newt metapopulation is a group of associated populations made up from newts which both breed in the ponds and live in the terrestrial habitat around a cluster of ponds. The newts are likely to return to the same pond each year; however, there may be some interchange of newts between the ponds within the metapopulation. Assumed metapopulations (AMP) have currently been identified based on a combination of desk based information and survey results. Details of AMP are given in Volume 5: Appendix EC-002-003.

[39] Guidance for the selection of non-statutory SINCs in Warwickshire (Warwickshire Wildlife Sites Project, 1998).

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	County/ metropolitan	Confirmed breeding great crested newt population, within one water body (north-west of Lady Hill) which does not lie within a great crested newt metapopulation	This water body has received six complete and supports a medium population size class of great crested newts. It also supports smooth newts. The water body is outside of the land required for construction of the Proposed Scheme.
	County/ metropolitan	A great crested newt population near Wormleighton	Desk study information obtained from a committed development[40] (no surveys in support of the assessment due to access restrictions) indicate a breeding medium population size class of great crested newts and a low population size class of smooth newts. This metapopulation is outside of the land required for construction of the Proposed Scheme.
	Up to county/ metropolitan	Great crested newt populations in all ponds not subject to survey; outside of assumed great crested newt metapopulations	Using a precautionary approach, ponds which have not been surveyed could support breeding great crested newts of medium population size class.
	District/borough	AMP3, west of A423 Southam Road to the north of Ladbroke	AMP3 has a total of two water bodies, both of which have been surveyed (one complete and one incomplete). One of these water bodies has a small population size class (peak count of one) of great crested newts. This water body also supports smooth newts. The second water body supports no amphibians. This metapopulation is outside of the land required for construction of the Proposed Scheme.
	District/borough	AMP6, south of Bascote Heath to the north of A425 Leamington Road	AMP6 has a total of four water bodies, all of which have been surveyed (two complete and two incomplete). One water body, surveyed fully, supports a confirmed breeding population of great crested newts of small population size class (peak count of four). Both completed water bodies support other amphibians (smooth newt, common frog and common toad). This metapopulation is partially within the land required for construction of the Proposed Scheme.
	District/borough	Palmate newt population in one water body (near to Lady Hill) outside of the six great crested newt metapopulations	This water body does not contain great crested newt but supports palmate newt. There are very few records of this species within Warwickshire or within the local area. This pond is within the land required for construction of the Proposed Scheme.

[40] AECOM (July 2011), *Stoneton Wind Farm. Great Crested Newt Survey Report*. AECOM, Newcastle upon Tyne. Submitted in support of Planning Application reference 12/01500/FUL.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Amphibian population in six individual water bodies which lie outside of the six great crested newt metapopulations	There are no additional water bodies with great crested newt presence outside of the metapopulations identified. The surveys found other amphibians in six additional water bodies; two support common frog, three support smooth newts (one supporting a medium size class and two supporting a small size class) and four support common toad (all supporting a small size class).
Reptiles	County/ metropolitan	Breeding adder population at Ladbroke Hill Farm, Southam	Juvenile adder found during surveys indicating a breeding population within the land required for construction of the Proposed Scheme. Although the adder has a wide distribution in Britain, its distribution is sparse in the Midlands. It is understood that adder was thought to be almost extinct within Warwickshire[41]. There have been county surveys for adder at 18 sites in the last three years, but only three of these sites are now thought to have potential for adders[42]. None of these sites is close to the Ladbroke and Southam area. Anecdotal evidence suggests a continued decline in the county which mirrors a national decline. The adder is therefore considered to be of rare occurrence in the county.
	Local/parish	Populations of grass snake recorded at the B4451 Kineton Road in Southam and at Ladbroke Hill Farm, Southam	Low population size class of grass snake recorded during surveys at Ladbroke Hill Farm and medium population size class recorded at the B4451 Kineton Road within the land required for construction of the Proposed Scheme. Grass snake is widespread within Warwickshire.
	Up to local/parish	Populations of reptiles in suitable habitat not surveyed	Grass snake populations are likely to be common but restricted to suitable habitat which includes habitats within and adjacent to watercourses such as the Oxford Canal, the River Itchen and the Grand Union Canal.
Terrestrial invertebrates	County/ metropolitan	Assemblage within Long Itchington and Ufton Woods SSSI	Five noteworthy invertebrate species were recorded during 2013 and it is thought that this is a conservative estimate of the number of notable species that could be present given the habitat features present.
	District/borough	Assemblage using woodland and arable margin habitat at Ladbroke Hill Farm near Ladbroke	The site supports a species of principal importance, the large garden bumblebee (*Bombus ruderatus*). There is the possibility of the brown-banded carder-bee *Bombus humilis*, a species of principal importance, being present due to suitable foraging habitat (red clover margins), as well as other calcareous loving species such as marbled white butterfly within the land required for construction of the Proposed Scheme.

[41] Verbal communication with Warwickshire reptile and amphibian recorder during meeting arranged by Warwickshire County Council and Warwickshire Wildlife Trust in 2012.
[42] Warwickshire BAP Adder Species Action Plan Progress Report 2011-2007.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Otter	District/borough	Population using the Oxford Canal and the River Itchen	A confirmed otter holt was identified from surveys on the River Itchen in June 2013; an otter was found using an old open brick manhole approximately 70m north-east of Thorpe Bridge in Hall Farm Wood, outside of the land required for construction of the Proposed Scheme. Other potential holts were identified along the River Itchen close to Thorpe Bridge. Abundant evidence of otter (spraints) has been found on the Oxford Canal and the River Itchen. No evidence has been found on the unnamed tributaries of the River Itchen. Otter is a species of principal importance. Desk study results indicate the presence of juvenile otters on the River Itchen, indicating that this is within the territory of a breeding female otter. The national and county surveys concluded a trend showing the continued re-colonisation of otter to all main watercourses in the county, although likely to still be relatively few in number and transient, but breeding.
Fish	District/borough	Population in the River Itchen	No access was available for survey of a section of the River Itchen crossed by the route of the Proposed Scheme. However, surveys upstream and downstream of Thorpe Bridge on the A425 Leamington Road identified a species rich mixed coarse fish assemblage containing notable numbers of roach and bullhead, a species of conservation interest. As the River Itchen at the crossing point has similar characteristics to the reaches surveyed the fish population is assumed to have the same value.
	Local/parish	Population in the unnamed tributary of the River Itchen upstream of the fish ponds at Lower Radbourne	Species rich mixed coarse fish assemblage containing low number of larger cyprinid species.
	Up to local/parish	Populations in all other watercourses in the area	In discussion with the Environment Agency, no other watercourses were identified as requiring survey although they may provide suitable habitat for commonly occurring species. Using a precautionary approach, the fish populations within watercourses where no access was available are assumed to have up to the highest value achieved for watercourses sampled in this area.
Aquatic macro-invertebrates	Local/parish	Assemblage on the River Itchen	Surveys on the River Itchen 0.6km downstream of the Proposed Scheme crossing point, between Southam and the Dallas Burston Polo Club, recorded relatively high taxon richness with a community dominated by pollution intolerant taxa.
	Up to local/parish	Assemblages within all other watercourses in this area	In discussion with the Environment Agency, no other watercourses were identified as requiring survey although they may provide suitable habitat for commonly occurring species. Using a precautionary approach, the macro-invertebrate communities within watercourses where no access was available are assumed to have the highest assessment achieved for this area.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Hazel dormouse	Up to county/ metropolitan	Dormouse populations within suitably woody habitats in the area	No survey evidence in this area, although there was limited survey access. However, no evidence was found during full surveys on Long Itchington and Ufton Woods and adjacent connected habitats, which were considered the most suitable within the area to support hazel dormouse. Hazel dormouse is a species of principal importance.
Water vole	Up to county/ metropolitan	Potential remnant population on the River Itchen and associated tributaries at Lower Radbourne	No field observations from surveys although some watercourses had restricted access. Desk study records of water vole on the River Itchen and its tributaries near fish ponds at Lower Radbourne. Historic presence of water voles at both upstream and downstream locations along the River Itchen indicates the presence of suitable habitat features and the potential importance of this watercourse in maintaining connective corridors for water vole populations. Water vole is a species of principal importance and is uncommon within Warwickshire. There has been continued decline of this species throughout the county.
Birds	Up to county/ metropolitan	Population of breeding lesser spotted woodpecker at Long Itchington and Ufton Woods	A probable lesser spotted woodpecker territory was identified within Ufton and Long Itchington Woods. This species is on the Red List of Birds of Conservation Concern (BoCC)[43] and is a species of principal importance. A territory is considered to constitute more than 1% of the estimated county breeding population.
	County/ metropolitan	Population of breeding tree sparrow at Harp Farm, north of Ladbroke	Up to four tree sparrow breeding territories (two confirmed, two probable/possible). Tree sparrow is a Red List BoCC species and a species of principal importance. This population is thought to constitute more than 1% of the estimated county breeding population.
	County/ metropolitan	Wintering barn owl to the east of Ladbroke	A barn owl was recorded during a winter survey. Although barn owls have a large wintering range, this bird was recorded around midday and is therefore thought to roost nearby. A single barn owl is thought to be more than 1% of the estimated county population. Barn owls are a Schedule 1 species[44].
	Up to county/ metropolitan	Barn owl territory to the north of Wormleighton	Anecdotal information obtained from local recorders during a meeting with Warwickshire Wildlife Trust and Warwickshire County Council identified a barn owl nest site to the north of Wormleighton, within the land required for the construction of the Proposed Scheme.

[43] Gregory RD, Wilkinson NI, Noble DG, Robinson JA, Brown AF, Hughes J, Proctor DA, Gibbons DW and Galbraith CA (2002), The population status of birds in the United Kingdom, Channel Islands and the Isle of Man; an analysis of conservation concern 2002-2007. British Birds 95: 410-450.

[44] Specially protected or Schedule 1 birds receive full protection under the Wildlife and Countryside Act 1981 (as amended). In addition to the protection from killing or taking that all birds, their nests and eggs have under the Act, Schedule 1 birds and their young must not be disturbed at the nest.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	District/ borough	Population of breeding yellow wagtails using habitats along the Oxford Canal	Up to four yellow wagtail breeding territories (two confirmed, two probable/possible). Yellow wagtail is a Red List BoCC species and a species of principal importance; it is thought to be widespread in the regional farmland landscape.
	District/ borough	Population of breeding yellow wagtails at Starbold Farm, south of Southam	Up to three yellow wagtail breeding territories (one confirmed, two probable/possible).
	Local/parish	Assemblage of breeding birds along Oxford Canal	Field surveys recorded 63 bird species within this area of which 30 are notable. Eighteen notable species are thought to have bred on the site, including species such as green woodpecker and reed bunting, both species of principal importance. Species recorded (with the exception of yellow wagtail whose population at the site is of district/borough value) are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds within Ladbroke Hill Farm, east of Ladbroke	Field surveys recorded 54 bird species within this area of which 30 are notable. Seventeen notable species are thought to have bred on the site, including species such as reed bunting and yellow wagtail, species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds within Harp Farm, north of Ladbroke	Field surveys recorded 60 bird species within this area of which 31 are notable. Eighteen notable species are thought to have bred on the site, including species such as skylark and yellowhammer. Species recorded (with the exception of tree sparrow whose population at the site is of county/metropolitan value) are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds between Starbold Farm and Southam	Field surveys recorded 50 bird species within this area of which 24 are notable. Seventeen notable species are thought to have bred on the site, including species such as lapwing and reed bunting. Species recorded (with the exception of yellow wagtail whose population at the site is of district/borough value) are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds at Stoney Thorpe Home Farm, east of Ufton	Field surveys recorded 54 bird species within this area of which 23 are notable. Thirteen notable species are thought to have bred on the site, including species such as green woodpecker and reed bunting. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Assemblage of breeding birds to the south of Stoney Thorpe Hall, east of Ufton	Field surveys recorded 43 bird species within this area of which 16 are notable. Eleven notable species are thought to have bred on the site, including species such as green woodpecker and reed bunting. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds within Long Itchington and Ufton Woods	Field surveys recorded 34 bird species within this area of which 10 are notable. Eight notable species are thought to have bred on the site, including species such as marsh tit and spotted flycatcher, both species of principal importance. Species recorded (with the exception of lesser spotted woodpecker whose population at the site is of county/metropolitan value) are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds using habitats outside of Long Itchington and Ufton Woods, passing Bascote Lodge Farm and along the Grand Union Canal	Field surveys recorded 57 bird species within this area of which 25 are notable. Eighteen notable species are thought to have bred on the site, including species such as marsh tit and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of breeding birds within Woodmeadow Farm, north-east of Ufton	Field surveys recorded 45 bird species within this area of which 17 are notable. Eleven notable species are thought to have bred on the site, including species such as cuckoo, a species of principal importance and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of wintering birds along Oxford Canal	Field surveys recorded 46 bird species within this area of which 21 are notable, including species such as lesser redpoll and tree sparrow, species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of wintering birds within Ladbroke Hill Farm, east of Ladbroke	Field surveys recorded 46 bird species within this area of which 25 are notable, including species such as lesser redpoll and peregrine, a Schedule 1 species. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
	Local/parish	Assemblage of wintering birds within Harp Farm, north of Ladbroke	Field surveys recorded 46 bird species within this area of which 23 are notable, including species such as lapwing and woodcock, a species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Assemblage of wintering birds at Stoney Thorpe Home Farm, east of Ufton	Field surveys recorded 49 bird species within this area of which 21 are notable, including species such as lesser redpoll and reed bunting. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large/important populations were recorded.
Badger	Local/parish	At least three badger social groups with territories located wholly or partly within this area	Badgers are widespread throughout the UK and Warwickshire. The badger social groups within the study area are not likely to form a critical part of the county or district population.
White-clawed crayfish	Negligible	Potential populations in watercourses in the area	Limited data; may be no viable populations remaining on watercourses within the study area. Signal crayfish, which out-compete the native species, found during surveys on the Oxford Canal and the River Itchen. Additionally there are records of signal crayfish on nearby reaches of the River Itchen on both upstream and downstream locations of the Proposed Scheme. Due to the known declining status of white-clawed crayfish within Warwickshire, together with the recorded presence of non-native signal crayfish on the Oxford Canal and River Itchen watercourses where white-clawed crayfish were previously recorded, it is likely that any populations of the native species existing on these watercourses have now been lost.

Future baseline

Construction (2017)

7.3.29 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 Section 2.1, with further details provided in Volume 5: Appendix CT-004-000. It is not expected that these developments will significantly affect the character and value of ecological resources within the area.

Operation (2026)

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

7.4 Effects arising during construction

Avoidance and mitigation measures

7.4.1 The following measures have been included as part of the design of the Proposed Scheme and avoid or reduce impacts to features of ecological value:

- placing the route in bored tunnel beneath Long Itchington and Ufton Woods SSSI, significantly reducing habitat loss and severance in the SSSI, within ancient woodland and within habitats used by roosting, foraging and commuting bats near Dallas Burston Polo Club. Habitats within the Ladbroke and Southam area, in the vicinity of Long Itchington and Ufton Woods SSSI, are known to support low levels of activity by the rare barbastelle bat;

- reinstatement of the A425 Leamington Road and associated roadside scrub habitats above Long Itchington Wood green tunnel will maintain a suitable habitat link for commuting bats and avoid habitat severance;
- raising the alignment through Boddington cutting near the southern boundary of the area, requiring less land for construction, including a reduction in the loss of woodland at Fox Covert (Glyn Davis Wood) near the Northamptonshire border;
- reducing the land required for construction within Windmill Hill Spinney;
- viaducts or overbridges at the Oxford Canal, the River Itchen, two unnamed tributary watercourses of the River Itchen near the fish ponds at Lower Radbourne and an unnamed tributary watercourse of the River Leam at Longhole Bridge which negate the need for culverting and will retain wildlife connectivity along these watercourses for species such as otter and bats. There will also be connectivity under the route of the Proposed Scheme provided by Wills Pastures Road underpass;
- watercourse diversions to prevent the need for culverting of the River Itchen north of Southam and the unnamed tributary watercourse of the River Leam at Longhole Bridge;
- avoidance of in-channel structures associated with viaducts and bridges to prevent impacts to watercourse habitat, form and function;
- minimising the length of required culverts through watercourse realignment works on the unnamed tributary of the River Itchen near Ladbroke Fox Covert to reduce the extent of stream habitat loss; and
- 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.

7.4.2 The assessment assumes implementation of the measures set out within the draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-003-000), which includes translocation of protected species where appropriate.

Assessment of impacts and effects

Designated sites

7.4.3 The only designated site expected to experience impacts is Long Itchington and Ufton Woods SSSI, through the construction of a bored tunnel for the Proposed Scheme under the SSSI. There will be no requirement for surface land within the SSSI. Potential impacts from construction of the bored tunnel are:

- settlement over the tunnel leading to habitat damage through soil movement and surface water pooling;
- interruption of groundwater flow beneath the SSSI; and
- disturbance of breeding birds for which the woodland is important.

7.4.4 Construction of the tunnel beneath the SSSI could lead to some settlement of ground. In the absence of information from a geotechnical investigation, the settlement has been estimated as a 'worst case' maximum of 40mm. Settlement could affect a ground area with a maximum total width of 150m along the length of both tunnels; the length of tunnels beneath the SSSI will be approximately 750m. The settlement could therefore extend across an area of 11.3ha (approximately 14% of the area within the SSSI boundary). The depth of settlement, and therefore potential impacts on soil and flora, will be greater directly over the tunnel centres and will reduce with distance from the tunnel centres.

7.4.5 The area of settlement would extend largely through the pedunculate oak – ash – hazel woodland and the higher slopes which are on heavy clay soils. In the southern half of the woodland the tunnel will be below hazel coppice stools and the main north-south and east-west tracks through the woodland.

7.4.6 A characteristic of many clay soils is that they naturally swell in volume when wet and reduce in volume as they dry. 'Shrink-swell', as this phenomenon is known, tends to occur near the ground surface. Therefore clay soils undergo normal seasonal movements associated with changes in rainfall and vegetation growth. Given that settlement of 40mm is a 'worst case' and that this depth of settlement would only occur above the centre of the bored tunnels, it is unlikely that this settlement would cause adverse impacts on the trees, understorey or ground flora within the woodland. The settlement will not cause loss of ancient woodland soils or the seed bank.

7.4.7 Ground settlement could lead to hydrological effects, such as pooling of surface water and possible disruption of surface water flow. There are wet areas within the southern part of the pedunculate oak – ash – hazel woodland dominated by sedges, and ditches are present on the southern edge of the woodland close to Bascote Heath Road. Given that the settlement will be minor and will largely affect a part of the woodland already on heavy clay soils, supporting rushes and sedges (these plants are particularly common along ditches and rides, the latter due to compaction by vehicles), then small areas of surface water pooling created by settlement, if they occurred, will not be out of character. Given the gradient and lack of current pools or ditches in the ash – wych elm woodland on the northern slopes of the SSSI it is unlikely that settlement will result in any noticeable changes to surface water. There are no impacts expected in relation to ground slippage or soil movement as a result of construction of the Proposed Scheme. The retaining wall constructed at the northern tunnel portal will prevent landslips and will act to stabilise the ground.

7.4.8 The deep cutting at the northern Long Itchington Wood tunnel portal is within geology designated as an aquifer. Dewatering may be required to facilitate construction in this area. However, no significant effects on groundwater flow or levels near the SSSI have been identified (see Section 13). The tunnel beneath the SSSI will be bored and therefore dewatering in this area will not be required. There are no expected impacts on the SSSI as a result of changes to groundwater flow or levels.

7.4.9 Taking into account the potential impacts within the SSSI discussed above, it is not expected that the Proposed Scheme will have an adverse effect on the integrity of Long Itchington and Ufton Woods SSSI.

Habitats

7.4.10 There is 12ha of woodland within the land required for the construction of the Proposed Scheme within this area, the majority of which is broadleaved with 0.3ha being coniferous plantation and with many thin belts of woodland along field boundaries, roads and watercourses. The impacts on woodland habitats will include the following:

- loss of 1.9ha of secondary woodland from within Fox Covert (Glyn Davis Wood), approximately one third of the woodland. The effects on Fox Covert are reported in the Greatworth to Lower Boddington area report (CFA15). However, the Proposed Scheme will also cause severance of habitat between Fox Covert and Berryhill Plantation on the eastern side of Stoneton Lane (within this area). There will be severance of mature hedgerows and woodland strips, on the western side of Stoneton Lane. There will also be loss of approximately 0.3ha within Berryhill Plantation due to the realignment of Stoneton Lane although this loss will be minimal and along the road edge. The permanent loss and severance of habitat will result in a permanent adverse effect on the conservation status of Berryhill Plantation which will be significant at a district/borough level;
- loss of 1.8ha of secondary woodland around the fish ponds at Lower Radbourne (approximately 38% of the woodland present), which will result in a permanent adverse affect on conservation status that is likely to be significant at a district/borough level; and
- loss of 1.7ha of secondary woodland, scrub and associated grassland at Windmill Hill Spinney due to the construction of Ladbroke Cutting. The Proposed Scheme will result in loss of approximately 30% of Windmill Hill Spinney. The permanent loss and severance of the spinney is likely to result in a permanent adverse affect on the conservation status of the woodland and associated habitats which will be significant at a district/borough level.

7.4.11 Losses of woodland that will be significant at a local/parish level are reported in Volume 5: Appendix EC-005-003. Cumulative effects of loss of woodland are dealt with in Volume 3.

7.4.12 There is 0.5ha of Hill Farm Wood, adjacent to the A425 Leamington Road, within the land required for the Proposed Scheme. The woodland will be retained to screen a balancing pond and would not be lost.

7.4.13 There is approximately 34.5km of hedgerow within the land required for construction of the Proposed Scheme. This includes 17 hedgerows which are important for wildlife and landscape in the context of the Hedgerows Regulations 1997; a further eight species-rich hedgerows are within the land required for the Proposed Scheme although the majority of hedgerows that would be lost are species-poor.

7.4.14 The final length of hedgerow to be lost will depend on the detailed design and they will be retained where practical, but as a precautionary approach for the purposes of assessment, it is assumed that all of the hedgerows will be lost. Hedgerows form wildlife corridors within a largely arable landscape and are therefore important for habitat connectivity. The large amount of hedgerow loss across the landscape is likely

to result in widespread habitat severance along the route of the Proposed Scheme. The loss and severance of hedgerows will cause an adverse impact on the conservation status of hedgerows which will be significant at a district/borough level.

7.4.15 Taking a precautionary approach to assessment, the loss of ponds within the land required for the construction of the Proposed Scheme could result in a permanent adverse effect on the conservation status of water bodies that, in each case, would be significant at up to the district/borough level.

7.4.16 The culvert crossing and associated realignment works of the unnamed tributary watercourse of the River Itchen near Ladbroke Fox Covert spans an approximate watercourse length of 70m. This will result in direct permanent adverse impacts on watercourse habitat, form and function and will reduce the value of the watercourse as a wildlife corridor due to the lack of natural bank side habitat. This will have a permanent adverse effect on the conservation status of this watercourse that will be significant at a district/borough level.

7.4.17 It is considered unlikely that any other effects on habitat receptors at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-003.

Species

7.4.18 Long Itchington and Ufton Woods SSSI is important for a number of bird species such as warblers, stock dove, nuthatch, and woodpeckers. Tawny owl and woodcock also breed within the wood. All these birds are mentioned on the SSSI citation and lesser spotted woodpecker was recorded during surveys. The southern portal of the Long Itchington Wood tunnel is sufficiently distant from the SSSI that disturbance of breeding bird populations will not represent an adverse affect. There may be localised disturbance of the breeding birds using the SSSI from noise, lighting and movement during construction of the tunnel at the northern portal. However, due to the separation of the northern portal from the SSSI boundary and the size of the woodland (giving birds a chance to take refuge from disturbance elsewhere within the woodland) there are no expected significant effects on the conservation status of breeding birds within the SSSI.

7.4.19 The construction process will cause temporary loss of habitats used by birds, together with disturbance of adjacent habitats. In areas of open farmland this would cause minimal effect as there is plenty of suitable alternative habitat nearby. However, for the wet woodland near the fish ponds at Lower Radbourne, the woodlands along the unnamed tributary of the River Itchen near Ladbroke Fox Covert and Windmill Hill Spinney, some of the affected species will have less alternative habitat to utilise and the effect is considered to be significant at local/parish level.

7.4.20 The Proposed Scheme may result in the removal of nesting and foraging habitat from a barn owl breeding territory to the north of Wormleighton, leading to loss of this territory. This will result in an adverse effect on the possible breeding pair of barn owl that will be significant at up to a county/metropolitan level.

7.4.21 There would be loss of five of the ten water bodies within assumed great crested newt metapopulation AMP2, east of the A425 Southam Road to the north of Ladbroke. Four of these ponds contain great crested newts of a medium population size class.

The remaining ponds have not been fully surveyed. There will also be loss of over half of the available terrestrial habitat affecting grassland and hedgerows which could be used by great crested newt and other amphibians for foraging and refuge. The metapopulation will be fragmented by the Proposed Scheme; with two water bodies retained to the south-west of the route and isolated from terrestrial habitat and other water bodies retained to the north-east of the route. These impacts will result in a permanent adverse effect on the conservation status of the amphibians within the metapopulation that will be significant at a county/metropolitan level.

7.4.22 At AMP1 near Windmill Hill Spinney, east of Ladbroke, there will be loss of one water body supporting a medium population size class of great crested newts and other amphibians. There will also be loss of less than a third of available terrestrial habitat affecting grassland and hedgerows which could be used for foraging and refuge. There will be no fragmentation or isolation of the metapopulation. These impacts will result in a permanent adverse effect on the conservation status of the amphibians within the metapopulation that will be significant at a county/metropolitan level.

7.4.23 There are no expected impacts on the other assumed great crested newt metapopulations within the area (AMP3, AMP4, AMP5 and AMP6).

7.4.24 There will be loss of 12 water bodies outside of assumed great crested newt metapopulations, three of which have received full surveys (finding palmate newts in one, smooth newts and common frogs in another and no amphibians in the third), a further three water bodies have received incomplete surveys and the remaining six water bodies have not been surveyed. Should amphibians be present within water bodies which have not received full survey the Proposed Scheme will result in an adverse impact on the conservation status of amphibian populations which will, in each case, be significant at a county/metropolitan level. The drainage lagoon adjacent to the B4451 Kineton Road and the large ornamental pond within Dallas Burston Polo Club, which support great crested newt, will be retained.

7.4.25 The low population size class of reptiles (grass snake and adder) at Ladbroke Hill Farm is likely to be affected, due to the loss of the majority of the suitable habitat, severance of the remainder of the habitat and disturbance during construction. Given that adder were considered to be almost extinct in the county and the record of a juvenile at Ladbroke Hill Farm indicates a breeding population, the loss of this breeding population will have a permanent adverse effect on the conservation status of the species which will be significant at the county/metropolitan level.

7.4.26 There would be loss of habitats supporting a population of spreading hedge-parsley at Bascote Heath, north of Long Itchington Wood. This loss will have a permanent adverse effect on the conservation status of the population of spreading hedge-parsley which would be significant at the district/borough level.

7.4.27 Construction activities associated with installation of the River Itchen Viaduct will not result in the loss of the confirmed otter holt near Thorpe Bridge or any potential holts identified. Due to the design of viaducts there will be no permanent loss of navigable watercourse or riverine habitat for otters along the Oxford Canal, the River Itchen, or the two unnamed tributaries of the River Itchen near the fish ponds at Lower Radbourne. The bridging of these watercourses may offer further cover and territorial marking sites for otters. Construction activities along these watercourses, and

particularly near the River Itchen, may result in noise and visual disturbance to otter, potentially acting as a deterrent to otter commuting, causing temporary displacement from the confirmed holt and creating temporary barriers within an otter's territorial range. These impacts could result in a temporary impact during construction but will not result in a long-term adverse effect on the conservation status of the otter population concerned and will not be significant.

7.4.28 No current water vole populations have been confirmed within the Ladbroke and Southam area. However, desk study records of water vole presence on the unnamed tributaries of the River Itchen near the fish ponds at Lower Radbourne, where no survey has been possible due to access restrictions, suggest the possibility of a remnant population. Water voles rely on vegetative cover along commuting corridors and may be reluctant to cross open areas, or may be more vulnerable to predation by crossing open areas. The construction of viaducts along the River Itchen and two unnamed tributary watercourses of the River Itchen could cause temporary loss of continuous vegetation at watercourse margins resulting in habitat fragmentation and barrier effects to this species. However, due to the width and height of these features, significant permanent loss and severance of aquatic vegetation underneath viaducts in the area is unlikely. The requirement to install a box culvert on an unnamed tributary watercourse of the River Itchen near Ladbroke Fox Covert will result in the direct loss of natural bank side habitats although a mammal ledge will be provided. These impacts are not expected to result in an adverse effect on the conservation status of the assumed remnant water vole population and will not be significant.

7.4.29 Partial loss of Windmill Hill Spinney and associated habitats will result in loss of features that support terrestrial invertebrates. There is a general lack of broadleaved woodland or species-rich arable margins with good quality habitat for invertebrates within the study area. The permanent loss of these habitats will result in an adverse effect on the conservation status of invertebrate assemblages which will be significant at a district/borough level.

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

7.4.31 The impact of disturbance on bat populations will generally be localised and limited to the period of construction. Bats utilising retained habitats may be subject to irregular and localised disturbance from lighting and noise during the construction period where works in autumn, winter and spring may be carried out for short periods after dusk or prior to dawn. These impacts will only temporarily deter bats from using foraging and commuting habitats.

7.4.32 Only one confirmed transient bat roost for common pipistrelle would be lost due to demolition of the residential building along the A423 Banbury Road, Southam. Given that only individual bats were found to use the building as a transient non-breeding roost, the loss of the building will not significantly affect the conservation status of the population of common pipistrelle.

7.4.33 Construction works adjacent to a likely maternity building roost used by brown long-eared bat within a residential property south-west of the B4451 Kineton Road, may result in disturbance of bats using this roost. However, the adoption of measures within the draft CoCP will provide appropriate controls to prevent displacement of bats and the loss of this roost. Although there will be loss of potential commuting habitat along hedgerows between the building roost and Southam, this loss would be minor and commuting routes will be maintained between the roost and suitable foraging habitat within the floodplain of the River Itchen. These impacts will not significantly affect the conservation status of the population of brown long-eared bat.

7.4.34 Woodland habitat that will be lost at Windmill Spinney is used by a diverse assemblage of bats including: common pipistrelle and soprano pipistrelle, noctule, Leisler's, serotine and *Myotis* sp. Within Windmill Spinney no known tree roosts will be lost, although many trees with high and moderate potential to be used by roosting bats will be lost, reducing roosting opportunities within this area. The Proposed Scheme will result in the permanent loss and severance of key commuting routes along woodland edge and hedgerows. These severance impacts may displace bat populations away from preferred foraging and commuting habitats. Whilst the impacts on areas of key foraging and key commuting habitat will be localised, there is a low cover of woodland within the area, predominantly comprising fragmented pockets within a predominantly arable landscape. The combination of these impacts will lead to a temporary adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a district/borough level.

7.4.35 Very low levels of barbastelle bat activity have been confirmed within habitats associated with Dallas Burston Polo Club. It is considered likely that the main commuting routes to this area are along tall hedgerows within Dallas Polo Club which link the surrounding woodland areas including Thorpe Rough and Long Itchington and Ufton Woods SSSI. No confirmed roost sites, or habitats confirmed to support key foraging and commuting activity by barbastelle bat, will be lost. The presence of the Long Itchington Wood tunnel and Long Itchington Wood green tunnel are considered to minimise impacts on this species south of Long Itchington and Ufton Woods SSSI and no adverse effects on the conservation status of the population of barbastelle bat are expected.

7.4.36 A diverse assemblage of bats has been recorded using the habitats around the Dallas Burston Polo Club and north toward the Grand Union Canal, including Woodmeadow Farm, Long Itchington and Ufton Woods SSSI and Thorpe Rough. Eleven species of bat have been confirmed including whiskered, brandt's, serotine, Leisler's, Daubenton's, noctule and Natterer's. Bats utilising habitats to the north and south of Long Itchington and Ufton Woods SSSI may be subject to disturbance from lighting and noise during the construction of the Long Itchington Wood portal and associated temporary access track leading from the A425 Leamington Road. Works associated with the construction of the tunnel are to be undertaken 24 hours a day, seven days a week for up to two years. These impacts may deter bats from using the habitats around the portals and associated tunnel compounds (Long Itchington Wood south portal satellite compound, Long Itchington Wood green tunnel satellite compound and Long Itchington Wood tunnel main compound). No confirmed tree bat roosts have been identified within the SSSI but trees that support features with high

potential to support roosting bats are present along the northern edge of the SSSI. Disturbance may displace bat populations from roosting, foraging and commuting habitat along the woodland edge and adjacent hedgerows. The Proposed Scheme will result in loss and severance of hedgerows north of the SSSI, as the route of the Proposed Scheme approaches the Grand Union Canal. While the impacts on areas of key foraging and key commuting habitat would be localised, these habitats support a diverse assemblage of bats, some of which are rare within the UK. The combination of these impacts will lead to an adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a county/metropolitan level.

7.4.37 There will be limited loss of habitat used by bats in the Stoneton/Wormleighton area, including the fish ponds at Lower Radbourne. Access to assess the commuting and foraging activity and roosting potential of trees around the fish ponds at Lower Radbourne was not available but this represents a complex of habitats with good connectivity, set within a landscape dominated by arable fields. The Proposed Scheme will remove hedgerow links in this area for commuting bats and will remove trees with high potential for roosting bats, identified during surveys for the proposed Stoneton Wind Farm (AECOM, 2012). Habitats within land required for the construction of the Proposed Scheme are known to support an assemblage of bats including common pipistrelle, soprano pipistrelle, noctule with additional bat passes identified as *Myotis* sp. and noctule, serotine and Leisler's bats. The impacts on areas of key foraging and key commuting habitat will be localised and the Oxford Canal will still be available as a commuting and foraging corridor during and following construction. However, surveys for the Stoneton Wind Farm indicate that the network of hedgerows form key commuting routes between suitable foraging habitats associated with Newland Pool and buildings at Wormleighton which may support roosting bats. These impacts will lead to an adverse effect on the conservation status of the assemblage of bats concerned, that will be significant at a district/borough level.

7.4.38 It is considered 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-005-003.

Other mitigation measures

7.4.39 This section describes additional measures designed to reduce or compensate for significant ecological effects. These include habitat creation, habitat enhancement, green bridges and wildlife underpasses.

7.4.40 As a precaution, the ditches and surface water flow within Long Itchington and Ufton Woods SSSI will be monitored regularly by visual inspection during and following tunnel construction. If any pooling of water or change in surface water flows was found to be having a detrimental impact on the woodland habitat, suitable remedial measures will be agreed and implemented in discussion with Natural England.

7.4.41 There are six main ecological compensation areas in the Ladbroke and Southam area: an extension to Fox Covert (Glyn Davis Wood) near the Northamptonshire-Warwickshire border; an area of wet woodland and ponds adjacent to the fish ponds at Lower Radbourne; an area for woodland creation and watercourse enhancements near Ladbroke Fox Covert; woodland, scrub and grassland habitats adjacent to

retained sections of Windmill Hill Spinney; improvements of land within Dallas Burston Polo Club for bats; woodland creation and links between Long Itchington and Ufton Woods SSSI and wet woodland along the southern edge of the Grand Union Canal.

7.4.42 Compensation for woodland loss at Fox Covert and Berryhill Plantation will involve an extension to both woodlands near the Northamptonshire border. A 1.0ha woodland creation area will connect the woodlands into a single larger unit. The new woodland will be broadleaved native woodland with an open structure. The target condition of the woodland will be the habitat of principal importance, lowland mixed deciduous woodland. There will also be several hectares of broadleaved native woodland planting on the earthwork slopes either side of the maintenance sidings; this woodland will primarily be for screening purposes and to integrate the sidings into the landscape but will benefit biodiversity and will result in a net gain in woodland habitat in the local area. Banbury Road green overbridge (in the adjoining area) will increase the connectivity of this woodland planting on either side of Boddington cutting. There will be temporary adverse effects whilst the new woodland planting establishes and matures; which could be 50 years. However, many animals are likely to be able to utilise the new woodland creation and the hedgerows in advance of the woodland planting reaching full maturity. Following maturity, the compensation planting would reduce impacts on Fox Covert and Berryhill Plantation to a level at which they will not result in any significant effect on the conservation status of the woodland.

7.4.43 To compensate for the loss of woodland surrounding the fish ponds at Lower Radbourne, there will be creation of approximately 3.6ha of wet woodland adjacent to the fish ponds. It will also create wet woodland links between the two unnamed tributaries of the River Itchen and will create links between two small copses which are otherwise isolated in arable fields. The target condition of the woodland would be the habitat of principal importance, wet woodland. There will be temporary adverse effects whilst the new woodland planting establishes and matures, which could be over a period of 50 years. However, many animals are likely to be able to utilise the new woodland creation and wetland habitats within the first couple of years following creation. Following maturity, the compensation planting would reduce impacts to a level at which they will not result in any significant effect on the conservation status of the habitats concerned.

7.4.44 Although there will be no long-term adverse effects on the conservation status of otter the woodland creation area and woodland landscape planting near the fish ponds at Lower Radbourne, adjacent to the Oxford Canal, near the Oxford Canal viaduct and the Oxford Canal culvert will provide terrestrial cover for otter to compensate for the loss of potential terrestrial refuge habitat (woodland and scrub).

7.4.45 To offset the effect on the unnamed tributary of the River Itchen near Ladbroke Fox Covert, improvements will be made to the channel within the area of land required for construction of the Proposed Scheme. These measures will off-set the residual effects from culverting and could have beneficial effects on the conservation status of the watercourse habitats that would be significant at up to a district/borough level.

7.4.46 South-west of Ladbroke, woodland planting will extend Ladbroke Fox Covert on the northern side of the unnamed tributary of the River Itchen by 1.5ha and replace

woodland habitats lost along the watercourse (compensating for a local/parish effect as identified in Volume 5: Appendix EC-005-003). The target condition of the woodland would be the habitat of principal importance lowland mixed deciduous woodland. There will be temporary adverse effects whilst the new woodland planting establishes and matures, which could be over a period of 50 years. However, many animals are likely to be able to utilise the new woodland creation prior to maturation.

7.4.47 The compensation area adjacent to the retained part of Windmill Hill Spinney will include approximately 11ha of woodland and scrub planting, and 7.7ha of species-rich grassland. The grassland area will include ponds suitable for amphibians and there will also be hedgerow improvements at the edges of the compensation area. The compensatory woodland planting will occur on both sides of the route of the Proposed Scheme; along the steep south-facing slope of the limestone escarpment toward Ladbroke Hill Farm, and immediately adjacent to the retained part of the spinney to the west. The target condition of the created woodland will be the habitat of principal importance, lowland mixed deciduous woodland.

7.4.48 There will be temporary adverse effects whilst the new woodland planting establishes and matures, which could be over a period of 50 years. However, many animals are likely to be able to utilise the new woodland creation areas prior to maturation and the scrub and grassland areas are likely to be established within the first five years following planting. Following maturity, the created habitats will reduce impacts to a level at which they will not result in any significant effect on the conservation status of the habitats.

7.4.49 The creation of woodland, scrub and species rich grassland near Windmill Hill Spinney will provide habitat for the benefit of invertebrates, including butterflies such as marbled white and bumblebees, in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). Once these habitats are established (within five years), impacts will be reduced to a level at which they will not result in any significant effect on the conservation status of the habitats.

7.4.50 Woodland links will be created between Long Itchington and Ufton Woods SSSI and the Grand Union Canal, along the Proposed Scheme. The 3.5ha of woodland planting will be designed to reflect the range of species characteristic of those currently present. Woodland creation along the realigned unnamed tributary of the River Itchen south of the Grand Union Canal, approximately 0.85ha, will have a target condition of wet woodland. This woodland creation will provide foraging and nesting opportunities for woodland edge birds such as tree sparrows and song thrush and nesting opportunities for more woodland specialists such as lesser spotted woodpecker.

7.4.51 Tree sparrow populations within the areas surveyed within the Ladbroke and Southam area are reliant on nest holes in trees, and some nest sites may be lost. Tree sparrow nest boxes will be provided at the outer edges of the planting areas near the Oxford Canal and within the compensation area near Windmill Hill Spinney (compensating a local/parish effect as identified in Volume 5: Appendix EC-005-003).

7.4.52 In addition to the woodland creation areas included within the Proposed Scheme to compensate loss of ecologically valuable habitats, there are 48.9ha of woodland and scrub which are primarily for landscape purposes. Whilst these areas will not be

created and managed specifically for the benefit of wildlife, they will still be of value to wildlife. The larger areas of woodland landscape planting included in the Proposed Scheme are located: just south of PRoW SM116a near the Oxford Canal, north and south of the Oxford Canal viaduct, on the engineering slopes between Lower Radbourne Farm accommodation overbridge and the embankment near Ladbroke Fox Covert, and along the engineered slopes north and south of the A423 Banbury Road near Southam.

7.4.53 The pond containing the nationally rare water soldier (an aquatic plant) will be retained and incorporated into an area of landscape planting (species rich grassland with native scrub) south of Southam Industrial Estate. As an enhancement measure for water soldier, a new pond will be created within the landscape planting area and some of the water soldier within the existing drainage pond will be translocated to the new pond. Water soldier has a growth form that is well suited to translocation (free-floating/submerged)[45].

7.4.54 This landscape area will also incorporate the majority of the habitat likely to support the medium population size class of grass snake adjacent to the B4451 Kineton Road. This area will be improved specifically for grass snake, including management of the rough grassland and incorporation of egg laying habitat, and will act as a donor site for any reptiles which need to be translocated from the area required for construction of the Proposed Scheme.

7.4.55 Compensatory habitat to address impacts on adder and grass snake in the area will be provided within the ecological compensation area near Windmill Hill Spinney, in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). This is likely to include ponds as well as habitat suitable for refuge, basking and hibernation habitat sufficient to maintain the favourable conservation status of the populations affected.

7.4.56 Compensatory habitat to address impacts on great crested newt populations in the area will be provided within the aforementioned ecological compensation areas, particularly within the areas near Berryhill Plantation and near Windmill Hill Spinney, in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2).This will include the provision of replacement ponds, terrestrial habitat and hibernation habitat sufficient to maintain the favourable conservation status of the population affected.

7.4.57 Mitigation measures to reduce the effect of severance of habitat for several species including bats, amphibians, reptiles, and badgers include the following vegetated links on overbridges:

- Banbury Road green overbridge (Boddington), which lies within Greatworth to Lower Boddington (CFA15), will link woodland to the east and west of the route of the Proposed Scheme;
- Footpath SM101 green overbridge and adjacent hedgerows will link a commuting route known to be used by the Stoneton/Wormleighton bat assemblage along an existing track and hedgerow; and

[45] Palmer, M. (2008), *Plants of British standing waters: A conservation fact file*. Version 1. Joint Nature Conservation Committee.

- Windmill Lane green overbridge will allow connectivity to habitats associated with Windmill Hill Spinney.

7.4.58 Severance of habitats used by commuting bats during construction will be addressed by measures in accordance with the Principles of Ecological Mitigation identified within the Environmental Minimum Requirements (Volume 5: Appendix EC-008-001). These will include woodland planting between Long Itchington and Ufton Woods SSSI and the Grand Union Canal, planting along the Warwick Road, adjacent to the fish ponds near Lower Radbourne, along the Lower Radbourne access track, at Paxhall Farm, and along the road corridor leading to the western end of Windmill Hill Lane green overbridge.

7.4.59 Habitat in the ecological compensation areas will compensate for the loss of foraging habitat and will include artificial bat roosts to increase roosting opportunities. There is an ecological compensation area identified between Long Itchington and Ufton Woods SSSI and Thorpe Rough specifically to improve habitat for bats. The area will improve hedgerows and woodland links and provide a new water body to increase bat foraging opportunities. This area will also have artificial roosts suitable for summer roosting bats, particularly for the rare barbastelle and *Myotis* sp., as well as an underground bat cave suitable for a number of hibernating bat species. Following the implementation of the measures proposed it is expected that any adverse impacts on bats during the construction of the Proposed Scheme will be reduced to a level at which they will not result in any significant effect on the conservation status of the species concerned.

7.4.60 The creation of a bat cave between Long Itchington and Ufton Woods SSSI and Thorpe Rough will provide a net gain in suitable hibernation roosts within the area. If new roosting opportunities are utilised by rarer bat species including noctule, Leisler's and Natterer's, these mitigation measures will have a beneficial effect on bats at up to a county/metropolitan level.

7.4.61 There will be a permanent adverse effect on the assumed barn owl territory north of Wormleighton due to loss of nest sites, foraging habitat, disturbance and displacement that will be significant at up to a county/metropolitan level. To offset any loss of barn owls from the vicinity of the Proposed Scheme, opportunities to provide barn owl nesting boxes in areas greater than 1.5km from the route will be explored with local landowners to enhance barn owl populations in existing habitats that would not be affected by the Proposed Scheme.

7.4.62 Mitigation measures to address the potential killing, injury and disturbance of badgers will be provided in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). This will include the provision of badger proof fencing and replacement setts where necessary.

Summary of likely residual significant effects

7.4.63 The mitigation, compensation and enhancement measures described reduce the effects to a level that is not significant except for the unnamed tributary watercourse of the River Itchen near Ladbroke Fox Covert and the assumed barn owl territory near Wormleighton. The effects on barn owls would be offset if barn owl nest boxes could be located on suitable land.

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 will avoid or reduce impacts on features of ecological value:

- mitigation measures to reduce the effect of severance of habitat will also reduce the risk of animals such as bats colliding with trains including the provision of Banbury Road green overbridge (Boddington, in the adjoining area); Footpath SM101 green overbridge and adjacent hedgerows; and Windmill Lane green overbridge. In addition, the installation of Wills Pastures Road underpass may reduce habitat severance impacts on bats as they would be able to use it to fly beneath the railway;
- Long Itchington Wood tunnel and Long Itchington Wood green tunnel provides habitat connectivity across the route of the Proposed Scheme and minimises operational impacts of the Proposed Scheme on the diverse bat assemblage and notable birds using Long Itchington and Ufton Woods SSSI and adjacent habitats;
- the placement of the route within Boddington cutting, at Ladbroke cutting near Windmill Hill Spinney and at Southam cutting on the approach to Long Itchington and Ufton Woods SSSI will minimise the risk of bat and birds crossing in the path of trains. Within cutting the absence of woody species being planted along the cutting slopes will result in a low density of bat species using the slopes for foraging and commuting thus reducing the risk of collision; and
- viaducts over the Oxford Canal, the River Itchen, and two unnamed tributary watercourses of the River Itchen will retain wildlife corridors along these watercourses. These will offer a way of crossing the Proposed Scheme to some animals and reduce the risk of collisions with trains.

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 following species have been identified within the area that could be at particular risk of collision with trains: Brandt's, Natterer's, Daubenton's, noctule, pipistrelle, barbastelle bats and brown long-eared bat. The mitigation measures that are included within the Proposed Scheme to reduce the impacts of habitat severance during construction will act to reduce the risk of collisions of bats with trains.

7.5.7 Four viaducts within the Ladbroke and Southam area will cross habitats used by foraging and commuting bats. Bats may fly across the route of the Proposed Scheme at the Oxford Canal and through the area north of Long Itchington and Ufton Woods SSSI. Most bat species will fly underneath structures by following the watercourse under them whilst the higher flying noctule, Leisler's and serotine are likely to navigate over the structures. Although there is a risk of individual bats being killed or injured by collision with trains, the risks are considered to be minimal and unlikely to result in significant effects on the conservation status of any of the bat species concerned.

7.5.8 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.

7.5.9 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 are often killed by cars and trains. This is because they hunt low over the rough grassland habitats that are associated with road verges and railway embankments and are slow moving. 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. A single barn owl was recorded near Windmill Hill Spinney close to Ladbroke on one occasion during winter bird surveys and may overwinter at this site. Collision risk of barn owls should be significantly reduced in this location due to the presence of Ladbroke cutting and the presence of trees along the cutting edges. Due to this

reduced risk of collision, the impact on wintering barn owls is not expected to be significant at this location.

7.5.10 It is considered unlikely that any other effects at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-003.

Other mitigation measures

7.5.11 Additional elements designed to reduce or compensate for significant ecological effects are not required in this area.

Summary of likely residual significant effects

7.5.12 The mitigation, compensation and enhancement measures described above reduce the effects 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 Proposed Scheme in relation to land quality and reports the likely impacts and any significant effects resulting from the construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, either from a scientific, mining or mineral resources point of view including: geological sites of special scientific interest (SSSI), local geological sites (LGS), areas of current underground or opencast mining and areas of designated mineral resources. Mitigation measures are presented and any residual effects are summarised.

8.1.2 Potentially contaminated areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (for example contaminated soils may need to be removed or the construction may alter existing contamination pathways). Each of these areas has been studied 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 Oxford Canal, the River Itchen, Long Itchington and Ufton Woods SSSI, and areas of identified mineral resources including cement raw materials, sand and gravel, building stone and deep coal.

8.1.4 The main land quality issues in this area include:

- areas of former or current potentially contaminative land use which the Proposed Scheme will intersect such as Harp Farm, a vehicle breakdown recovery business, and historical and current operations at Kineton Road Industrial Estate; and
- six Mineral Safeguarding Areas (MSA) – one coal MSA underlying the whole of the study area, one building stone MSA underlying the study area from Southam to the northern end of the Proposed Scheme in this study area, one cement raw materials MSA underlying the study area at Southam and three sand and gravel MSA, one at New House Farm, one at Ladbroke Hill Farm and the other to the north of Long Itchington and Ufton Woods.

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

- Appendix CT-001-000/1: the SMR and Appendix CT-001-000/2 the SMR Addendum; and
- Appendix LQ-001-016: Land quality appendices.

8.1.6 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding potential groundwater resources are addressed in Section 1. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3, Section 14.

8.1.7 Engagement has been undertaken with Warwick District Council (WDC) and the Environment Agency regarding contaminated land, with Warwickshire County Council (WCC) regarding mineral resources and with the WCC Petroleum Officer.

8.2 Scope, assumptions and limitations

8.2.1 The assessment scope, key assumptions and limitations for the land quality assessment are set out in Volume 1 and in the SMR and its addendum presented in Volume 5 (Appendices CT-001-000/1 and 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 Areas of utility diversion works in existing highways have been excluded because with respect to land quality issues, utility works within the highway are a low risk construction activity, as most of the excavation works will be within the highway construction layers, and re-instatement will be undertaken with highway construction materials.

8.2.4 Familiarisation visits to the study area were made in October 2012 where the location of the Proposed Scheme was viewed from points of public access only. Due to access constraints not all sites considered to have the greatest potential for contamination were visited. However, the purpose of site visits is to verify desktop information and the lack of complete site walkovers is considered unlikely to have substantially affected the land quality assessment.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless otherwise stated, all features described in this section are presented in Volume 5: Map Book 16 – Land quality, Maps LQ-001-040b to 044a.

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 Book 16, Map WR-02-16.

8.3.3 An area of made ground is shown on the British Geological Survey mapping in the study area directly to the east of the River Itchen. There are numerous ponds or pits shown on the historical mapping within the study area which appear to have been infilled. There is also likely to be made ground associated with existing infrastructure.

8.3.4 There is one active landfill in the study area, Ufton Farm Landfill Site. The landfill is licensed to accept non-hazardous and stable non-reactive hazardous waste. There are no other landfills located in the study area.

8.3.5 Superficial deposits underlying the Proposed Scheme in the Ladbroke and Southam area are largely confined to Alluvium (clay, silt, sand and gravel) in river valleys. Head deposits consisting of sand and gravel with lenses of silt and clay are present to the north-west of Long Itchington and Ufton Woods.

8.3.6 Mudstone and occasional limestone of the Charmouth Mudstone Formation are present from the south of the study area to the south of Southam. The Rugby Limestone Member (interbedded mudstones and limestones) and the Saltford Shale Member (mudstone), both of the Blue Lias Formation, are present to the south and south-west of Southam. Northwards from the valley formed by the River Itchen, the bedrock comprises the Penarth Group (interbedded argillaceous rock and limestone) and the Langport Member (limestone) of the Lilstock Formation as far as the northern extent of Long Itchington and Ufton Woods. Bedrock from the north of Long Itchington and Ufton Woods to the north of the Proposed Scheme comprises the Mercia Mudstone Group, including the Arden Sandstone Formation sub-unit and dolomitic siltstones.

Groundwater

8.3.7 There are four categories of aquifer identified within the study area. Alluvium, the Rugby Limestone Member and the Arden Sandstone Formation are classified as Secondary A aquifers. The Saltford Shale Member, Penarth Group and Mercia Mudstone Group are classified as Secondary B aquifers. Head Deposits, the Langport Member and dolomitic siltstones of the Mercia Mudstone Group are classified as Secondary (undifferentiated) aquifers. The Charmouth Mudstone Formation is classified as unproductive strata.

8.3.8 The Proposed Scheme does not lie within any groundwater source protection zones (SPZ).

8.3.9 There is one licensed groundwater abstraction within 1km, shown on Volume 5: Map Book 16, Map WR-02-16. The Local Authority hold records of a further four groundwater abstractions used for private potable supply within 1km of the Proposed Scheme.

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

Surface waters

8.3.11 Surface watercourses that will be intersected by the Proposed Scheme include the Oxford Canal to the north of Wormleighton, the River Itchen to the west of Southam and various tributaries of the River Itchen.

8.3.12 There are also several other minor surface watercourses, drains and surface water bodies within the study area.

8.3.13 One surface water abstraction is located within 1km of the Proposed Scheme. It relates to an abstraction from the River Itchen for use in irrigation at the Dallas Burston Polo Ground at Southam.

8.3.14 Further information on surface waters is provided in Section 13.

Current and historical land use

8.3.15 All potentially contaminated sites (identified from both current and historical land uses) are shown on Volume 5: Map Book 16 – Land quality, Maps LQ-01-040b to 044a. Each potentially contaminative land use is annotated on the maps using the code 16-XX, where 16 denotes the CFA number and XX denotes the individual site reference.

8.3.16 Current potentially contaminative land uses in the study area include Ufton Farm Landfill Site (LQ-01-043, D9), a vehicle breakdown recovery business to the south-east of Southam (LQ-01-042, B6), Warwick House Industrial Park (LQ-01-042, A5), current industries at Kineton Road Industrial Estate (LQ-01-043, H5), Harp Farm (LQ-01-042, C6) and a fuel filling station off Northfield Road in Southam (LQ-01-43, G5). Harp Farm has been included as a potential source of contamination because it may store and use fuels, oils and pesticides.

8.3.17 Historical potentially contaminative land uses within the study area include former factories located at Kineton Road Industrial Estate (LQ-01-043, H5), two former garages off Banbury Road in Southam, and a former sheep wash (LQ-01-040b, G7).

8.3.18 There are also infilled ponds, infilled pits and infilled domestic water wells within the study area which may have been manually infilled with a variety of waste materials and could give rise to landfill gases such as methane, carbon dioxide and volatile organic compounds (VOC).

8.3.19 All potentially contaminated sites (identified from both current and historical land uses) are shown on Maps LQ-01-040b to LQ-01-044a.

Other regulatory data

8.3.20 Regulatory data reviewed include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). A number of these have been recorded in the study area; the most notable are as follows:

- Environment Agency enforcement notice at a site located to the south of Long Itchington and Ufton Woods, relating to the keeping of waste without a Waste Management License and failure to remove waste; and
- licensed waste management facility relating to a skip operator located at Kineton Road Industrial Estate.

Mining/mineral resources

8.3.21 The Minerals Local Plan for Warwickshire[46] aims to safeguard land where there are mineral resources of economic or conservation value (Policies MPS1 and MPS5). The

[46] Warwickshire County Council (1995), *Minerals Local Plan for Warwickshire*.

Warwickshire Minerals Development Framework (MDF) Core Strategy is currently in development.

8.3.22 There are no active mining or mineral sites or Preferred Areas[47] within the study area.

8.3.23 The Proposed Scheme will cross several MSA which are located in this study area. An MSA for deep coal covers the whole of the study area and a building stone MSA underlies the study area from Southam to the northern end of the Proposed Scheme in this study area. The Minerals Local Plan for Warwickshire lists the geological units which form the building stone MSA; in this area the MSA relates the Rugby Limestone Member and the Saltford Shale Member, both of the Blue Lias Formation, and the Langport Member of the Lilstock Formation. A cement raw materials MSA underlies the study area at Southam and there are three sand and gravel MSA, one at New House Farm, one at Ladbroke Hill Farm and the other to the north of Long Itchington and Ufton Woods.

8.3.24 The MSA are shown on Volume 5: Map Book 16 – Land quality, Maps LQ-01-040b to LQ-01-044a.

Geo-conservation resources

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

Receptors

8.3.26 The sensitive receptors that have been identified within this study area are summarised in Table 13.

Table 13: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents	High
		Workers	Moderate
	Controlled waters	Secondary A aquifers	High
		Secondary B aquifers	Moderate
		Secondary (undifferentiated) aquifers	Moderate
		Unproductive strata	Low
		River Itchen and its tributaries, Oxford Canal	High
		Other minor surface watercourses and water bodies	Moderate
	Built environment	Buildings and property	Low to high
		Underground structures and services	Low
	Mineral resources	Building stone MSA	Moderate
		Cement raw materials MSA	Moderate
		Deep coal MSA	Low

[47] Areas where mineral deposits are known to exist and where the County Council considers there would be least planning objection to mineral extraction taking place.

Issue	Receptor type	Receptor description	Receptor sensitivity
		Sand and gravel MSA	Moderate
	Ecological	Long Itchington and Ufton Woods SSSI	High
Impacts on mining/mineral sites (severance[48] and sterilisation of mineral sites)	Mining/mineral sites	Building stone MSA	Moderate
		Cement raw materials MSA	Moderate
		Deep coal MSA	Low
		Sand and gravel MSA	Moderate

Future baseline

8.3.27 All committed development is described in Volume 5: Appendix CT-004-000. There are committed developments associated with Kineton Road Industrial Estate and the Dallas Burston Polo Ground within the study area. However, the proposed changes associated with these developments will not alter the overriding land use at each location and for this reason the baseline conditions against which the assessment is undertaken remains unchanged.

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 Code of Construction Practice (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 the following:

- methods to control noise, waste, dust, odour gases and vapours (draft CoCP, Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (draft CoCP, Section 5);
- the management of human 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); and

[48] 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.

- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect land quality during construction (draft CoCP, Section 5).

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

- Environment Agency CLR11 Model Procedures for the Management of Land Contamination (2004)[49]; and
- British Standard BS10175 Investigation of Potentially Contaminated Sites (2011)[50].

8.4.3 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. This appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with Sustainable Remediation Forum UK's A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010)[51]. The preferred option will then be developed into a remediation strategy in consultation with regulatory authorities prior to implementation.

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

Assessment of impacts and effects

8.4.5 Construction of the Proposed Scheme through this study area will mainly require cut below existing ground levels. The main construction features of the Proposed Scheme will include a deep bored tunnel beneath Long Itchington and Ufton Woods SSSI and viaducts crossing the River Itchen and two of its tributaries.

8.4.6 Construction works will include earthworks, utility diversions, deep foundations, temporary dewatering and other activities. In addition, road infrastructure works will be required within this section of the Proposed Scheme.

8.4.7 Construction compounds for the Ladbroke and Southam area will be located at various points along the Proposed Scheme (refer to Section 2.3). The compounds will

[49] Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination*.
[50] British Standards Institution (2001), *BS10175 Investigation of Potentially Contaminated Sites*.
[51] Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*.

include maintenance facilities for plant and machinery and fuel storage in bunded tanks.

Land contamination

8.4.8 In line with the assessment methodology (as set out in the SMR, SMR Addendum and its appendices), an initial screening process was undertaken (identified in the methodology as Stages A and B) to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. In total, 66 areas were considered during this screening process; 13 of these areas were taken forward to more detailed risk assessments (Stage C and D), in which the potential risks were assessed more fully. Areas undergoing the more detailed risk assessments included industrial estates, infilled pits, infilled ponds and infilled wells. All areas assessed are shown on Volume 5: CFA16 Map Book – Land quality, Maps LQ-01-040b to LQ-01-044a and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

8.4.9 Conceptual site models (CSM) have been produced for the 13 areas taken to Stage C and D assessments. The detailed CSM are provided in Volume 5: Appendix LQ-001-016, Section 3 and the results of the baseline risk assessments are summarised in this section. Potentially contaminated areas have been grouped and considered together, where appropriate. The following factors have determined the need for Stage C and D assessment:

- whether the area is on or off the route of the Proposed Scheme or associated offline works, e.g. roads;
- the vertical alignment, i.e. whether the Proposed Scheme is in cutting 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.

8.4.10 A summary of the baseline CSM* is provided in Table 14. The impacts and baseline risks quoted are before any mitigation is applied.

Table 14: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area ref**	Area name	Main potential impacts	Main baseline risk
16-01 (LQ-01-040b, G7)	Sheep wash	Potential impact to surface water receptors	Low
16-20, 16-22 and16-23 (LQ-01-042, C6 and C7)	Infilled pits, infilled ponds and infilled well	Potential impact to on-site and off-site humans, surface water and property receptors	Low
16-55 (LQ-01-042, B6)	Former garage, now breakdown recovery business	Potential impact to on-site and off-site human receptors	Low

Area ref**	Area name	Main potential impacts	Main baseline risk
16-56 (LQ-01-043, I4)	Former garage, now Warwick House Industrial Park	Potential impact to on-site and off-site, groundwater and surface water receptors	Low
16-57 (LQ-01-043, H5	Former works, depot, warehouse, now Kineton Road Industrial Estate	Potential impact to off-site human, groundwater and surface water receptors	Low
16-30 (LQ-01-043, H6)	Infilled well	Potential impact to off-site human, groundwater and property receptors	Low
16-31 (LQ-01-043, G7)	Infilled well	Potential impact to off-site human, groundwater and property receptors	Low
16-33 (LQ-01-043, G7)	Former tank	Potential impact to off-site human, groundwater and property receptors	Low
16-39 (LQ-01-043, E6)	Infilled well	Potential impact to off-site human, groundwater and property receptors	Low
16-53 (LQ-01-042, C6)	Harp Farm	Potential impact to on-site and off-site human and surface water receptors.	Low
16-59 (LQ-01-043, G5)	Fuel station	Potential impact to off-site human, groundwater and surface water receptors	Low

* CSM have been prepared as part of the detailed land contamination methodology (refer to Volume 5) for baseline, construction and post-construction.
** Each area is assigned a unique identification number (see Volume 5, Appendix LQ-001-016).

Temporary effects

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

8.4.12 Table 15 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment takes into account the implementation of the mitigation measures set out within the draft CoCP. The details of these comparisons are presented in Volume 5: Appendix LQ 001-016.

Table 15: Summary of temporary (construction) effects

Area ref	Area name	Main baseline risk	Main construction risk	Temporary effect and significance
16-01 (LQ-01-040b, G7)	Sheep wash	Low	Moderate/Low (surface water)	Negligible to minor adverse (not significant)
16-20, 16-22 and 16-23 (LQ-01-042, C6 and C7)	Infilled pits, infilled ponds and infilled well	Low	Moderate/Low (surface water)	Negligible to minor adverse (not significant)
16-55 (LQ-01-042, B6)	Former garage, now breakdown recovery business	Low	Low	Negligible (not significant)
16-56 (LQ-01-043, I4)	Former garage, now Warwick House Industrial Park	Low	Low	Negligible (not significant)
16-57 (LQ-01-043, H5	Former works, depot, warehouse, now Kineton Road Industrial Estate	Low	Low	Negligible (not significant)

Area ref	Area name	Main baseline risk	Main construction risk	Temporary effect and significance
16-30 (LQ-01-043, H6)	Infilled well	Low	Low	Negligible (not significant)
16-31 (LQ-01-043, G7)	Infilled well	Low	Low	Negligible (not significant)
16-33 (LQ-01-043, G7)	Former tank	Low	Low	Negligible (not significant)
16-39 (LQ-01-043, E6)	Infilled well	Low	Low	Negligible (not significant)
16-53 (LQ-01-042, C6)	Harp Farm	Low	Low	Negligible (not significant)
16-59 (LQ-01-043, G5)	Fuel station	Low	Low	Negligible (not significant)

8.4.13 Table 15 indicates that based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination. However minor adverse effects to surface waters have been identified where potential contamination from the sheep wash and infilled ground may be disturbed and mobilised during construction.

8.4.14 Construction site compounds located in this study area will include staff welfare facilities, maintenance facilities for plant and machinery and fuel storage in bunded tanks. Construction compounds will store and use potentially contaminative materials such as fuels, oils and solvents and the measures outlined in the draft CoCP will manage risks from the storage of such materials.

8.4.15 The main and satellite compounds may also be used for temporary storage of potentially contaminated soils. The measures outlined in the draft CoCP will manage risks from the storage of such materials. The locations of these construction site compounds are given in Section 2.3.

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

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

Permanent effects

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

8.4.19 Table 16 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 001-016.

Table 16: Summary of permanent (post-construction) effects

Area ref	Area name	Main baseline risk	Main post-construction risk	Post-construction effect and significance
16-01 (LQ-01-040b, G7)	Sheep wash	Low	Very Low	Negligible to minor beneficial (not significant)
16-20, 16-22 and 16-23 (LQ-01-042, C6 and C7)	Infilled pits, infilled ponds and infilled well	Low	Low	Negligible to minor beneficial (not significant)
16-55 (LQ-01-042, B6)	Former garage, now breakdown recovery business	Low	Very low	Negligible to minor beneficial (not significant)
16-56 (LQ-01-043, I4)	Former garage, now Warwick House Industrial Park	Low	Low	Negligible (not significant)
16-57 (LQ-01-043, H5	Former works, depot, warehouse, now Kineton Road Industrial Estate	Low	Low	Negligible (not significant)
16-30 (LQ-01-043, H6)	Infilled well	Low	Low	Negligible (not significant)
16-31 (LQ-01-043, G7)	Infilled well	Low	Low	Negligible (not significant)
16-33 (LQ-01-043, G7)	Former tank	Low	Low	Negligible (not significant)
16-39 (LQ-01-043, E6)	Infilled well	Low	Low	Negligible to minor beneficial (not significant)
16-53 (LQ-01-042, C6)	Harp Farm	Low	Very Low	Negligible to minor beneficial (not significant)
16-59 (LQ-01-043, G5)	Fuel station	Low	Low	Negligible (not significant)

8.4.20 Table 16 indicates that following remediation, there will be an overall negligible to minor beneficial impact. Depending on the type of remediation undertaken, the beneficial effect could include an improvement in groundwater quality, the breaking of a ground gas migration pathway or the reduction in the volume of contaminants present in the soil.

8.4.21 An example is Harp Farm, which will be intersected by the Proposed Scheme. Any contaminated material encountered during construction will be removed. This will result in a reduction in the effects of contaminants present in the soil, providing a minor beneficial effect. Similar beneficial effects are anticipated at the sheep wash, the vehicle breakdown recovery business and at areas of infilled ground.

8.4.22 There are anticipated to be no significant cumulative permanent effects.

Mining/mineral resources

8.4.23 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, direct excavation during construction of the Proposed Scheme or

through temporary and/or permanent severance[52] that may occur during the construction phase of the Proposed Scheme, possibly continuing through to operation.

Temporary effects

8.4.24 Temporary adverse effects are anticipated on MSA where land will be temporarily used for construction and returned to the landowner after construction. In the Ladbroke and Southam area there are a number of areas which will only be used temporarily, including areas for main and satellite construction compounds, and areas of stockpiling.

8.4.25 Main construction compounds are present to the north of the Oxford Canal and to the north of Long Itchington and Ufton Woods overlying the sand and gravel MSA and part of the building stone MSA at the north of the study area. A satellite construction compound is located to the west of Lady Hill and there are areas of temporary stockpiling to the south of Harp Farm, encroaching on the cement raw materials MSA, and to the south of the Grand Union Canal overlying the sand and gravel MSA. There are also a number of areas of mitigation earthworks in the Proposed Scheme. All the temporary uses listed overlie the deep coal MSA, which encompasses the whole of the Ladbroke and Southam area. There are no construction works planned over the sand and gravel MSA at New House Farm.

8.4.26 Table 17 presents a summary of the assessment of temporary effects on the mining and mineral resources identified. As the temporary land uses cover a very small area of the overall MSA for a temporary period the magnitude of impact is assessed as minor.

Table 17: Summary of temporary effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area around Southam	Mineral Safeguarding Area	Mineral Safeguarding Area for cement raw materials extraction	Moderate	Minor	Negligible (not significant)
Entire study area	Mineral Safeguarding Area	Mineral Safeguarding Area for deep coal extraction	Low	Minor	Negligible (not significant)
Area at Ladbroke Hill Farm	Mineral Safeguarding Area	Mineral Safeguarding Areas for sand and gravel extraction	Moderate	Negligible	Negligible (not significant)
Area to the north of Long Itchington and Ufton Woods	Mineral Safeguarding Area	Mineral Safeguarding Areas for sand and gravel extraction	Moderate	Minor	Negligible (not significant)
Area around New House Farm	Mineral Safeguarding Area	Mineral Safeguarding Areas for sand and gravel extraction	Moderate	Negligible	Negligible (not significant)
Area from Southam to northern end of the study area	Mineral Safeguarding Area	Mineral Safeguarding Area for building stone extraction	Moderate	Minor	Negligible (not significant)

[52] 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.

8.4.27 No significant temporary effects are anticipated on the existing mineral resource.

Permanent effects

8.4.28 Construction of the Proposed Scheme will affect the cement raw materials, sand and gravel, deep coal and building stone MSA.

8.4.29 Impacts on the sand and gravel MSA, building stone MSA and deep coal MSA can be classified as minor (slight loss of resource with no isolation) because of their large extent across the county. Combining this with the medium value assigned to MSA gives a negligible significance of effect.

8.4.30 The cement raw materials MSA, whilst extensive, is smaller than the other MSA, hence the impact can be described as moderate (partial loss of resource or significant isolation of a resource), giving a slight adverse effect.

8.4.31 It is possible that some mineral extraction could be undertaken in advance of, or during, the construction of the Proposed Scheme in the cement raw materials MSA. This will reduce the effect on the cement raw materials MSA to negligible.

8.4.32 Table 18 presents a summary of the assessment of effects on the mining and mineral resources identified.

Table 18: Summary of effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area around Southam	Mineral Safeguarding Area	Mineral Safeguarding Area for cement raw materials extraction	Moderate	Moderate	Minor adverse (not significant)
Entire study area	Mineral Safeguarding Area	Mineral Safeguarding Area for deep coal extraction	Low	Minor	Negligible (not significant)
Area at Ladbroke Hill Farm	Mineral Safeguarding Area	Mineral Safeguarding Areas for sand and gravel extraction	Moderate	Minor	Negligible (not significant)
Area to the north of Long Itchington and Ufton Woods	Mineral Safeguarding Area	Mineral Safeguarding Areas for sand and gravel extraction	Moderate	Minor	Negligible (not significant)
Area around New House Farm	Mineral Safeguarding Area	Mineral Safeguarding Areas for sand and gravel extraction	Moderate	Negligible	Negligible (not significant)
Area from Southam to northern end of the study area	Mineral Safeguarding Area	Mineral Safeguarding Area for building stone extraction	Moderate	Minor	Negligible (not significant)

8.4.33 No significant effects are anticipated on the existing mineral resource.

8.4.34 There are anticipated to be no significant cumulative effects from construction or operation on the mineral resource. The cumulative effects on mineral resource across the whole of the Proposed Scheme are discussed in the assessment of route wide effects presented in Volume 3.

Geo-conservation sites

8.4.35 No geo-conservation areas such as SSSI or LGS are present in the study area.

Other mitigation measures

8.4.36 At this stage, no additional mitigation measures are considered necessary to mitigate risks from land contamination at the construction phase beyond those set out in the draft CoCP and instigated as part of required remediation strategies.

8.4.37 Mitigation of the effects on mineral resources can include prior extraction of the resource for use within the Proposed Scheme or elsewhere. Extraction may be limited to landscaped 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 WCC and any other interested parties to assist in achieving an effective management of minerals within the MSA.

Summary of likely residual significant effects

8.4.38 No likely residual significant effects are anticipated with the application of the mitigation measures described.

8.5 Effects arising from operation

8.5.1 Users of the Proposed Scheme (i.e. rail passengers), whilst within trains, will 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 whereby appropriate spillage and pollution response procedures will be established.

Assessment of impacts and effects

8.5.3 Boddington auto-transformer station will be situated adjacent to the Proposed Scheme to the north of Wormleighton; Lower Radbourne auto-transformer station will be located approximately 260m to the north-west of the fish ponds at Lower Radbourne; and Stoney Thorpe auto-transformer station will be situated between Lower Farm and the River Itchen. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer stations, in common with other modern substations, will use secondary containment appropriate to the level of risk.

8.5.4 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 or in-combination effects on receptors because of the environmental controls that will be placed on operational procedures.

Other mitigation measures

8.5.6 No other mitigation measures will be required beyond what has already been outlined relating to land quality in the Ladbroke and Southam study area.

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

Summary of likely residual significant effects

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

9 Landscape and visual assessment

9.1 Introduction

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

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

9.1.3 Principal landscape and visual issues in the area include:

- temporary landscape and visual effects arising during construction from the presence of construction plant, construction compounds, removal of existing vegetation, severance of agricultural land and the construction of the Proposed Scheme; and
- permanent landscape and visual effects arising during operation from the presence of new engineered landforms cutting across the existing landscape, new viaducts, noise fence barriers, highway infrastructure, overhead line equipment, and regular passing of high speed trains. In the main, such effects will reduce over time as planting established as part of the Proposed Scheme matures.

9.1.4 A separate but related assessment of effects on the setting of heritage assets is included in Section 6. Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in Volume 5: Appendix LV-001-016, which comprises the following:

- 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 Stratford-on-Avon District Council (SADC), Warwickshire County Council (WCoC) and Warwickshire District Council (WDC). Summer field surveys, including photographic studies of LCA and visual assessment of viewpoints, were undertaken from May to October 2012 and from May to July 2013. Winter surveys were undertaken from November 2012 to March 2013.

9.2 Scope, assumptions and limitations

9.2.1 The assessment scope, key assumptions and limitations for the landscape and visual assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-0001-000/1)

and the SMR Addendum (Volume 5: Appendix CT-0001-000/2). This report follows the standard assessment methodology.

9.2.2 The study area has been informed by the construction and operational phase zones of theoretical visibility (ZTV), which are shown in Volume 5: Map Book – Landscape and visual assessment, Maps LV-07-063 to LV-07-063b and LV-08-063 to LV-08-63b. The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-001-000/2), and is an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover will mean the actual visibility is substantially less than that shown in the ZTV. Tall construction plant (e.g. cranes and piling rigs) are excluded from the ZTV for the construction phase and overhead line equipment is excluded from the ZTV for the operational phase, but these are described and taken into account in the assessment of effects on landscape character areas and visual receptors.

9.2.3 LCA and visual receptors within approximately 2km of the Proposed Scheme have been assessed.

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 land use in the area is primarily agricultural, with a pattern of fields divided by hedgerows and mature trees across an undulating landform. This undulation is more pronounced to the east and west of the area, with ridgelines between Priors Hardwick to Stoneton and Ufton to Bunkers Hills and at localised areas such as Windmill Hill and Lady Hill. The settlement pattern is a mixture of isolated farmsteads, residential areas at Southam and small scale villages at Ladbroke and Wormleighton. These settlements are connected by a few main roads (A425 Leamington Road and A423 Banbury Road) and also by minor routes, including Stoneton Lane and Welsh Road (C36). The main infrastructure elements are the Coventry to Leamington Spa Line, National Grid overhead power lines and a large scale radio frequency mast. There are strong historic influences within the area, with ridge and furrow fields, locally distinctive architecture in the villages of Wormleighton and Ladbroke and the Oxford and Grand Union canals. The narrow River Itchen meanders across the west of the area, often bordered by mature vegetation. The agricultural land use has resulted in sparse woodland coverage, generally being on higher terrain at Long Itchington and Ufton Woods (both ancient woodlands). There are networks of public rights of way (PRoW) across the area, including the Harry Green Way and Centenary Way along Ridgeway Lane (E2994).

9.3.2 The LCA within the area have been identified through reference to Natural England's National Character Areas (NCA)[53] and The Warwickshire Landscape Guidelines[54].

9.3.3 Descriptions of all LCA are provided in Volume 5: Appendix LV-001-016 Part 2. For the purposes of this assessment the study area has been sub-divided into seven discrete LCA, four of which are most likely to be affected. A summary of these LCA is provided below. The LCAs are shown in Volume 5: Map Books LV-02-063 to LV-02-063b.

Radbourne Ironstone Fringe LCA

9.3.4 The rural character of this LCA is influenced by large scale open fields, often divided by hedgerows and mature trees in good condition. These fields are mostly situated across low lying undulating landform, partly crossed by the meandering Oxford Canal. This canal is bordered by a towpath and hedgerows and occasionally crossed by small scale brick bridges. There is steeper landform at the ridge lines between Priors Hardwick and Stoneton and in localised areas such as Windmill Hill. Woodlands are generally small in scale and localised at Fox Covert, Berryhill Plantation and Windmill Hill Spinney. Some fields exhibit relic ridge and furrow patterns, with further notable historic associations in the built form at Wormleighton. There are few roads, principally the A423 Banbury Road and Welsh Road (C36) which link with several tracks and lanes including Wills Pastures Road, Lower Radbourne Farm access and Windmill Lane. As a predominantly rural landscape, there are many farms and cottages interspersed across the landscape. Additionally there is limited infrastructure, with the radio frequency mast adjacent to Lower New House Farm and the two modern wind turbines on Lady Hill, near to Ladbroke Hill Farm being the most prominent elements. There are numerous PRoW, usually linking the villages, with PRoW SM101, SM116, SM116a and SM200 and SM90 being the main ones. The tranquillity is high, due to the open countryside and the absence of major infrastructure. The landscape is likely to be valued at a local level for its extensive network of PRoW and historic associations. Therefore, this area has a medium sensitivity to change.

Southam Village Farmlands LCA

9.3.5 The rural character of this LCA is influenced by medium to large scale fields divided by hedgerows overlaid across undulating landform. Interspersed across the LCA are areas of woodland, either as narrow linear groups along the course of the River Itchen or as larger extents on the higher ground at Long Itchington and Ufton Woods (both ancient woodland). The field hedgerows are generally gappy or in poor health and in places have been replaced by wire fencing. Therefore the landscape condition is considered to be fair. The market town of Southam is the main settlement and is predominantly residential with industrial development at Kineton Road Industrial Estate to the south. There are two smaller villages at Ufton and Ladbroke, both with distinctive architectural buildings. These villages are linked to Southam via the A425 Leamington Road and the A423 Banbury Road. There are numerous farms interspersed across the landscape, including Harp Farm and Lower Farm. Other land uses include the Dallas Burston polo grounds and the Ufton landfill site. A number of

[53] Natural England, *NCA Profile: 97 Arden (NE337),* http://www.naturalengland.org.uk/publications/nca/default.aspx, accessed: 2012.
[54] Warwickshire County Council and The Countryside Commission (1993), *The Warwickshire Landscape Guidelines,* Warwickshire County Council, Warwick.

PRoW cross the LCA, including Footpath SM96 which runs alongside the River Itchen. Tranquillity is medium due to the intensity of agricultural activities, the absence of major infrastructure and small settlement pattern within the LCA. The landscape is likely to be valued at a local level for its network of PRoW. Therefore, this area has a medium sensitivity to change.

Ufton Vale Farmlands LCA

9.3.6 This LCA is also located within the adjacent CFA17 Offchurch and Cubbington. The rural character of this LCA is influenced by the geometric pattern of medium scale fields; which are often loosely bounded by hedgerows with mature trees in fair condition. The field pattern overlays low lying, typically flat land either side of the Grand Union Canal which is crossed by the Welsh Road (C36). The Grand Union Canal is bordered by a narrow band of mature vegetation and crossed by numerous small brick canal bridges. There are several PRoW in the area, the most notable of which is the Centenary Way along Ridgeway Lane (E2994); and also the towpath along the Grand Union Canal. The settlement pattern is predominantly characterised by individual farms and cottages, associated with the agricultural land use of this LCA. This, together with an absence of major infrastructure, gives the LCA a medium level of tranquillity. It is likely to be valued at the local level for its rural character and network of PRoW. Therefore, this area has a medium sensitivity to change.

Leamington Plateau Fringe LCA

9.3.7 The majority of this LCA is located within the adjacent CFA17 Offchurch and Cubbington. The rural character of this LCA is influenced by the broad valley of the River Leam, which is bordered by short steep slopes. The agricultural land is gently undulating, with fields crossed by often gappy or intermittent hedgerows with mature trees in a fair condition. Vegetation is otherwise localised to roadsides, bordering the Offchurch Greenway (PRoW W192), the River Leam at Ash Beds and intermittently within fields, as at Burnt Firs woodland. Settlements are mainly small-scale nucleated (clustered around a central point) villages including Offchurch and Hunningham. They are linked by the Hunningham Road (D2246), which in conjunction with the Long Itchington Road (C33), Welsh Road (C36) and B4455 Fosse Way are the principal transport routes in the area. Numerous PRoW cross the area, including the Offchurch Greenway (W192) which in part includes National Cycle Route 41. As the LCA has a primarily agricultural land use, with intermittent built form, the tranquillity is medium. It is likely to be valued at a regional level due to the green belt designation (which covers approximately half of the LCA), numerous PRoW, and the National Cycle Route. Therefore, this area has a medium sensitivity to change.

Visual baseline

9.3.8 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-016 Part 2. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are shown in Volume 2: CFA16 Map Book – Landscape and visual assessment, Maps LV-03-063 to LV-03-063b and LV-04-063 to LV-04-63b. The viewpoints are numbered to identify their locations. 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 and 6: Employment.

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

9.3.10 Residential receptors have a high sensitivity to change and are located on the edges of Wormleighton, Ladbroke and at isolated farms throughout the study area. Views are typically across agricultural fields, and while many receptors are situated in slightly elevated locations, the intermittent vegetation and field boundaries often shorten or partially filter views.

9.3.11 Recreational receptors have a high sensitivity to change and are located on PRoW throughout the study area, including the Centenary Way along the Ridgeway Lane (E2994) and the Oxford Canal towpath. Viewpoints are typically located in agricultural settings, often on ridge lines or localised elevated terrain, such as Windmill Hill, enabling extensive and panoramic views across the landscape. The combination of an agricultural landscape with little infrastructure results in vertical features, such as the radio frequency beacon mast near to Lower New House Farm being prominent in many views.

9.3.12 Viewpoints for people travelling along scenic roads are located on the A425 Leamington Road and the A423 Banbury Road and have a medium sensitivity to change. These views are characterised by roadside hedgerows with occasional or filtered views of undulating agricultural fields.

Future baseline

9.3.13 A summary of the committed developments which are assumed to be built and occupied prior to either the construction or operation of the Proposed Scheme is provided below, along with the consequential effect on the character of LCA and nature of views. Developments which would introduce new visual receptors which may be significantly affected are also described. These developments are shown in Volume 5: Appendix CT-004-000.

Construction (2017)

9.3.14 The restoration of the central part of Ufton landfill site would aid in integrating the site into the landform. However, due to the localised scale of the restoration, the sensitivity of this area would be unchanged for the assessment of effects during construction.

Operation (2026)

9.3.15 By 2026, the landscape character is considered to remain as per the baseline, as the sensitivity of this area will not alter as a result of the Ufton landfill restoration scheme.

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 and structure works.

9.4.2 The effects associated with the peak construction phase in this CFA will generally be considered to be long term given the construction programme (see Section 2.3). Overall, civil engineering works in this CFA will be undertaken between the start of 2017 and the end of 2022. The Chipping Warden Tunnel main compound (in CFA15) will be in place for approximately four years, the Oxford Canal north embankment main compound for approximately five years and the Long Itchington Wood tunnel main compound for approximately six years. Satellite compounds will be in place for between approximately one and four and a half years. The civil engineering works at most individual sites along the route in this CFA will occur for a period of between approximately six months and one and a half years, with the exception of the Long Itchington Wood green tunnel (approximately two years), the Ladbroke cutting (approximately three years) and the Long Itchington Wood tunnel (approximately six years). Effects during other phases of works are likely to be lower due to less construction equipment being required at the time and a reduced intensity of construction activity.

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

- localised hedgerow and tree removal from the fields, vegetation removal from Fox Covert and Windmill Hill Spinney, construction plant crossing the haul roads, the general earthworks and modification of the landform and the presence of construction compounds;
- the presence of Oxford Canal north embankment main compound, worker accommodation sites 1 and 2, material transfer stockpile areas and Long Itchington Wood tunnel main compound;
- upgrading of Wills Pastures road and realignment of Stoneton Lane;
- construction of the Boddington, Lower Radbourne and Stoney Thorpe auto-transformer stations;
- construction of the Footpath SM101 green overbridge, Lower Radbourne Farm accommodation overbridge, Lower Grove Farm accommodation overbridge and Windmill Lane green overbridge;
- construction of the Oxford Canal, Lower Radbourne south and north and the River Itchen viaducts;
- construction of the A423 Banbury Road and the B4451 Kineton Road overbridges and their associated realignments; and
- construction of the Long Itchington Wood green tunnel and bored tunnel, including the porous portals.

Avoidance and mitigation measures

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

- maximising the retention and protection of existing trees and vegetation

where possible (draft CoCP, Section 12);

- the use of well-maintained hoardings and fencing (draft CoCP, Section 5);
- the design of temporary lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses (draft CoCP, Section 5);
- replacement of any trees intended to be retained which may be accidentally felled or die as a consequence of construction works (draft CoCP, Section 12);
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (draft CoCP, Section 12); and
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect landscape and visual resources during construction (draft CoCP, Section 5).

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

Assessment of temporary impacts and effects

9.4.6 The most apparent changes to landscape character and viewpoints during construction will relate to the temporary presence of construction compounds, plant and the removal of existing landscape elements, such as trees, hedges and agricultural land. Changes will be most notable along the route of the Oxford Canal, Windmill Hill, the A423 Banbury Road and B4451 Kineton Road and the emerging construction of the Long Itchington Wood green tunnel. 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 landform 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 LCA during construction. All LCA within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-016 Part 4.

Radbourne Ironstone Fringe LCA

9.4.8 Within this LCA construction activity will be located to the east of Wormleighton across to Windmill Hill and will include excavations and embankment formation and the construction of viaducts and overbridges. At Boddington and Windmill Hill, the excavations will be approximately 16m and 29m respectively, below existing ground levels. There will be removal of vegetation from Fox Covert and Windmill Hill Spinney and from field boundaries. There will be the realignments of Stoneton Lane, Wormleighton Road, upgrade to Wills Pastures Road and the realignment of Lower Radbourne farm access and Windmill Lane. Construction plant will also cross the landscape via the haul roads and will include cranes. There will also be a temporary loss of agricultural land and disruption of field use. The presence of the construction

compounds, the Oxford Canal north embankment main compound and worker accommodation site 1 will be at variance with the open field character by introducing new temporary built form, parking areas, cabins, lighting and hoardings. The scale and extent of construction activity will reduce the tranquillity locally. Overall the magnitude of change is medium.

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

Southam Village Farmlands LCA

9.4.10 Within this LCA construction activity will be across the landscape from Windmill Hill to the northern edge of Long Itchington Wood and the Welsh Road (C36). The construction activity will include realignments to the A425 Banbury Road and B4451 Kineton Road with construction of new overbridges and the River Itchen viaduct and Long Itchington Wood green tunnel and south porous portal. The earthworks required for the embankment formation and extent of cutting will be at variance with the undulating landform. Field boundaries and mature trees will be removed from the fields and adjacent to the River Itchen. The presence of construction compounds, material transfer stockpile areas and Long Itchington Wood tunnel compound will be at variance with the open character of the fields by introducing new built form and lighting. There will be construction plant crossing the landscape via the haul roads and a temporary loss of agricultural land and disruption of field use. The scale and extent of construction activity will reduce the tranquillity locally. Overall the magnitude of change is medium.

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

Leamington Plateau Fringe LCA

9.4.12 All of the construction activity within this LCA will be located within CFA17 Offchurch and Cubbington. Within CFA17, the landscape character will be locally affected by the earthworks and excavation across the fields. The scale and extent of construction activity will reduce the tranquillity locally. Therefore the magnitude of change is considered to be medium and the effect moderate adverse.

Visual assessment

9.4.13 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken during winter, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, will be in leaf. Where residential receptors experience significant effects at night time arising from additional lighting, these are also presented in this section. Representative viewpoints within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-016, Part 4.

9.4.14 The number identifies the viewpoint locations which are shown in Volume 2: CFA16 Map Book – Landscape and visual assessment, Maps LV-03-063 to LV-03-063b. In each case, the middle number (xxx.X.xxx) identifies the type of receptor present in this area – 2: Residential, 3: Recreational, 4: Transport, 6: Employment and 7: Active Sport.

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

Viewpoints 224.2.001: View west from Stoneton Manor, 224.3.002: View west from PRoW (Footpath) SM101, 224.3.005: View north-west from PRoW (Footpath) SM104 and 226.3.002: View north-west from PRoW (Footpath) SM116a

9.4.16 The cranes constructing the Footpath SM101 green overbridge, the Oxford Canal and Lower Radbourne south and north viaducts will be visible in the middle ground. The Footpath SM101 green overbridge, Footpath SM116a underpass and Oxford Canal viaduct satellite compounds, construction plant on the haul roads, and the formation of the earthworks within the fields, including vegetation removal, will also be in the middle ground of the view. This activity will introduce temporary buildings and lighting and will result in a noticeable increase in activity compared to existing agricultural use. As views of this activity will be partially filtered by intervening vegetation, the magnitude of change is medium.

9.4.17 The medium magnitude of change assessed alongside the high sensitivity of the receptors will result in moderate adverse effects.

9.4.18 At night, for receptor 224.2.001, the continuous lighting of the Footpath SM101 green overbridge, Footpath SM116a underpass and Oxford Canal viaduct satellite compounds are considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 225.3.001: View north-east from PRoW (Footpath) SM101

9.4.19 The construction plant on the haul roads and the construction of the Footpath SM101 green overbridge will be visible in the middle ground. The removal of vegetation from Fox Covert will be visible in the background of the view. This activity will result in a noticeable alteration to the open fields and ridge line at Stareton, although it will be partially filtered by intervening vegetation. Overall, the magnitude of change is considered to be medium.

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

Viewpoints 225.3.004: View from PRoW (Footpath) SM116a and 226.3.001: View south-west from PRoW (Footpath) SM116a

9.4.21 The temporary earth stockpiles, hedgerow removal from the fields, Footpath SM116a underpass satellite compound, embankment formation and the construction plant on the haul roads will be visible in the foreground. The regrading of landform and the construction of the Oxford Canal viaduct and approach embankments will be visible in the middle ground. The cutting at Windmill Hill and cranes constructing Windmill Lane green overbridge will be visible in the background. These activities will represent a substantial change in close proximity to the viewpoint and will be incongruous with the existing view. Therefore the magnitude of change is considered to be high.

9.4.22 The high magnitude of change, assessed alongside the high sensitivity of the receptors, will result in major adverse effects.

Viewpoint 226.2.005: View west from Hill Farm

9.4.23 The construction of Lower Radbourne south and north viaducts and the Oxford Canal viaduct, including the formation of their approach embankments will be visible in the middle ground of the view. Views will also include the construction plant on the haul roads and Footpath SM101 green overbridge, Footpath SM116a underpass and Oxford Canal viaduct satellite compounds. The upper sections of cranes constructing Windmill Lane green overbridge and the cutting at Windmill Hill will be visible in the background and viewed alongside the wind turbines on Lady Hill. Overall this activity will be partially filtered by intervening vegetation within the fields. Therefore the magnitude of change is considered to be medium.

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

9.4.25 At night, the continuous lighting of the Footpath SM101 green overbridge, Footpath SM116a underpass and Oxford Canal viaduct satellite compounds are considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 227.3.001: View east from PRoW (Footpath) SM116

9.4.26 The removal of vegetation either side of the Oxford Canal, the upgrading of Stoneton access track, Oxford Canal viaduct satellite compound and the construction of the viaduct will be visible in the foreground, within the direct frame of view. Therefore the magnitude of change is considered to be high.

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

Viewpoint 227.3.006: View north from PRoW (Footpath) SM200

9.4.28 The Oxford Canal north embankment main compound, formation of the embankments, vegetation removal and construction plant on the upgraded access track to the A423 Banbury Road will be visible in the middle ground. The upper sections of cranes constructing the Lower Radbourne south and north viaducts will also be visible. This activity will be partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

Viewpoint 228.6.003: View west from Church Farm

9.4.30 The regrading of the landform, temporary earthwork stockpiles, construction of the track and track bed and construction plant on the haul roads will be visible in the foreground and middle ground of the view, within the direct frame of view. Therefore the magnitude of change is high.

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

Viewpoints 229.2.001: View north and south from Glebe Farm and 229.2.005: View east from Lower New House Farm and Leighton Oaks

9.4.32 The upgrade of Wills Pastures Road and subsequent construction plant crossing it will be visible in the foreground. The worker accommodation site 1 and the Oxford Canal north embankment main compound will be visible in the middle ground. These will introduce temporary buildings and lighting within open fields. Additionally the upper sections of cranes constructing the Lower Radbourne viaducts south and north will be visible in the middle ground. This activity will be partially filtered by intervening vegetation and agricultural buildings. Therefore the magnitude of change is considered to be medium.

9.4.33 The medium magnitude of change assessed alongside the high sensitivity of the receptors will result in moderate adverse effects.

9.4.34 At night the continuous lighting of the worker accommodation site 1 and the Oxford Canal north embankment are considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016 Part 4.

Viewpoint 230.3.002: View south-east from PRoW (Bridleway) SM96

9.4.35 The grading of landform for landscape mitigation and construction of the Lower Radbourne viaducts and approach embankments will be visible in the foreground and middle ground. These are considered to be highly visible and incongruous with the existing view from the receptor. Therefore the magnitude of change is considered to be high.

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

Viewpoint 231.2.001: View south-east from Lower Radbourne Farm

9.4.37 The construction of the Lower Radbourne viaducts, Lower Radbourne Farm accommodation overbridge, the realignment of Radbourne Lane and the construction of the Lower Radbourne auto-transformer station will be visible in the middle ground. Construction plant on the haul roads and the Ladbroke Grove Farm accommodation overbridge satellite compound, which will also be lit at night, will also be visible in the middle ground. This activity will be partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

9.4.39 At night, the continuous lighting of the Ladbroke Grove Farm accommodation overbridge satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 232.2.001: View north-east from Chapel Bank Cottage

9.4.40 The upgrading of the existing track and Lower Radbourne Farm accommodation overbridge satellite compound will be visible in the foreground and the middle ground. These elements will be highly visible and incongruous with the existing view from the receptor. Therefore the magnitude of change is considered to be high.

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

9.4.42 At night, the continuous lighting of the Lower Radbourne Farm accommodation overbridge satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoints 232.2.002: View south-west from Upper Radbourne Farm and 232.2.003: View south-west from Upper Radbourne Farm Cottages

9.4.43 Views will be of the upgrading of the existing track and construction plant (crossing between the Welsh Road (C36) and the Lower Radbourne Farm accommodation overbridge satellite compound) in the foreground. This activity will result in a noticeable increase in traffic, although views will be partially filtered by intervening vegetation. Therefore the magnitude of change is medium.

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

Viewpoint 234.2.001: View north-west from Ladbroke Grove Farm

9.4.45 Construction activity will be visible in the foreground and middle ground although partially filtered by intervening vegetation and built form. Views will be of the extent of the cutting at Windmill Hill, removal of vegetation from Windmill Hill Spinney and regrading of landform. This activity will be in close proximity to the receptor and within the direct field of view and will result in the loss of key characteristics of the view. Therefore the magnitude of change is considered to be high.

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

Viewpoint 235.2.001: View north from The Bungalow

9.4.47 Construction activity will be visible in the middle ground, including construction plant on Windmill Lane, the upper sections of cranes constructing the Windmill Lane green overbridge and the Windmill Lane green overbridge satellite compound. Views will also include the partial removal of vegetation from Windmill Hill Spinney and cutting at Windmill Hill. This activity will result in a substantial alteration to the existing views, by introducing temporary buildings, lighting and increased activity compared to the existing agricultural land use. Views of this activity will be partially filtered by intervening vegetation and therefore the magnitude of change is considered to be medium.

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

9.4.49 At night, the continuous lighting of the Windmill Lane green overbridge satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 235.3.003: View north-east from PRoW (Footpath) SM90

9.4.50 This viewpoint is elevated and the panoramic view is long and open. The partial removal of vegetation from Windmill Hill Spinney, the construction of Windmill Lane

green overbridge, the extent of cutting and Windmill Lane green overbridge satellite compound will be visible in the foreground. This activity will be visible, within the direct frame of view and will result in a noticeable deterioration in the view due to the changes to these key elements. Therefore the magnitude of change is considered to be high.

9.4.51 The view of the Proposed Scheme from this location during construction is illustrated on the photomontage shown on Map LV-01-196 (Volume 2).

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

Viewpoint 235.2.004: View east from residences adjacent to the A423 Banbury Road, Ladbroke

9.4.53 The partial removal of vegetation from Windmill Hill Spinney and the adjoining fields, embankment formation and implementation of new planting and ecological mitigation areas will be visible in the middle ground. As this activity will remove key characteristic vegetation and changes to the landform it will result in a noticeable deterioration in the view, although partially filtered by intervening vegetation along the A423 Banbury Road. Therefore the magnitude of change is considered to be medium.

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

Viewpoint 235.4.006: View north-east at junction of Windmill Lane and track

9.4.55 The Windmill Lane green overbridge satellite compound, the extent of cutting and construction of Windmill Lane green overbridge will be visible in the foreground. This activity will introduce new built form within the fields, remove key characteristics of the view and be in close proximity to the receptor. Therefore the magnitude of change is considered to be high.

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

Viewpoint 236.2.001: View south-west from Ladbroke Hill Farm

9.4.57 The construction of Windmill Lane green overbridge, the partial removal of vegetation from Windmill Hill Spinney, the cutting at Windmill Hill and the realignment of Windmill Lane will be visible in the foreground. This will remove key characteristics of the view and be in close proximity; therefore the magnitude of change is considered to be high.

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

Viewpoints 237.2.006: View north-east from Starbold Farm and 237.4.009: view north-east from junction of Starbold Farm Track and the A423 Banbury Road

9.4.59 The realignment of the A423 Banbury Road, construction of the embankments, overbridge, balancing ponds and pumping station with a new access road will be visible in the foreground. The demolition of buildings within Harp Farm and the material transfer stockpile area 1 and the A423 Banbury Road overbridge north satellite compound will also be visible in the foreground and middle ground. This activity will be within the direct frame of view at close range and therefore the magnitude of change is considered to be high.

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

9.4.61 At night, for receptor 237.2.006, the continuous lighting of the A423 Banbury Road overbridge north satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 237.2.010: View north-east from residences adjacent to the A423 Banbury Road

9.4.62 Open views of the material transfer stockpile area 1, construction plant on the A423 Banbury Road and the partial filling in of the pond will be visible in the foreground. The construction of the raised earthworks, demolition of buildings and construction plant on the haul road will be visible in the middle ground. This activity will be within the direct frame of view. Therefore the magnitude of change is high.

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

Viewpoints 239.2.003: View north-east from Field Cottage and 240.6.008: View south from Kineton Road Industrial Estate, west of the B4451 Kineton Road and 240.6.007 view south from Kineton Road Industrial Estate, east of the B4451 Kineton Road

9.4.64 The construction of the B4451 Kineton Road realignment and the associated overbridge, excavation for balancing ponds, the removal of vegetation, the excavation within the fields for the cutting and the B4451 Kineton Road overbridge satellite compound will be visible in the foreground. These views will also include construction plant on the haul roads. This activity will be within the direct frame of view and therefore the magnitude of change is considered to be high.

9.4.65 The high magnitude of change assessed alongside the high sensitivity of receptor 239.2.003 will result in a major adverse effect. The high magnitude of change assessed alongside the low sensitivity of receptors 240.6.007 and 240.6.008 will result in moderate adverse effects.

9.4.66 At night, for receptor 239.2.003, the continuous lighting of the B4451 Kineton Road overbridge satellite compound is considered to be non-significant, viewed in the context of lighting along the B4451 Kineton Road. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 240.3.005: View south-west from PRoW (Footpath) SM33

9.4.67 The removal of roadside vegetation and the realignment of the A423 Banbury Road will be visible in the middle ground, although set within the context of existing views of lighting columns and sport pitches. This will result in a noticeable deterioration in the view, with more open views of traffic due to the vegetation removal. Therefore the magnitude of change is medium.

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

Viewpoints 241.3.004: View north-east from PRoW (Footpath) SM24 and 242.3.011: View south-west from PRoW (Footpath) SM24

9.4.69 The construction of the River Itchen viaduct, vegetation removal, materials transfer stockpile area 2 and the construction plant on the haul roads will be visible in the foreground. This activity will be in close proximity, within the direct frame of view introducing new built form, hoardings and changes to landform and key characteristics of the view. Therefore the magnitude of change is high. The high magnitude of change assessed alongside the high sensitivity of the receptors will result in major adverse effects.

Viewpoints 243.2.001: View north from Lower Farm, 244.2.001: View south-east from Stoney Thorpe Home Farm and 244.7.002: View south from Dallas Burston Polo Grounds

9.4.70 The construction activity will be visible in the foreground and middle ground along the A425 Leamington Road. The activity will include the temporary diversion to this road across the polo grounds, vegetation removal and the construction of the Long Itchington Wood green tunnel and Long Itchington Wood porous portal. This activity will be continuously highly visible due to the open polo grounds and proximity to Stoney Thorpe Home Farm. Removal of vegetation along the A425 Leamington Road will also enable more open views of this construction of the Long Itchington Wood porous portal. Overall, the magnitude of change is considered to be high.

9.4.71 The high magnitude of change assessed alongside the high sensitivity of receptors 243.2.001 and 244.2.001 will result in major adverse effects. The high magnitude of change assessed alongside the low sensitivity of receptor 244.7.002 will result in a moderate adverse effect.

Viewpoints 245.2.002: view north-east from residences off Ridgeway Lane (E2994) and 245.5.003: view north-east from The White Hart (Public House)

9.4.72 The construction plant on the Ridgeway Lane (E2994) will be visible in the foreground. The upper sections of cranes constructing the Ufton Wood porous portal and Longhole viaduct, including the removal of vegetation and approach embankment formation will be visible in the middle ground. This activity will be partially filtered by intervening vegetation and the undulating landform. Therefore the magnitude of change is medium.

9.4.73 The medium magnitude of change assessed alongside the high sensitivity of the receptors will result in moderate adverse effects.

Viewpoints 246.2.001: View west from residential property off the Welsh Road (C36) and 246.3.002: View south-west from PRoW (Footpath) SM6

9.4.74 The material transfer stockpile 3, Long Itchington Wood tunnel main compound, the worker accommodation site 2 and the construction of the Longhole viaduct and Long Itchington Wood north portal will be visible in the middle ground. From the receptors elevated location, this activity will introduce new built form and lighting within the direct frame of view. Therefore the magnitude of change is considered to be high.

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

9.4.76 At night, for receptor 246.2.001 continuous lighting of the Long Itchington Wood tunnel main compound will be a noticeable deterioration, due to the change from unlit open fields. Therefore the magnitude of change is medium and the effect is moderate adverse.

Viewpoint 247.3.003: View north-east from Ridgeway Lane (E2994)

9.4.77 The construction of the Long Itchington Wood north portal, Longhole viaduct and the construction of the approach embankments will be visible in the foreground. This will include for removal of hedgerows and vegetation along the Grand Union Canal. This activity will be a major alteration to the key characteristics of open fields and vegetation and within the direct frame of view. Therefore the magnitude of change is considered to be high.

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

Viewpoint 247.2.004: View north-east from Wood Farm

9.4.79 The construction of Long Itchington Wood north portal, temporary worker accommodation site 2, Long Itchington Wood tunnel main compound and the material transfer stockpile area 3 will be visible in the foreground and middle ground. Views will also include the construction of the approach embankments to the Longhole viaduct, the removal of vegetation alongside the Grand Union Canal and the removal of hedgerows along field boundaries. This activity will introduce new temporary built form and lighting within the open fields and remove key vegetation within the view. Therefore the magnitude of change is considered to be high.

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

9.4.81 At night, the continuous lighting of the Long Itchington Wood tunnel main compound and worker accommodation site 2 will be within the direct frame of view, introducing lighting and resulting in a noticeable deterioration of the view. Therefore the magnitude of change is medium and the effect moderate adverse.

Viewpoint 248.4.003: View west from Welsh Road (C36)

9.4.82 The material transfer stockpile area and Long Itchington Wood tunnel main compound, the construction of the Longhole viaduct and approach embankments will be visible in the foreground and middle ground. These elements are considered to be highly visible, in close proximity and introducing new elements within the open fields

and removing key vegetation. Therefore the magnitude of change is considered to be high.

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

Viewpoint 250.2.001: View south-west from Print Wood Farm

9.4.84 The construction of the Longhole viaduct, material transfer stockpile area, Long Itchington Wood tunnel main compound and the Long Itchington Wood north portal will be visible in the middle ground. From the receptors elevated location these elements, although approximately 1.2km away, are considered to represent major alterations to existing views of the Grand Union Canal and undulating fields, with loss of key vegetation and introduction of new built form and lighting within the open fields. Therefore the magnitude of change is considered to be high.

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

9.4.86 At night, the continuous lighting of the Long Itchington Wood tunnel main compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-016 Part 4.

Cumulative effects

9.4.87 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 from part of the baseline for the construction of the Proposed Scheme. The consequential cumulative effect of these developments on LCA and viewpoints is described below. The developments are summarised in Section 2.1 and shown on Volume 5: Planning Map Book, Map series CT-13.

9.4.88 There are no committed developments within this LCA which are assumed to be under construction at the same time as the Proposed Scheme, and therefore, there are no consequential cumulative effects on LCA and viewpoints.

Other mitigation measures

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

Summary of likely residual significant effects

9.4.90 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 visibility of construction plant and vegetation loss from 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 effects on landscape and visual receptors include:

- high speed trains, overhead line equipment and boundary fencing, with new earthworks including for false cuttings;
- reduction in vegetation at Fox Covert, Windmill Hill Spinney and from hedgerows within the fields;
- new built form with the Boddington, Lower Radbourne and Stoney Thorpe auto-transformer stations;
- new built form with the Oxford Canal, the Lower Radbourne north and south and River Itchen viaducts, including new mass and scale of the earthworks and their approach embankments;
- realigned sections of the A423 Banbury Road and B4451 Kineton Road including for new overbridges; and
- new built form with the Long Itchington Wood green tunnel porous portal and Ufton Wood porous portal.

Avoidance and mitigation measures

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

- the adoption of a green infrastructure approach to the design of the landscape environment around the Proposed Scheme to ensure the creation of a well-connected landscape that helps to alleviate flooding, benefits biodiversity and recreation;
- embankments and cuttings, both for the railway and highway alignments, have been shaped so as to integrate the Proposed Scheme into the character of the surrounding landscape;
- where it is considered that a noise fence barrier will create a visual impact on neighbouring residences a landscape bund will be provided, where reasonably practicable;
- planting, including native broad-leaved woodland, shrub and hedgerows, to screen the Proposed Scheme from neighbouring residential properties and users of adjacent PRoW, and to aid integration of the Proposed Scheme into the landscape; and
- the selection of species will reflect tree and shrub species native to the area landscape and 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 Specific design measures to aid in integrating the Proposed Scheme within the landscape include:

- Banbury Road overbridge, Footpath SM101 green overbridge and Windmill Lane overbridge to have hedges on both sides to enable landscape connectivity;
- new road alignments to reflect the existing lane character with new hedgerows on either side, where practicable;
- establishment of woodland edge management zones at Fox Covert, Windmill Hill Spinney and adjacent to the Grand Union Canal to enable retention of existing vegetation where possible and more integrated transition between the Proposed Scheme and retained vegetation;
- substantial areas of new woodland planting with many areas of advance planting, (Windmill Hill and south of the Long Itchington Wood green tunnel), to aid integration and more readily screen the Proposed Scheme;
- realignment of the southern section of Wills Pastures Road across the fields to retain hedgerows and mature trees along the road;
- false cuttings shaped around the Lower Radbourne auto-transformer station to aid integration into the landscape;
- taking the Proposed Scheme in tunnel under Long Itchington Wood to retain this ancient woodland;
- grading of outer slopes of embankments to shallow gradients where practicable, to enable the slopes to be returned to agricultural use and so become more easily integrated into the landscape; and
- hedgerow planting along the tops of cuttings and near the tops of false cuttings, to create appropriate new field boundaries and help screen the earthworks and railway beyond.

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

Assessment of impacts and effects

9.5.5 The likely significant effects on the landscape character and viewpoints in operation will arise from new engineered landforms cutting across the existing landscape; the introduction of new viaducts with associated infrastructure; the introduction of noise fence barriers that will create a man-made linear feature; permanent severance of land; the introduction of highway infrastructure into the rural environment, including road bridges; the introduction of overhead line equipment; and the introduction of regular high speed trains. At a number of locations, views of the Proposed Scheme will be obscured by the rising landform, retention of intervening hedgerows and trees and the route of the Proposed Scheme within a cutting. Furthermore, in most cases effects will reduce over time as planting established as part of the Proposed Scheme matures.

Landscape assessment

9.5.6 This section describes the significant effects on LCA during year 1, year 15 and year 60 of operation. Non-significant effects on LCA are presented in Volume 5: Appendix LV-001-016, Part 4.

9.5.7 The assessment of effects in year 15 assume 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.

Radbourne Ironstone Fringe LCA

9.5.8 The Proposed Scheme will cross this LCA from east of Wormleighton to Windmill Hill, and be predominantly in cutting with several viaducts (Oxford Canal and Lower Radbourne south and north) and associated approach embankments. Landscape effects of the Proposed Scheme will include:

- reduction in vegetation at Fox Covert and Windmill Hill Spinney and localised hedgerow and mature tree loss from the fields, considered overall to be a partial loss to the key vegetation characteristic of the LCA;
- extensive raised earthworks including false cuttings and embankments, considered to be a partial alteration to the gently undulating landform;
- the introduction of new built form with the Boddington, Stoney Thorpe and Radbourne auto-transformer stations, which will be prominent due to their scale and overhead line equipment connections;
- new built form with the Oxford Canal viaduct, which will be prominent compared to existing canal crossings due to its scale and mass;
- realignments of numerous roads, including Windmill Lane and Stoneton Lane, which will not influence the overall character of the LCA; and
- the partial alteration of Windmill Hill, due to the cutting (approximate depth of 29m and 150m wide), which will be a partial loss of the key characteristic landform within the LCA.

9.5.9 There will be a reduction in tranquillity of the character area due to the introduction of high speed trains within a largely rural area with relatively limited infrastructure. Therefore, due to the partial alteration to the character of the area, the magnitude of change is considered to be medium in year 1 of operation.

9.5.10 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.

9.5.11 By year 15 of operation, planting will have established at Fox Covert, Windmill Hill Spinney and within the fields to be largely characteristic of the key vegetation pattern. However, the extent of the alteration to Windmill Hill and presence of the high speed trains and viaducts will remain at variance with the landform and rural character. Therefore the magnitude of change will remain as medium in year 15 of operation and the effect will be unchanged.

9.5.12 By year 60 of of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape, particularly for the realigned roads and viaducts. However the continued presence of major infrastructure will remain at variance with the agricultural landscape character. Therefore the magnitude of change will remain as medium in year 60 of operation and the effect will be unchanged.

Southam Village Farmlands LCA

9.5.13 The Proposed Scheme will cross the LCA from Windmill Hill to Long Itchington Wood, predominantly in cutting and then in tunnel. Landscape effects of the Proposed Scheme will include:

- extensive cutting and embankments and localised hedgerow and tree loss, considered at variance with the undulating agricultural landform and vegetation;
- realignments to the B4451 Kineton Road and A423 Banbury Road, which will reflect the existing road character;
- new built form with the River Itchen viaduct and Long Itchington Wood porous portal, which will be prominent; and
- introduction of high speed trains, overhead line equipment and boundary fencing, within a largely agricultural area.

9.5.14 There will be a reduction in tranquillity of the character area due to the introduction of high speed trains within an area of generally limited infrastructure. Overall, due to the alteration of this agricultural character, the magnitude of change is considered to be medium.

9.5.15 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.

9.5.16 By year 15 and beyond to year 60 of operation, the maturity of planting will integrate the overbridges and realigned roads to reflect the existing character. This will result in Long Itchington Wood porous portal and River Itchen viaduct being largely inconspicuous elements alongside the A425 Leamington Road. The effects will reduce to be non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Ufton Vale Farmlands LCA

9.5.17 This LCA is also located within CFA17 Offchurch and Cubbington. Within the Ladbroke and Southam area, the Proposed Scheme will cross from the Ufton Wood porous portal to the Grand Union Canal on embankment. Landscape effects of the Proposed Scheme within this CFA include:

- introduction of high speed trains, overhead line equipment and boundary fencing within an agricultural area with little infrastructure. This includes for the partial loss of key characteristic hedgerows;
- raised earthworks at variance with the gently undulating landform; and
- new built form of the Ufton Wood porous portal.

9.5.18 There will be a reduction in tranquillity of the character area due to the introduction of high speed trains within an area of generally limited infrastructure. Due to the variance from the agricultural character, the magnitude of change is considered to be medium.

9.5.19 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.

9.5.20 By year 15 of operation, new planting adjacent to the Grand Union Canal and within the fields will have established. This will aid in reducing the mass of the embankment and replicating the key characteristic vegetation. However, the high speed trains, the scale and mass of Ufton Wood porous portal and the elements of the Proposed Scheme within CFA17 will remain at variance with the landform and existing canal crossings. Therefore the magnitude of change will remain as medium in year 15 of operation.

9.5.21 By year 60, the new planting will have matured and largely integrate the Proposed Scheme within the small extent of the landscape that it crosses within this LCA. This will reduce the effects to non-significant. These are reported in Volume 5: Appendix LV-001-016, Part 4.

Leamington Plateau Farmlands LCA

9.5.22 The Proposed Scheme in operation will be situated entirely within CFA17 Offchurch and Cubbington. Within CFA17 the Proposed Scheme will introduce major infrastructure within an agricultural landscape and will reduce the extent of ancient woodland and tranquillity. Therefore the magnitude of change is considered to be medium in year 1 of operation and the effect moderate adverse. This effect remains in years 15 and 60 due to the continued presence of the trains and loss of ancient woodland.

Visual assessment

9.5.23 This section describes the significant effects on visual receptors during year 1, year 15 and year 60 of operation. Non-significant effects on visual receptors are presented in Volume 5: Appendix LV-001-016, Part 4.

9.5.24 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.

9.5.25 Where significant effects have been identified, an assessment of effects at night time arising from additional lighting has also been undertaken.

9.5.26 The number identifies the viewpoint locations which are shown in Volume 2, Map Books LV-04-063 to LV-04-63b. In each case, the middle number (xxx.X.xxx) identifies the type of receptor present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels; 6: Employment and 7: Active Sport.

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

Viewpoints 224.2.001: View south-west from Stoneton Manor, 224.3.002: View west from PRoW (Footpath) SM101, 224.3.005: View north-west from PRoW (Footpath) SM104 and 226.3.002: View north-west from PRoW (Footpath) SM116a

9.5.28 The overhead line equipment, boundary fence line and regraded earthworks will be visible in the middle ground due to the slightly elevated location of the viewpoint. The extent of cutting at Windmill Hill will be visible in the background. These elements will introduce new features that are prominent within the view, due to their linearity and variance from the gently undulating landform, although partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

9.5.29 The medium magnitude of change assessed alongside the high sensitivity of the receptors will result in moderate adverse effects in the winter of year 1 of operation.

9.5.30 In summer of year 1 of operation (and beyond to years 15 and 60) the intervening vegetation will largely screen views of the Proposed Scheme which will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 225.3.004: View from PRoW (Footpath) SM116a

9.5.31 The embankment will be visible across a wide extent of the foreground of the view, including the upper sections of trains and overhead line equipment, from this elevated location. Also within the view there will be the Footpath 116a underpass structure, which will enable open views of the trains, albeit within a small extent of the view. As an elevated viewpoint, views of the agricultural landscape and ridgeline in the middle ground and background of the view will remain. The trains, overhead line equipment, embankments and boundary fencing will be visible in the foreground and middle ground. These elements will be continuously highly visible. Therefore the magnitude of change is considered to be high.

9.5.32 The view of the Proposed Scheme from this location during operation year 1 is illustrated on the photomontage shown in Figure LV-01-108 (Volume 2).

9.5.33 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.

9.5.34 In summer of year 1, the lack of screening, scale of the embankments and elevated location of the receptor will retain views as per winter. Therefore the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.35 By year 15 the planting on the embankments will have established to reduce the scale of the earthworks and partially filter views of the trains, overhead line equipment and boundary fencing. Therefore the magnitude of change is medium.

9.5.36 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the summer of year 15 of operation.

9.5.37 By year 60 of operation, planting established on the embankments will largely filter the overhead line equipment, trains and new fence line and integrate the embankments within the landform. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 226.3.001: View south-west from PRoW (Footpath) 116a

9.5.38 Open views of the raised earthworks and elevated trains and overhead line equipment will be visible in the middle ground of the view. In addition to the introduction of new infrastructure within the view, the mass of these elements will be at variance to existing views of an undulating wooded ridgeline. Therefore this is a major alteration to the existing view and the magnitude of change is considered to be high.

9.5.39 The view of the Proposed Scheme from this location in operation year 1 is illustrated on the photomontage shown in Figure LV-01-109 (Volume 2, CFA16 Map Book).

9.5.40 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 operation.

9.5.41 In summer of year 1, the proximity and lack of screening is considered to retain views as per winter. Therefore the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.42 By year 15, planting on the embankments will have established to partially filter views of the trains and overhead line equipment and boundary fencing. However the mass and scale of the embankments and open views of the trains, albeit within a smaller extent of the view will remain. Therefore the magnitude of change is considered to be medium.

9.5.43 The view of the Proposed Scheme from this location in operation year 15 is illustrated on the photomontage shown on Map LV-01-245 (Volume 2).

9.5.44 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the summer of year 15 of operation.

9.5.45 By year 60 of operation the proposed planting will have matured, to aid in largely filtering views of the trains and overhead line equipment. However due to the scale and mass of the embankments and the noticeable loss of background views the magnitude of change is considered to remain medium, meaning the overall effect will be unchanged.

Viewpoint 226.2.005: View west from Hill Farm

9.5.46 The overhead line equipment and trains along localised areas of embankment (Oxford Canal embankments) and viaduct crossings (Oxford Canal and Lower Radbourne south viaducts) will be visible in the middle ground. Overall, these elements will be partially filtered by existing vegetation within the adjacent fields. Therefore the magnitude of change is considered to be medium.

9.5.47 The medium magnitude of change assessed alongside the high sensitivity of the receptor is likely to result in a moderate adverse effect in winter of year 1 of operation.

9.5.48 In summer of year 1 the view is considered to remain as per winter, due to the elevated location of the receptor. Therefore the magnitude of change is considered to remain medium, meaning the overall effect will be unchanged.

9.5.49 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely filtering the overhead line equipment and new boundary fence line and integrating the embankments within the landform. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 227.3.001: View east from PRoW (Footpath) SM116

9.5.50 The trains, overhead line equipment, Oxford Canal viaduct and approach embankments will be visible in the foreground. These elements will be highly visible and within the direct frame of view. These elements will represent a major alteration compared to existing open views of the Oxford Canal due to the scale and mass of the viaduct and new infrastructure within the view. Therefore the magnitude of change is considered to be high.

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

9.5.52 In summer of year 1 the view is considered to remain as per winter, due to the proximity to the receptor and direct open views. Therefore the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.53 By year 15 and 60, the view is considered to remain as per summer year 1 due to the close proximity and direct open views. Therefore the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

Viewpoint 227.3.006: View north from PRoW (Footpath) SM200

9.5.54 The raised earthworks, new planting and upper sections of overhead line equipment will be visible in the middle ground. These views will be partially filtered by hedgerows within the adjacent fields. Therefore the magnitude of change is considered to be medium.

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

9.5.56 In summer of year 1 the views will remain as per winter due to the linearity of the upper sections of the overhead line equipment across the landscape. Therefore the magnitude of change will be medium and the effect moderate adverse.

9.5.57 By years 15 and 60 the new planting and vegetation within the fields will largely filter views. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part4.

Viewpoint 228.6.003: View west from Church Farm

9.5.58 The outer slopes of the false cutting, upper sections of overhead line equipment and boundary fencing will be visible in the foreground and middle ground, in close

proximity to the receptor and within the direct frame of view. Therefore the magnitude of change is considered to be high.

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

9.5.60 In summer of year 1 the view is considered to remain as per winter due to the close proximity of the Proposed Scheme. Therefore the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.61 By year 15 and beyond to year 60 of operation, planting established on the boundaries as part of the Proposed Scheme will have matured, largely filtering the overhead line equipment and new boundary fence line and integrating the earthworks within the landform. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 230.3.002: View south-east from PRoW (Bridleway) SM96

9.5.62 Lower Radbourne north viaduct (approximately 4.7m above existing ground levels), raised earthworks, overhead line equipment, trains and new planting will be visible in the foreground. These features will be highly visible, especially the section on viaduct and as a result the magnitude of change is considered to be high.

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

9.5.64 In summer of year 1 the view is considered to remain as per winter due to the elevated position of the Proposed Scheme on viaduct and its close proximity to the viewpoint. Therefore the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.65 By year 15 the new planting within the foreground of the view will have established and partially filter views of the trains, viaduct and embankment. Therefore the magnitude of change is considered to be medium.

9.5.66 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in summer year 15 of operation.

9.5.67 By year 60 the planting established on the boundaries as part of the Proposed Scheme will have matured, largely filtering the overhead line equipment and the new boundary fence line and integrating the earthworks within the landform. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV001-016, Part 4.

Viewpoint 231.2.001: View east from Lower Radbourne Farm

9.5.68 The overhead line equipment and Lower Radbourne north viaduct (approximately 4.7m above existing ground levels) and raised earthworks will be visible in the middle ground, although partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

9.5.70 In summer of year 1 (and beyond to years 15 and 60) the intervening vegetation will further screen views of the Proposed Scheme. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 234.2.001: View north-west from Ladbroke Grove Farm

9.5.71 The overhead line equipment, boundary fencing, the reduction of vegetation from Windmill Hill Spinney and the changes to the landform of Windmill Hill will be visible in the middle ground. These elements are will be partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

9.5.73 In summer of year 1 (and beyond to years 15 and 60) the intervening vegetation is likely to further screen views of the Proposed Scheme. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 235.2.001: View north from The Bungalow

9.5.74 The changes in the landform of Windmill Hill, Windmill Lane green overbridge and new planting along Windmill Lane will be visible in the middle ground, although partially filtered by intervening vegetation. Therefore the magnitude of change is medium.

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

9.5.76 In summer of year 1, (and beyond to years 15 and 60) the intervening vegetation will further filter views of the Proposed Scheme. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 235.3.003: View north-east from PRoW (Footpath) SM90

9.5.77 . The partial reduction in the vegetation from Windmill Spinney, to the left of the view, he 150m wide cutting with new planting and the boundary fencing will be visible in the foreground of the view. The Windmill Lane green overbridge, extent of cutting and the trains will be visible in the middle ground of the view. These elements will be highly visible from this elevated location and represent substantial change to the landform and key vegetation. Therefore the magnitude of change is considered to be high.

9.5.78 The view of the Proposed Scheme in operation year 1 is illustrated on the photomontage shown in Figure LV-01-110 (Volume 2).

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

9.5.80 In summer of year 1 the view is considered to remain as per winter due to the open views of the reduction in vegetation from Windmill Hill Spinney and the changes to the landform. Therefore the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.81 By year 15 the planting adjacent to the top of cutting will have established and will partially filter views of the boundary fence line and replicate the existing character of Windmill Hill Spinney. Therefore the magnitude of change is medium.

9.5.82 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in summer year 15 of operation.

9.5.83 By year 60 the planting established adjacent to the top of cutting will have matured and will largely filter views of the boundary fencing and Windmill Lane green overbridge. This will reduce the effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 235.4.006: View north-east at junction of Windmill Lane with track

9.5.84 The Windmill Lane green overbridge, boundary fence and changes to the landform of Windmill Hill will be visible in the foreground and middle ground. Therefore the magnitude of change is considered to be medium.

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

9.5.86 In summer of year 1 the view is considered to remain as per winter due to the limited screening by intervening vegetation. Therefore the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.87 By year 15 and beyond to year 60 of operation, planting established on the boundaries as part of the Proposed Scheme will have matured, largely filtering the boundary fencing, Windmill Lane green overbridge. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 236.2.001: View south-west from Ladbroke Hill Farm

9.5.88 The partial reduction in vegetation from Windmill Hill Spinney and the realigned farm access track and Windmill Lane green overbridge will be visible in the middle ground. While these elements will result in a partial alteration to the existing view and introduce new built form within the fields, the view will be partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

9.5.90 In summer of year 1 the views of the reduction in Windmill Hill Spinney will remain due to its elevated situation within the view. Therefore the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.91 By year 15 and beyond to year 60 of operation, planting established on the boundaries as part of the Proposed Scheme will have matured, largely replicating the existing character of Windmill Hill Spinney and largely screening the Windmill Lane green overbridge. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 237.2.006: View north-east from Starbold Farm

9.5.92 The realigned A423 Banbury Road onto embankment (approximately 6m above existing ground level), the A423 Banbury Road overbridge and the upper sections of the pumping station will be visible in the middle ground. This will also include the more open views of the raised earthworks due to the loss of buildings at Harp Farm. These elements are considered to be major alterations due to the change in landform and the A423 Banbury Road being elevated within the field of view. Therefore the magnitude of change is considered to be high.

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

9.5.94 In summer of year 1 the views remain as per winter due to the lack of screening and elevated position of the A423 Banbury Road within the field of view. Therefore the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.95 By year 15 and beyond to year 60 of operation, the planting on the A423 Banbury Road embankments will have established to largely filter views of the traffic, the overbridge and pumping station and the raised earthworks. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016 Part 4.

Viewpoint 237.2.010: View north-east from residences adjacent the A423 Banbury Road

9.5.96 The balancing pond access road and balancing pond with areas of new planting will be visible in the foreground. The raised earthworks and upper sections of the overhead line equipment will be visible across a wide extent of the field of view in the middle ground. These elements will be in close proximity to the receptor. Therefore the magnitude of change is high.

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

9.5.98 In summer, the open views will remain due to the open character of the existing A423 Banbury Road and proximity of the Proposed Scheme. Therefore the magnitude of change will remain high and the effect unchanged.

9.5.99 By years 15 and beyond to year 60 the new planting will have integrated the balancing pond access road and will largely filter views of the balancing pond. Views of the raised earthworks across the field of view will remain. Therefore the magnitude of change is medium.

9.5.100 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in moderate adverse effects in the summer of years 15 and 60 of operation.

Viewpoint 239.2.003: View north-east from Field Cottage

9.5.101 The boundary fencing, new planting along the top of the cutting and the upper sections of overhead line equipment will be visible in the foreground. Additionally the view will include the realigned B4451 Kineton Road onto embankment and the B4451 Kineton Road overbridge. The scale of the embankment will reduce existing views of

the middle ground and background. Therefore the magnitude of change is considered to be high.

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

9.5.103 In summer of year 1 the views are considered to remain as per winter due to the proximity of the Proposed Scheme. Therefore the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.104 By year 15 and beyond to year 60 the planting on the embankments of the B4451 Kineton Road will largely filter views of traffic, the overbridge and overhead line equipment and integrate the road and raised earthworks within the landform. However as the proximity of the new planting and the scale of the embankment will continue to limit views of the middle ground and background there will be a noticeable deterioration to the view. Therefore the magnitude of change is considered to be medium.

9.5.105 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the summers of years 15 and 60 of operation.

Viewpoints 240.6.008: View south from Kineton Road Industrial Estate, west of the B4451 Kineton Road and 240.6.007 view south from Kineton Road Industrial Estate, east of the B4451 Kineton Road

9.5.106 The upper sections of overhead line equipment and trains and the realigned B4451 Kineton Road onto embankment will be visible in the foreground and middle ground. These views will be from the upper storeys of the buildings within the industrial estate due to their close proximity to the Proposed Scheme. The views of the trains and cutting are a major alteration to existing views of generally flat open fields. Therefore the magnitude of change is high.

9.5.107 The high magnitude of change assessed alongside the low sensitivity of the receptors will result in moderate adverse effects in winter year 1 of operation.

9.5.108 In summer of year 1 the open view is considered to remain as per winter due to the elevated position of the receptor. Therefore the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.109 By year 15 and beyond to year 60 of operation, the planting between the receptor and the top of the cutting will have established as part and largely filter the overhead line equipment and trains. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 240.3.005: View south-west from PRoW (Footpath) SM33

9.5.110 The realigned A423 Banbury Road and open views of traffic will be visible in the middle ground. Although this will result in a noticeable deterioration in the view, it will be seen within the context of existing views of lighting columns and sport pitches. Therefore the magnitude of change is medium.

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

9.5.112 In summer of year 1, as the new planting will not have established to filter views of the traffic the magnitude of change remain medium and the effect moderate adverse.

9.5.113 By year 15 and beyond to year 60 the new planting alongside the A423 Banbury Road will have established to largely screen traffic and reflect existing views. This will reduce the effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 241.3.004: View north-east from PRoW (Footpath) SM24

9.5.114 The ecological mitigation areas within the fields will be visible in the foreground of the view. The trains and overhead line equipment will be visible in the middle ground of the view, on the River Itchen viaduct, although partially filtered by intervening vegetation. The view will also include the cutting for Long Itchington Wood porous portal, with new buildings and facilities. Overall these elements will be a major alteration to the open fields and undulating landform and within the direct frame of view. Therefore the magnitude of change is high.

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

9.5.116 In summer of year 1, while views of the trains crossing the River Itchen viaduct will be largely filtered by intervening vegetation, the open views will remain of the Long Itchington Wood porous portal. Therefore the magnitude of change will be medium.

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

9.5.118 By year 15 and beyond to year 60 the new planting alongside the cutting will have established to largely screen the built form within the Long Itchington Wood porous portal. This will reduce the effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 242.3.011: View south-west from PRoW (Footpath) SM24

9.5.119 The River Itchen viaduct will be in close proximity and highly visible in the foreground, along with the built form within the Long Itchington Wood porous portal. These elements are a major alteration compared with existing views of open fields. Therefore the magnitude of change is considered to be high.

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

9.5.121 In summer of year 1 the open views of the Proposed Scheme will remain. Therefore the magnitude of change is considered to remain as high, meaning the overall effects will be unchanged.

9.5.122 By year 15 of operation, the planting will have established to partially filter views of the built form within the Long Itchington Wood porous portal and reduce the mass and scale of the River Itchen viaduct. Therefore the magnitude of change is 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 summer year 1 of operation.

9.5.124 By year 60 the planting will have matured to largely screen all elements of the Proposed Scheme. This will reduce the effects to non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 247.3.003: View north-east from Ridgeway Lane (E2994)

9.5.125 Open views of the trains and the raised earthworks will be visible in the middle ground. The view will also include the upper sections of trains and overhead line equipment above the raised earthworks. These elements will be visible across a wide extent of the view above the skyline. Therefore the magnitude of change is high.

9.5.126 The view of the Proposed Scheme in operation of year 1 is illustrated on the photomontage shown on Map LV-01-111 (Volume 2).

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

9.5.128 In summer of year 1 existing vegetation will largely screen part of the extent of the view, however open views will remain of the raised earthworks and upper sections of the trains due to the open character of the fields. Therefore the magnitude of change is medium.

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

9.5.130 In summer of year 15 and beyond to year 60, the new planting will largely filter views of the Proposed Scheme. This will reduce the effects to non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 247.2.004: View north-east from Wood Farm

9.5.131 The new planting and change to the landform due to Ufton Wood porous portal will be visible within the foreground, within the direct frame of view. The raised earthworks and overhead line equipment on the approach embankment to Longhole viaduct will be visible in the middle ground. This is a major alteration compared to existing views of open fields. Therefore the magnitude of change is considered to be high.

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

9.5.133 In summer of year 1 the open views will remain as per winter due to elevated location of the receptor. Therefore the magnitude of change is considered to remain as high, meaning the overall effect will be unchanged.

9.5.134 By year 15 the new planting within the foreground of the view will have established to largely filter views of the Ufton Wood porous portal and replicate existing views of Long Itchington Wood. The planting along the raised earthworks in the middle ground will also largely filter views of the overhead line equipment. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 248.4.003: View west from Welsh Road (C36)

9.5.135 The access road to the Ufton Wood porous portal and new planting alongside the Grand Union Canal will be visible in the foreground. The raised earthworks and upper

sections of the overhead line equipment across the fields will be visible in the middle ground. These views will be partially filtered by roadside vegetation. Therefore the magnitude of change is considered to be medium.

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

9.5.137 In summer of year 1 (and beyond to years 15 and 60) views will be largely filtered by the roadside vegetation. This will reduce effects to being non-significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Viewpoint 250.2.001: View south-west from Print Wood Farm

9.5.138 The upper sections of raised earthworks, overhead line equipment and the cutting of the Ufton Wood porous portal will be visible in the middle ground. This will also include the removal of vegetation from the Grand Union Canal. Therefore the magnitude of change is considered to be high.

9.5.139 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.

9.5.140 In summer, the view is considered to remain as per winter due to the elevated situation of the receptor. Therefore the magnitude of change is considered to remain as high, meaning the overall effect will be unchanged.

9.5.141 By years 15 and 60 the planting will have established and matured to largely filter views of the Proposed Scheme. This will reduce the effects to being non significant. This is reported in Volume 5: Appendix LV-001-016, Part 4.

Cumulative effects

9.5.142 Section 2.1 and Volume 5: Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme.

9.5.143 There are no known developments within this area which are assumed to be under construction at the same time as the Proposed Scheme, and therefore there are no cumulative effects on the LCA and viewpoints.

Other mitigation measures

9.5.144 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

9.5.145 In most cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. Therefore, on the basis that the

proposed other mitigation measures are delivered, the following residual effects will remain at year 15 of operation:

- adverse effects on the landscape character of the Radbourne Ironstone Fringe LCA, Ufton Vale Farmlands and Leamington Plateau Fringe LCA due to the continued presence of high speed trains within an agricultural landscape. This includes the linear extent of earthworks across gently undulating landform, localised cutting at Windmill Hill and loss of ancient woodland, within CFA17 Offchurch and Cubbington; the effects on Ufton Vale Farmlands LCA is not however significant by year 60 of operation due to the further maturing of proposed planting;
- adverse effects on residential receptors adjacent the A423 Banbury Road (237.2.010) and at Fields Cottage (239.2.003) arising from proximity to the Proposed Scheme and foreshortening of views across the landscape;
- adverse effects on recreational users PRoW (Footpath) SM24 (242.3.011), PRoW (Footpath) SM116a (225.3.004 and 226.3.001), PRoW (Footpath) SM116 (227.3.001), PRoW (Bridleway) SM96 (230.3.002) and PRoW (Footpath) SM90 (235.3.003) due to their close proximity to the Proposed Scheme and elevated location enabling open views. At all but PRoW (Footpath) SM116, the effects are not significant by the year 60 of operation due to the further maturing of proposed planting.

10 Socio-economics

10.1 Introduction

10.1.1 The 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 proposed 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 of Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

10.2.2 There have been no variations to the socio-economic assessment methodology arising from engagement with stakeholders and community organisations.

10.3 Environmental baseline

Existing baseline

Study area description

10.3.1 Section 2.1 of this report provides a general overview of the Ladbroke and Southam area which includes data of specific relevance to socio-economics, notably demographic and employment data. The following provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the area[55].

10.3.2 The Ladbroke and Southam area lies wholly within the area covered by Stratford-on-Avon District Council.

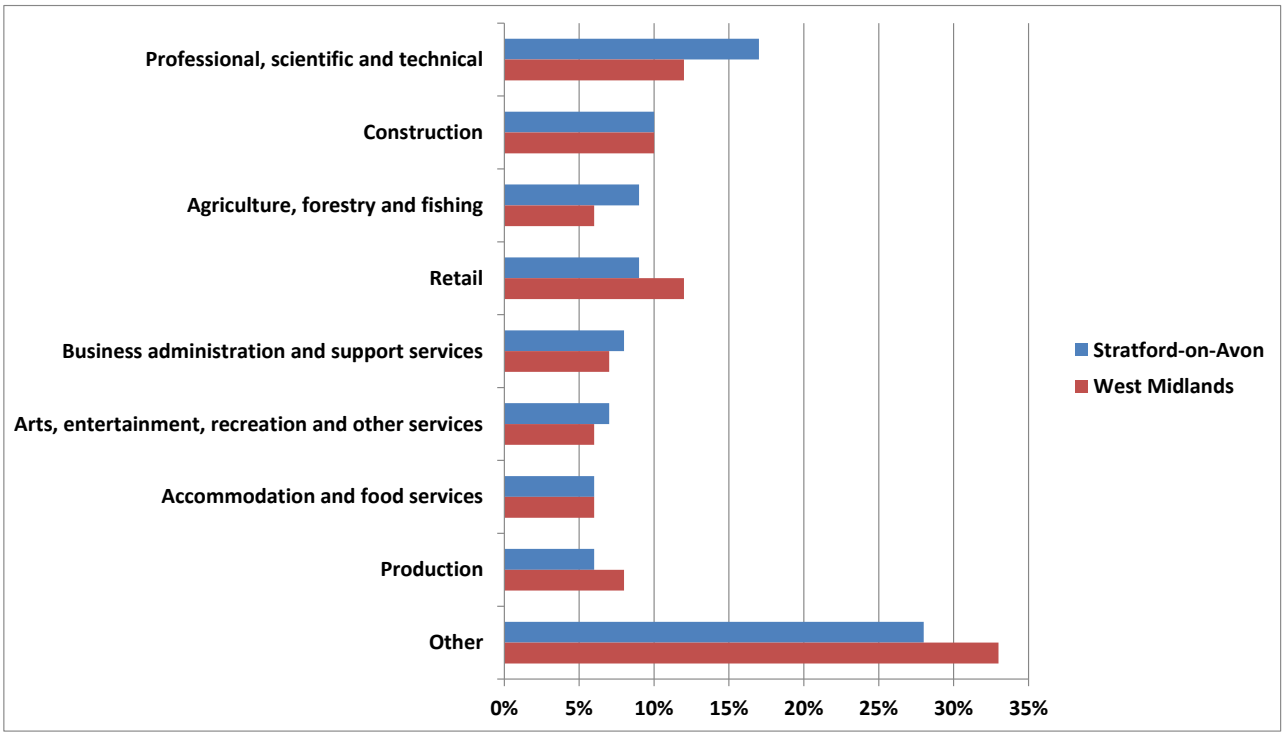
10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)[56] to provide a profile of local communities. Volume 5: Appendix SE-002-101 shows the location of the DCA. Given the rural nature of the Ladbroke and Southam area there is only one DCA; Southam which contains the town of Southam.

Business and labour market

10.3.4 In 2011 the Stratford-on-Avon District Council area had a larger proportion (at 17%) of businesses within professional, scientific and technical services than both the West Midlands regional average (12%) and English average (14%). Similarly agriculture, forestry and fishing industries at 9% accounted for a greater proportion in Stratford-on-Avon District Council area than regionally at 6% and nationally at 4%[57]. The higher proportion of agricultural enterprises is reflective of the rural character of this area. This is shown in Figure 6[58].

[55] Further information on the socio-economics baseline, with regard to business and labour market profile, within the area is contained in Volume 5: Appendix SE-001-000.
[56] 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 (LSOA).
[57] 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.
[58] The figure presents the proportion of businesses within each business sector in the district but not the proportion of employment by sector.

Figure 6: Business sector composition in Stratford-on-Avon District Council and the West Midlands[59] [60]

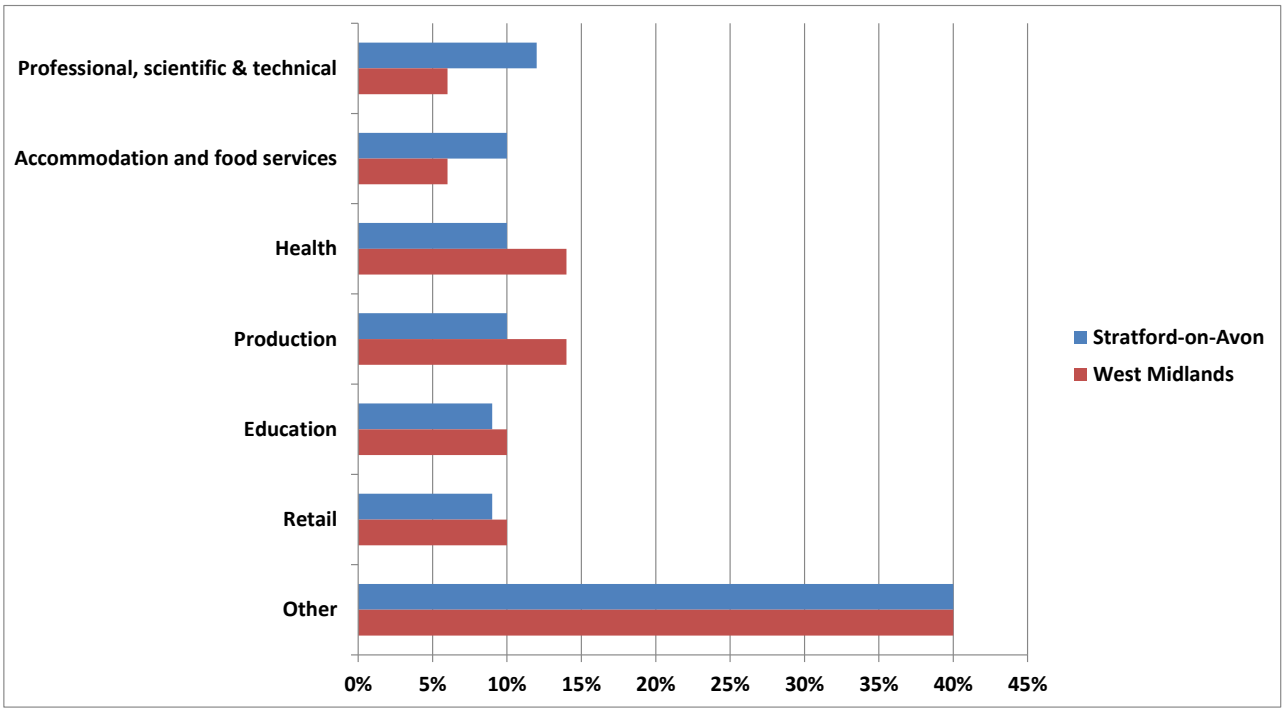


10.3.5 Approximately 56,000 people worked in the Stratford-on-Avon District Council area in 2011, while 3,100 worked in the Southam DCA[61].

10.3.6 The sector with the highest proportion of employment in Stratford-on-Avon District is professional, scientific and technical (12%) which is higher than the West Midlands average (6%) and England (8%). Accommodation and food services also make up 10% of the district employment, higher than for the West Midlands (6%) and England (7%). Production accounts for 10% of employment in Stratford-on-Avon District which is lower than the West Midlands (14%) and the same as England (10%). A further key sectors for employment is health, though at 10% it makes up a smaller proportion of employment in Stratford-on-Avon District than the West Midlands (14%) and England (13%). This is shown in Figure 7. Key sectors for Southam DCA are production (16%), arts, entertainment, recreation and other services (14%) and wholesale (14%).

[59] 'Other' includes motor trades; wholesale; transport and storage; information and communication; financial and insurance; property; public administration and defence; education; and health.
[60] ONS (2012), *UK Business: Activity, Size and Location 2011,* ONS, London.
[61] ONS (2012), *Business Register and Employment Survey 2011,* ONS, London.

Figure 7: Proportion of employment by industry in Stratford-on-Avon District Council and the West Midlands[62] [63]



10.3.7 According to the 2011 Census[64], the employment rate[65] within the area covered by Stratford-on-Avon District Council, in 2011, was 68% (70,000 people), which is higher than those recorded for the West Midlands (62%) and England (65%). This compares with the employment rate for Southam DCA which was 70%. The unemployment rate in Stratford-on-Avon District was 4% which was lower than a regional average of 9% for the West Midlands and 7% for England. Southam DCA had an unemployment rate of 4%.

10.3.8 According to the 2011 Census, in Stratford-on-Avon District 38% of residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4) and above while 16% had no qualifications. This compares with the regional average where 23% of West Midlands residents aged 16 and over are qualified to NVQ4 and above and 27% had no qualifications; for England the average figures were 27% qualified to NVQ4 and above while 23% had no qualifications. In Southam DCA 26% of residents aged 16 and over were qualified to NVQ4 and above while 23% had no qualifications.

10.3.9 Southam DCA is an employment area with a focus on production, arts, entertainment, recreation and other services and wholesale. Skills levels in the DCA are in line with the national average and unemployment is lower than the regional average.

[62] 'Other' includes agriculture, forestry and fishing; construction; motor trades; wholesale; information and communication; transport and storage; finance and insurance; property; public administration and defence; and arts, entertainment, recreation and other services.
[63] ONS (2012), *Business Register and Employment Survey 2011,* ONS, London.
[64] ONS (2012), *Census 2011,* ONS, London.
[65] The proportion of working age (16-74 year olds) residents who are in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.

Property

10.3.10 An Employment Land Study for Stratford-on-Avon District[66] in 2011 concluded that an estimated 8,300 square metres of new-build industrial and warehousing space has been completed and occupied since 2008.

10.3.11 Average vacancy rate for industrial and warehousing property in Stratford-on-Avon District in July 2013 has been assessed as 6% based on marketed space against known stock[67]. Overall, this suggests relatively good availability of alternative accommodation.

Future baseline

Construction (2017)

10.3.12 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. Implementation of all outstanding development consents and land allocations would result in approximately 150 additional jobs[68] 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)

10.3.13 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026. There are no consents or allocations in this local area which are expected to accommodate additional material employment between 2017 and 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 Code of Construction Practice (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:

- 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)

[66] Stratford-on-Avon District (2011), *Employment Land Study*, GL Hearn, London.
[67] Vacant space is based on marketed space identified from Estates Gazette data (EGi); stock data is taken from information supplied by the Valuation Office Agency (VOA).
[68] Potential employment has been estimated through employment floor space and the Homes and Communities Agency (HCA) *Employment Densities Guide 2nd Edition* (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas.

(draft CoCP Section 13);

- requiring contractors to monitor and manage flood risk and other extreme weather events which may affect socioeconomic resources during construction (draft CoCP, Sections 5 and 16); and
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP Section 14).

Assessment of impacts and effects

Temporary effects

Change in business amenity value

10.4.3 No non-agricultural businesses[69] have been identified within this 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 this area which are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

10.4.5 There are plans to locate two main construction compounds in the Ladbroke and Southam area, off the A423 Banbury Road and off Welsh Road and a further 14 satellite construction compounds and one additional satellite rail systems compound to support construction activity. The use of these sites could result in the creation of up to 1,700 person years of construction employment opportunities[70], or approximately 170 full-time equivalent jobs[71], 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 direct construction employment creation is described as part of the route wide assessment (see Volume 3).

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 and reported as part of the route-wide assessment (see Volume 3).

[69] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.
[70] 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.
[71] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

Permanent effects

Businesses

10.4.9 Businesses directly affected, i.e. those that lie within the land which will be used for the construction of the Proposed Scheme, are reported in groups where possible to form defined resources, based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses/resources are clustered together.

10.4.10 In all, three business accommodation units within the Ladbroke and Southam area will be directly impacted upon by the Proposed Scheme; together these form one defined resource on the A423 Banbury Road. However, from an employment perspective, no significant direct effects on non-agricultural employment[72] 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 ten jobs[73] within this area. Taking into account the availability of alternative premises and the total employed within the district (approximately 56,000), the displacement or possible loss of jobs is considered to be 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.

10.4.13 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed and reported as part of the route-wide assessment (see Volume 3).

Other mitigation measures

10.4.14 The assessment has concluded that there are no significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.

10.4.15 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.

10.4.16 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.

[72] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.
[73] 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 significantly from actual employment at the sites.

Summary of likely residual significant effects

10.4.17 There are no residual significant effects arising 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 non-agricultural businesses have been identified within this area which are expected to experience significant amenity effects as a result of operation 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 residual significant effects

10.5.8 There are no residual 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 Ladbroke and Southam area on:

- people, primarily where they live ('residential receptors') in terms of a) individual dwellings and b) on a wider community basis, including any shared community open areas[74]; 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[75]'.

11.1.2 The assessment of likely significant effects from noise and vibration on agricultural, community, cultural heritage or ecological 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 barriers.

11.1.4 Effects can either be temporary from construction or permanent from the operation of the Proposed Scheme. These effects may be direct, resulting from the construction or operation of the Proposed Scheme, and/or indirect e.g. resulting from changes in traffic patterns on existing roads or railways that result from the construction or operation of the Proposed Scheme.

11.1.5 This section sets out the means to avoid or reduce the adverse effects that may occur.

11.1.6 The approaches to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1 and scope and methodology are defined in the following documents:

- Scope and Methodology Report (SMR) (Appendix CT-001-000/1); and
- SMR addendum (Appendix CT-001-000/2).

11.1.7 More detailed information and mapping regarding the sound, noise and vibration assessment for Ladbroke and Southam is available in the relevant appendices in Volume 5:

[74] '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.

[75] 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.

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-016);
- sound, noise and vibration construction assessment (Appendix SV-003-016);
- sound, noise and vibration operation assessment (Appendix SV-004-016); 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 study area is predominantly rural in character, with agriculture the predominant land use. The southern part is the most sparsely populated, with a scattering of isolated farmsteads between Wormleighton and Ladbroke. The A423 Banbury Road/ Southam Road, which runs between Banbury in the south and Coventry in the north, together with the A425 Leamington Road which runs east to west between Leamington Spa and Daventry are the main transport routes through the area. The sound environment in the area is dominated by natural sound sources with contributions from traffic on a number of roads, the most significant of which are the A423, the A425 Welsh Road and the B4451 Kineton Road.

11.2.2 In the agricultural areas to the northwest of Southam, near the village of Bascote, sound levels are dominated by natural sources, with contributions from distant road traffic on the A425 Leamington Road and Welsh Road. The typical sound levels in these areas are 45 to 50dB[76] during the day and 35 to 40dB[77] at night.

11.2.3 The town of Southam is the largest settlement in the study area and extends to within 600m of the Proposed Scheme. In the southern residential areas of Southam, the soundscape is characterised by local road traffic with contributions from distant traffic on the A425 Leamington Road andA423 Banbury Road during both day and night-time periods. In these areas, typical daytime and night-time sound levels are 60 to 65dB and 55 to 60dB respectively. In the industrial area the soundscape is dominated by the constant flow of road traffic on the A425 Leamington Road and the B4451 Kineton Road as well as sounds from within the industrial estate. Here, baseline sound levels are generally 60 to 65dB during the day and up to 60dB at night.

11.2.4 The village of Ladbroke is located in the rural area to the west of the A423 Southam Road. Close to this main transportation route, road traffic dominates the sound environment. In rural areas away from the A423, the sound environment is characterised by natural sources and distant road traffic, as well as sporadic aircraft over-flights. Typical baseline sound levels during the day within Ladbroke are 50 to 55dB, increasing to 55 to 60dB in the vicinity of the A423 Banbury Road. Night-time levels are typically around 5 to 10dB lower.

[76] Quoted dB values at residential areas refer to the free-field 16-hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.
[77] 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 In the agricultural area south of Ladbroke, around the village of Wormleighton, the sound environment is shaped by natural sources with distant road traffic noise from the A423 Banbury Road. Within the residential village of Wormleighton, the sound environment is characterised by local traffic and natural sources with the occasional contribution from farming equipment and human activities during the daytime. Typical baseline sound levels are 55 to 60dB. During the night-time period, natural sources dominate, with baseline noise levels in the range of 45 to 50dB.

11.2.6 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-016.

11.2.7 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[78]. Vibration at all receptors from the Proposed Scheme has therefore been assessed using specific thresholds, below which receptors will not be affected by vibration. Further information is provided in Volume 1, Section 8.

Future baseline

11.2.8 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads[79], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

11.2.9 The assessment of noise from construction activities assumes a baseline year of 2017 which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline (2012/13) and the future baseline year of 2017. The assessment of noise from construction traffic assumes a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak.

Operation (2026)

11.2.10 The assessment is based upon the predicted change in sound levels that result from the Proposed Scheme. The assessment initially considered a worst case (that would overestimate the change in levels) by assuming that sound levels 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.

[78] Further information is available in the Volume 5: Appendix SV-001-000, the SMR and its Addendum.
[79] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

11.3 Effects arising during construction

Local assumptions and limitations

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 A Tunnel Boring Machine (TBM) will be used to excavate the tunnel under Long Itchington Wood. Materials (including tunnel lining segments), people and equipment will be transported from the surface to the TBM using small construction trains, which will travel at relatively low speeds. Excavated material from each TBM will be transported to the surface by conveyor. It has been assumed that significant noise and vibration effects arising from use of the temporary railway will be avoided through appropriate design and maintenance specification. Other methods of material movement may be employed; however, it is considered that these will result in lower ground-borne noise and vibration.

11.3.3 Although it is anticipated that there may be some night-time working during works to cross or tie into existing roads, it is expected that the noise effects will be limited in duration and will hence not be considered significant. Any noise effects arising from these short term construction activities will be controlled and reduced by the management processes set out in the draft CoCP.

11.3.4 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.

11.3.5 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. Further information is provided in Volume 5: Appendix SV-002-016.

Avoidance and mitigation measures

11.3.6 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP which are as follows:

- Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA) will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings; and then
  - screening: for example local screening of equipment or perimeter hoarding;
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-

housing will be offered in accordance with the draft CoCP's noise insulation and temporary re-housing policy;

- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration including confirmation of noise insulation / temporary re-housing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.7 In addition to this mitigation, taller screening as described in the draft CoCP[80] has been assumed along the edge of the construction site boundary passing by Southam.

11.4 Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.4.1 The mitigation measures will reduce noise inside all dwellings such that it does not reach a level where it would significantly affect[81] residents.

Residential receptors: direct effects –communities

Surface sections

11.4.2 The avoidance and mitigation measures in this area will avoid airborne construction noise adverse effects[82] on the majority of receptors and communities.

11.4.3 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

11.4.4 In locations with lower existing sound levels[82], construction noise effects[82] 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 effects are considered to be significant when assessed on a community basis taking account of the local context[83]. In this area, the mitigation measures reduce the effects of outdoor construction noise on the acoustic character around the local residential communities such that the effects are considered to be not significant.

[80] 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.
[81] Information is provided in the emerging National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk, e.g. the table summarising the noise exposure hierarchy.
[82] Further information is provided in Volume 5: Appendix SV-001-000.
[83] Further information is provided in SV-001-000 and SV-003-016.

Tunnelled sections

11.4.5 A TBM will be used to excavate the tunnel under Long Itchington Wood. The TBM is likely to generate ground-borne noise and vibration impacts but only at receptors within a close distance of the centre line of the tunnels and only for short periods of time (a few days). Overall, the deeper the tunnel is, the lower the impact. The perceptible noise and vibration will increase as the TBM approaches and diminish as it moves away from the receptor. Vibration from the TBM will present no risk of any building damage.

11.4.6 The effects of vibration from the TBM on building occupants will be short term (a matter of days) and hence they are not considered to be significant. Proactive and advanced community relations in advance of the TBM passing under properties will help manage expectations and allay possible concerns over the short term presence of vibration.

Residential receptors: indirect effects

11.4.7 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

Non-residential receptors: direct effects

11.4.8 Significant construction noise or vibration effects on non-residential receptors are unlikely to occur in this area.

Non-residential receptors: indirect effects

11.4.9 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.

11.4.10 This assessment has considered the potential cumulative construction noise effects of the proposed scheme and other committed developments[84]. In this area, there are no developments that would be 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

11.4.11 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it would significantly affect residents.

11.4.12 The measures also reduce the adverse effects of outdoor construction noise on the acoustic character around the local residential communities such that the effects are not considered to be significant.

[84] Refer to Section 2 of this report.

11.5 Effects arising during operation

Local assumptions and limitations

Local assumptions – service pattern

11.5.1 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.

11.5.2 The expected passenger service frequency for both Phase One and Phase One with Phase Two services is described in Volume 1[85]. As a reasonable worst case this assessment is based upon this 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 19. 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 19.

Table 19: Train flows and speeds

Description of line	Time period for peak daily train flows	Number of trains per hour in each direction with Phase Two services (Phase One only trains per hour in each direction is given in brackets)	Speed
Main line between London and the north	0700-2100 hours	18 (14)	330kph for timetabled trains (assumed 90% of services), and 360kph for 10% of services

Local assumptions – tunnelled sections

11.5.3 Tunnel portals are likely to include mechanical ventilation equipment. It is likely that this equipment will only operate for limited testing periods during the daytime[86], or in the event of an emergency.

Avoidance and mitigation measures

11.5.4 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

11.5.5 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 will reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train

[85] The change in noise and vibration effects between the different timetables is assessed in Volume 1.
[86] For example, HS1 vent shaft fans are tested monthly.

operating on the new track. Further information is provided in Volume 5: Appendix SV-001-000.

11.5.6 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise barriers in the form of landscape earthworks, noise fence barriers and/or 'low-level' barriers on viaducts. Noise barrier locations are shown on Volume 2: Map Book – Sound, noise and vibration Map series SV-05.

11.5.7 Generally, the assessment has been based on noise 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 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.

11.5.8 The Proposed Scheme incorporates 'low-level' barriers into the design of 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 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.

11.5.9 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 barriers are not required). The location of these barriers is shown on Volume 5: Map Book – Sound, noise and vibration, Map series SV-05.

11.5.10 The Proposed Scheme also includes a tunnel under Long Itchington Wood that avoids noise effects in and around Bascote Heath and Ufton. Tunnel portals will be designed to avoid any significant airborne noise effects caused by the trains entering or leaving the tunnel.

11.5.11 Significant noise effects from the operational static sources such as mechanical ventilation at tunnel portals and line-side equipment will be avoided through their design and the specification of noise emission requirements (for further information see Volume 5: Appendix SV-001-000).

11.5.12 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[87] (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.

11.5.13 Where required, as well as improvements to windows facing the railway to improve noise insulation, ventilation will be provided so that windows can be kept closed to protect internal sound levels.

[87] Her Majesty's Stationery Office (1996), *The Noise Insulation (Railways and Other Guided Transport Systems) Regulations*, London.

11.5.14 Following Government's emerging National Planning Practice Guidance, 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 Europe[88], 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 assessed[89]. 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 55dB[90], or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion21, noise insulation will be offered for these additional buildings.

Ground-borne noise and vibration

11.5.15 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

Surface sections of route – airborne noise and ground-borne vibration

11.5.16 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified two 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:

- Chapel Bank, Lower Radbourne; and
- Field Cottage, B4451 Kineton Road, Southam.

11.5.17 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.

Tunnelled sections of route – ground-borne noise and vibration

11.5.18 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed. Resilient materials will be used between the rails and the track-bed to protect nearby receptors from operational ground-borne noise and vibration.

11.5.19 Tunnel portals will be designed to avoid any significant airborne noise effects caused by the trains entering the tunnel.

[88] World Health Organization (2010), *Night-time Noise Guidelines for Europe*.
[89] 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: 85dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80dB L_{pAFmax} (where the number of train pass-bys exceeding this value is greater than 20).
[90] Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings.

Residential receptors: direct effects –communities

11.5.20 The avoidance and mitigation measures in this area will avoid adverse airborne noise effects within the following community areas:

- Southam (except as mentioned in Table 20);
- Ladbroke;
- Ufton;
- Wormleighton; and
- Bascote Heath.

11.5.21 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2 Map book) shows the long term 40dB[91] 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 contour[92]. In general, below these levels adverse effects are not expected.

11.5.22 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 Map Series SV-05 (Volume 2 Map Book).

11.5.23 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 basis taking account of the local context[93].

11.5.24 The direct adverse effects on the areas of the residential communities identified in Table 20 are considered to be significant.

Table 20: Direct adverse effects on residential communities and shared 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
OSV16-C01	Airborne noise increase from new train services	Daytime and night-time	Five dwellings in the vicinity of Starbold Farm, and A423 Banbury Road. Forecast increases in sound from the railway are likely to cause a major to moderate adverse effect on the acoustic character of the area around the closest properties. No adverse effects on shared open spaces have been identified

Residential receptors: indirect effects

11.5.25 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

[91] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$.
[92] With the train flows described in the assumptions section of this report, the daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or $L_{pAeq,day}$) 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.
[93] Further information is provided in SV-001-000 and SV-003-016.

Non-residential receptors: direct effects

11.5.26 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

11.5.27 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 residual significant effects

11.5.28 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect residents.

11.5.29 The avoidance and mitigation measures in this area will avoid noise and vibration adverse effects on the majority of receptors and communities including shared open areas.

11.5.30 Taking account of the avoidance and mitigation measures and the local context, the residual permanent noise effects on the acoustic character of the community of residential property around Starbold Farm and A423 Banbury Road are considered significant. No shared open areas have been identified as adversely affected.

11.5.31 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 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 Ladbroke and Southam area.

12.1.2 With regard to traffic and transport, the main issues are increased traffic as a result of implementation of the Proposed Scheme, road realignments and consequential temporary road closures, and temporary and permanent realignments of PRoW.

12.1.3 The effects on traffic and transport have been assessed quantitatively, based on baseline traffic conditions and future projection scenarios.

12.1.4 A detailed report on traffic and transport and surveys undertaken within the area is contained in the Volume 5 Appendix TR-001-000, Transport Assessment.

12.1.5 Figure 2 shows the location of the key transport infrastructure within this area.

12.1.6 Engagement has been undertaken with the key transport authorities including Warwickshire County Council (WCC) and the Highways Agency (HA).

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 roads potentially affected by the Proposed Scheme in the study area include the A423 Banbury Road, the A425 Leamington Road, the B4451 Kineton Road, Wormleighton Road, Stoneton Lane, Windmill Lane and Welsh Road.

12.2.3 A number of transport modelling tools have been used to inform the assessment including the Department for Transport's traffic forecasting tool, Trip End Model Presentation Program (TEMPRO), for future forecast road traffic growth in the area. The assessment covers the morning (08:00-09:00) and evening (17:00-18:00) peak periods for an average weekday.

12.3 Environmental baseline

Existing baseline

12.3.1 Existing conditions in the WCC area have been determined through site visits, specially commissioned transport surveys, and liaison with Warwickshire transport authorities and stakeholders to source transport models, and information on public transport, PRoW and accident data.

12.3.2 Traffic surveys of all roads crossing the route or potentially affected were undertaken in June, July and November 2012, with additional surveys undertaken in May and June 2013, comprising junction turning counts and queue surveys, as well as automatic traffic counts. This was supplemented by traffic and transport data obtained from

other sources, including from the Highways Agency and survey information held by the local authorities. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00.

12.3.3 PRoW surveys were undertaken in August and September 2012 to establish the nature of the PRoW and their usage by pedestrians, cyclists and riders (non-motorised users). The surveys included all PRoW and roads that will be crossed by the route of the Proposed Scheme, and any additional PRoW and roads that will be affected by the Proposed Scheme. The Proposed Scheme will affect ten PRoW and two E-roads (Wills Pastures Road and Radbourne Lane) within the Ladbroke and Southam area and crosses each of these. Nine of the routes were used by less than ten people a day. The routes with the greatest usage were FootpathSM33 (between Ladbroke and Southam) with 23 users and Footpath SM24 (across Stoney Thorpe Park) with 26 users per day. The Proposed Scheme crosses no roads with footways.

12.3.4 There are no strategic roads that pass through the area and the southern part of the area has relatively few roads. The main local roads affected by the Proposed Scheme are: the A423 Banbury Road (the A423 Ladbroke Bypass past Ladbroke), which runs in a south/north direction and connects Banbury in the south with Coventry in the north; the A425 Leamington Road, which runs in a broadly west/east direction and links Leamington Spa in the west with Southam in the east; the B4451 Kineton Road, which has a south-west/north-east alignment and joins the A425 at Southam; Wormleighton Road, which travels in a broadly west/south-east direction and becomes Banbury Road at the south edge of the area; Stoneton Lane, which has a broadly south/north-east alignment and joins Banbury Road; and Windmill Lane, which is a cul-de-sac that runs broadly east from the A425 at Ladbroke which runs in a broadly west/east direction. The Proposed Scheme crosses roads in six locations in the Ladbroke and Southam area.

12.3.5 Safety and accident data for the road network subject to assessment has been obtained from WCC for the three year period of mid 2009 to mid 2012. This has been assessed and no significant accident clusters were identified within the area.

12.3.6 There are four public bus services; route numbers 503, 63, 64 and 65 and Thursday only 503; that pass through the Ladbroke and Southam area. The communities served by bus services, that will be affected by the Proposed Scheme include:

- Rugby, Long Itchington, Ufton and Southam to Leamington – bus number 63, 64, 65, daily twice hourly; and
- Bishops Itchington and Southam to Banbury – bus number 503.

12.3.7 There are no existing national or local rail services in the Ladbroke and Southam area and so these have not been considered further in this assessment.

12.3.8 There is one navigable waterway, Oxford Canal, which will be affected by the Proposed Scheme in this area. The usage of Oxford Canal has been identified during surveys undertaken as approximately seven boats per hour.

Future baseline

12.3.9 The future baseline traffic volumes have been calculated by applying growth factors based on TEMPRO for the years of assessment 2021, 2026 and extrapolation to 2041,

and taking account of any major locally consented schemes. No other changes to the traffic and transport baseline are anticipated in this area.

Construction (2017 to 2025)

12.3.10 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 9% by 2021 compared to 2012.

Operation (2026)

12.3.11 Future baseline traffic volumes in the peak hours are forecast to grow by around 15% by 2026 compared to 2012.

Operation (2041)

12.3.12 Future baseline traffic volumes in the peak hours are forecast to grow by around 33% by 2041 compared to 2012.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as detailed in Section 2) have been included as part of the engineering design of the Proposed Scheme in the Ladbroke and Southam area and will avoid or reduce effects on transport users:

- construction materials and equipment will be transported along the haul road adjacent to the Proposed Scheme alignment where reasonable practicable to reduce lorry movements on the public highway;
- the majority of roads crossing the Proposed Scheme will be kept open during construction resulting in minimal significant diversions of traffic onto alternative routes;
- the Proposed Scheme includes permanent realignments of ten PRoW and two E-roads and temporary diversions as necessary to reduce loss of amenity;
- road closures will be limited to overnight and/or weekends;
- HGV routing along the strategic road network and using designated routes for access; and
- provision of on-site accommodation and welfare facilities to reduce daily travel by site workers.

12.4.2 The draft Code of Construction Practice (CoCP) (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 each 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 plan[94] 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. Where reasonably practicable, this will encourage the use of sustainable modes of transport.

12.4.4 The measures in the CoCP will include clear controls on vehicle types, hours of site operation, and routes for heavy goods vehicles, 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, footpaths and other PRoW affected by the Proposed Scheme as necessary.

12.4.5 Specific measures will include the following:

- core site operating hours will be 08:00-18:00 on weekdays and 08:00-13:00 on Saturdays and site staff and workers will therefore generally arrive before the morning peak hour and depart after the evening peak hour (although the assessment has assumed that some of work journeys to the construction sites take place within the morning and evening peak hours to reflect a reasonable worst case scenario) (draft CoCP, Section 5);
- sites associated with tunnelling works (Long Itchington Wood tunnel main compound) will be operational 24 hours a day; it is envisaged that the shift changeover times will not coincide with the highway peak hours (the excavated material will be removed from the route of the Proposed Scheme in the adjacent CFA17); and
- excavated material will be reused wherever reasonably practicable along the alignment of the Proposed Scheme which will reduce the effects of construction vehicles on the public highway (draft CoCP, Section 15).

Assessment of impacts and effects

Temporary effects

12.4.6 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.

12.4.7 The temporary traffic and transport impacts within this area will be:

- construction vehicle movements to/from the main compounds and satellite compounds;
- road realignments and associated overnight or weekend diversions; and
- PRoW diversions.

[94] 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.

12.4.8 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.

12.4.9 Details of construction compounds are provided in Section 2. Some compounds only have traffic movements to other locations within the construction area. The duration of when there will be busy transport activity at each site is shown in Table 21. This represents the periods when the construction traffic flows will be greater than 50% of the peak flows. Also shown is the estimated number of daily vehicle trips during the peak month of activity, the lower end of the range shows the average number of trips in the busy period and the upper end the peak month flows. The assessment scenario has assumed the peak month for the combination of activities, i.e. not necessarily the peak activity at each individual site.

Table 21: 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	
						Cars/LGV	HGV
Main	Oxford Canal north embankment main compound	Glebe Farm access road, A423 Banbury Road / Southam Road, A422 Hennef Way	2018	5	39	160-245	40-60
Main	Long Itchington Wood tunnel main compound	Welsh Road, B4455 Fosse Way, B4100 Banbury Road, A452 Warwick Bypass	2019	3.5	48	150-180	55-60
Satellite	Footpath SM101 green overbridge compound	Track/haul road via Oxford Canal north embankment main compound	2018	1.5	-	Few external movements	
Satellite	Footpath SM116A underpass compound	Track/haul road via Oxford Canal north embankment main compound	20190	1	-	Few external movements	
Satellite	Oxford Canal viaduct compound	Track/haul road via Oxford Canal north embankment main compound	20190	1.5	-	Few external movements	
Satellite	Lower Radbourne south viaduct compound	Track/haul road via Oxford Canal north embankment main compound	2018	2	-	Few external movements	
Satellite	Lower Radbourne north viaduct compound	Track/haul road via Oxford Canal north embankment main compound	2017	1	-	Few external movements	

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	
						Cars/LGV	HGV
Satellite	Lower Radbourne Farm accommodation overbridge compound	Welsh Road East via Paxhall Farm access, then A425 Daventry Road, A423 Banbury Road/Southam Road	2018	2.5	21	50-65	25-30
Satellite	Ladbroke Grove Farm accommodation overbridge compound	Track/haul route via Lower Radbourne Farm accommodation overbridge compound	2018	1	-	Few external movements	
Satellite	A423 Banbury Road overbridge (north) compound	A423 Banbury Road	2018	1	11	60-65	15-20
Satellite	A423 Banbury Road overbridge (south) compound	Track/haul route via A423 Banbury Road overbridge (north) compound	2018	1	-	Few external movements	
Satellite	Windmill Lane Farm overbridge compound	Windmill Lane, A423 Banbury Road/Southam Road	2018	4	25	50-65	25-30
Satellite	B4451 Kineton Road overbridge compound	B4451 Kineton Road, A425 Leamington Road, A423 Banbury Road/Southam Road	2018	1	12	60-65	20
Satellite	River Itchen viaduct compound	A425 Leamington Road, A423 Banbury Road/Southam Road	2019	3	34	75-85	-25-30
Satellite	Long Itchington Wood green tunnel compound	A425 Leamington Road, A423 Banbury Road/Southam Road	2018	2.5	27	105-125	30
Satellite	Longhole viaduct (south) Compound	Track/haul route via Long Itchington Wood tunnel main compound	2018	1	-	Few external movements	
Road head	RH-126	A425 Leamington Road, B4455 Fosse Way, B4100 Banbury Road, A452 Warwick Bypass	2019	2	23	-	234

12.4.10 Details of the construction phasing are provided in Section 2.3. The assessment of construction traffic has considered the traffic and transport impacts and effects in three peak periods of construction activity, based on the proposed phasing of the works. The peak periods have been identified as months 25 to 36 (2018 Quarter 2 to

2019 Quarter 2) when there will be 11 operational compounds and months 41 (2019 Quarter 3) and 49 (2020 Quarter 2) when there will be 10 operational compounds. It is envisaged that the M40, via the A423 and A425 or B4451, B4100 and A452 will provide the primary HGV access and egress routes.

12.4.11 There will be overnight and/or weekend closures on Wormleighton Road, Stoneton Lane, Windmill Lane, the A423 Banbury Road, the B4451Kineton Road and the A425 Leamington Road. The effect of these off peak closures on traffic flows and delays to vehicle occupants, in terms of the diversions and traffic congestion[95], will not be significant.

12.4.12 Construction of the Proposed Scheme will result in changes in traffic flows and delays to vehicle users due to increased traffic flows from workers and construction vehicles accessing compounds and also temporary road closures and diversions.

12.4.13 Highway realignments in this area will result in changes in journey length of less than 630m and thus will not be significant.

12.4.14 Changes in traffic flows will lead to a significant increase in delay and congestion to vehicle users in the following locations between the M40 and the A423, all of which are located within CFA15 Greatworth to Lower Boddington:

- M40 slip roads / A422 Hennef Way / A361 Willamscot Hill junction (major adverse effect);
- A422 Hennef Way / Ruscote Avenue / A423 Southam Road junction (minor adverse effect);
- A422 Hennef Way / Concord Avenue junction (moderate adverse effect); and
- A422 Hennef Way / Ermont Way junction (major adverse effect).

12.4.15 The majority of these junctions are predicted to be over capacity in the future baseline scenario, assuming that background traffic growth is unconstrained. The addition of construction traffic will, however, increase congestion.

12.4.16 Construction of the Proposed Scheme is forecast to result in substantial increases in daily traffic flow (i.e. more than 30% for HGV or all vehicles) causing a significant increase in traffic related severance[96] for non-motorised users in the following locations:

- A423 Banbury Road, between the Ruscote Avenue / A423 / A422 Hennef Way junction in Banbury in the south and the A423 Banbury Road/A426 junction in the north of Southam (moderate adverse effect due to increase in HGV traffic);
- A423 Banbury Road and Glebe Farm Access road in the vicinity of their

[95] In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows at a junction will be beyond or very close to capacity with the Proposed Scheme and the increases in traffic due to the Proposed Scheme will be such as to substantially increase queues and delays on a routine basis at peak times. A moderate adverse effect will occur when traffic flows at a junction will be approaching or at capacity with the Proposed Scheme and modest increases in traffic will increase the frequency of queues and more substantial delays. A minor adverse effect occurs when traffic flows at a junction are not generally exceeding capacity with the Proposed Scheme but the increase in flows will result in occasional queues and delays or small increases in existing delays.

[96] In the context of this assessment, 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 for access.

junction (major adverse effect due to increase in all-vehicle flows);

- Welsh Road between the Proposed Scheme and B4455 Fosse Way (moderate adverse effect due to increase in HGV); and
- B4455 Fosse Way, between Welsh Road and B4100 Banbury Road (major adverse effect due to increase in HGV).

12.4.17 Utilities works (including diversions) have been assessed in detail only 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 from such works within the area. Smaller utilities works are expected to result in only localised traffic and pedestrian diversions, which will be of short-term duration. No additional significant effects are expected.

12.4.18 In order to access the Oxford Canal north embankment main compound the existing access from the A423 Banbury Road to Wills Pastures Road will require to be upgraded to a suitable carriageway. The effect of these works on traffic flows and delays to vehicle occupants will not be significant.

12.4.19 The effect on accidents and safety 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.

12.4.20 It is not expected that the construction of the Proposed Scheme will require any bus route diversions, as road closures are only proposed overnight when bus services will not be operational.

12.4.21 Construction of the Proposed Scheme is not expected to result in any temporary loss of pedestrian access to public transport. There are no stations/interchanges affected by the Proposed Scheme in this area.

12.4.22 There will be a minor adverse effect on non-motorised users due to one PRoW (SM101) being diverted by approximately 250m resulting in a increased travel distance. Effects arising from permanent PRoW realignments are reported in Section 12.5.

12.4.23 There will be four minor adverse effects on journey ambience within the Ladbroke and Southam area. These are: Footpath SM24, where users will have to cross the A425 Leamington Road which will be used as a construction route; and Bridleway SM96, Footpath SM90 and Footpath SM33, where the journey ambience will be adversely affected by the construction of the Proposed Scheme.

12.4.24 There is one navigable waterway, Oxford Canal, within the Ladbroke and Southam area. The effect of the construction of the Proposed Scheme on the Oxford Canal will not be significant since no stoppage of the waterway is proposed.

Cumulative effects

12.4.25 The assessment includes cumulative effects of planned development during construction, by taking this into account within the background traffic growth.

12.4.26 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in the neighbouring areas of Greatworth

to Lower Boddington (CFA15) and Offchurch and Cubbington (CFA17). Construction traffic flows of 800 cars/LGV and 450 HGV per day inbound and 750 cars/LGV and 450 HGV outbound have therefore been included in the assessment for this area.

Permanent effects

12.4.27 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 of the operations phase need to be considered together.

Other mitigation measures

12.4.28 The implementation of the measures set out in 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. These reductions in effects arising from the travel plan measures have not been included in the assessment, which will mean the effects may be over-stated.

12.4.29 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 residual significant effects

12.4.30 The most intensive peak periods of construction will cause increases in traffic in the Banbury area that will affect pedestrians, cyclists and equestrians crossing and using: A423 Banbury Road between the Ruscote Avenue / A423 / A422 Hennef Way junction in Banbury in the south and the A423 Banbury Road / A426 junction in the north of Southam; on A423 Banbury Road and Glebe Farm Access in the vicinity of their junction; On Welsh Road between the Proposed scheme and B4455 Fosse Way; and on B4455 Fosse Way between Welsh Road and B4100 Banbury Road.

12.4.31 Similarly temporarily increased traffic will cause additional congestion, increasing delays for road users on the M40 slip roads / A422 Hennef Way / A361 Willamscot Hill junction, the A422 Hennef Way/Ruscote Avenue/A423 Southam Road junction, the A422 Hennef Way / Concord Avenue junction, and the A422 Hennef Way / Ermont Way junction.

12.4.32 One PRoW (Footpath SM101) will be temporarily diverted resulting in increased walking distances of approximately 250m.

12.4.33 The significant effects that result from construction of the Proposed Scheme are shown on Map TR-03-101 (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:

- retaining the majority of roads crossing the Proposed Scheme in their current location, or very close to their current location resulting in no significant

diversions of traffic onto alternative routes; and

- retaining PRoW crossing the Proposed Scheme, with localised realignments kept to a minimum where reasonably practicable.

Assessment of impacts and effects

12.5.2 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).

12.5.3 The operational traffic and transport impacts within this area will include:

- realignments of six roads;
- permanent PRoW and E-road realignments; and
- traffic accessing the areas of the Proposed Scheme for maintenance purposes.

12.5.4 The only changes to traffic will be occasional traffic that may access areas of the Proposed Scheme for maintenance purposes. However, these vehicle movements are expected to be very infrequent and will therefore have no significant effect, including no effects on travel times or non-motorised users. There are no other changes to traffic flows as a result of the Proposed Scheme.

12.5.5 The effect on accidents and safety will not be significant as there are no substantial increases in traffic due to the operation of the Proposed Scheme.

12.5.6 The Proposed Scheme will have no effect on the four bus services (503, 63, 64 and 65) which will intersect with the alignment of the Proposed Scheme. There will be no significant effects on public transport within this area.

12.5.7 A total of ten PRoW and two E-roads will be realigned within this area. Of these, seven PRoW and one E-road will be realigned by less than 100m, which will not be significant. The Proposed Scheme will have a minor adverse effect on four PRoW (Footpath SM116a, Bridleway SM96, Footpath SM90 and Footpath SM33) and one E-road (E2413 Radbourne Lane) due to increased travel distances of up to 460m with the exception of Bridleway SM96 that is diverted by approximately 845m (during surveys undertaken no users utilised this PRoW).

12.5.8 The effects in 2041 will be the same as those in 2026.

Cumulative effects

12.5.9 The assessment includes for the cumulative effects of planned development during operation, by taking this into account within the background traffic growth.

12.5.10 The assessment has considered in-combination effects with neighbouring CFAs, but there will be no additional transport impacts in this area due to other CFAs.

Other mitigation measures

12.5.11 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on this assessment.

Summary of likely residual significant effects

12.5.12 A total of four PRoW (Footpath SM116a, Bridleway SM96, Footpath SM90 and Footpath SM33) and one E-road (E2413) will be diverted and will permanently increase travel distance and journey times for pedestrians, cyclists and equestrians.

12.5.13 The significant effects that result from operation of the Proposed Scheme for 2026 and 2041 are shown on Map TR-04-101 (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 that are present across the Ladbroke and Southam area (CFA16) include:

- the River Itchen and three of its tributaries, which are all classified as ordinary watercourses, will be crossed by the Proposed Scheme;
- a tributary of the River Leam, which is classified as an ordinary watercourse and will be crossed by the Proposed Scheme at the northern boundary of the Ladbroke and Southam area;
- the Oxford Canal will be crossed by the Proposed Scheme;
- a number of Secondary aquifers;
- Long Itchington and Ufton Woods Site of Special Scientific Interest (SSSI);
- numerous minor springs; and
- one licensed groundwater abstraction and four private groundwater abstractions used for potable water supply within the area.

13.1.3 Key environmental issues relating to water resources and flood risk include:

- the potential impact of the viaduct crossings over watercourses in this area, specifically tributaries of the River Itchen south of Chapel Bank Cottage and at Chapel Bank Cottage, the River Itchen at Thorpe Bridge and a tributary of the River Leam at Longhole Bridge;
- the potential impact of culvert crossings over a tributary of the River Itchen at Ladbroke Fox Covert;
- the potential impact of the viaduct crossings over the Oxford Canal at Stoneton Farm;
- the realignment of a tributary of the River Leam at Longhole Bridge around the embankment required for the Longhole viaduct;
- the realignment of a tributary of the River Itchen at Ladbroke Fox Covert as a result of straightening the watercourse for the Ladbroke culvert;
- the potential impact on groundwater flow to issues, springs and on groundwater dependent ecological receptors; and
- potential impacts on groundwater flow to local private abstractions.

13.1.4 Volume 5: Appendix WR-001-000 contains a report on the route-wide effects including:

- generic assessments on a route-wide basis;
- stakeholder engagement;
- in combination effects;
- a draft operation and maintenance plan for water resources and flood risk;
- a Water Framework Directive (WFD)[97] 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:

- Appendix WR002-016: Water Resources Assessment report;
- Appendix WR003-016: Flood Risk Assessment; and
- Appendix WR-004-009: River Modelling Report.

13.1.6 Map series WR-01 to WR-06 showing details referred to in this report and those in Volume 5 are contained in Volume 5: Map Book – Water resources.

13.1.7 Discussions have been undertaken with the Environment Agency, Warwickshire County Council (WCoC) as the Lead Local Flood Authority (LLFA), Warwickshire Wildlife Trust and the Canal & River Trust (formerly British Waterways).

13.2 Scope, assumptions and limitations

13.2.1 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1, Section 8 and in the SMR and its addendum (Volume 5: Appendices CT-001-000/1 and CT-001-000/2) and appendices presented in Volume 5: WR-002-016 and WR-003-016. This report follows the standard assessment methodology.

13.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area.

13.2.3 Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the

[97] Directive 200/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, European Parliament and European Council, Strasbourg.

Proposed Scheme, or within the calculated zone of influence have been included in the assessment.

13.2.4 Site visits were undertaken in June 2013 with the Environment Agency and Warwickshire County Council for the following locations along the route: a tributary of the River Itchen at Ladbroke Fox Covert and the River Itchen at Thorpe Bridge.

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 River Basin Management Plan (RBMP), these are referred to as 'not assessed by the Environment Agency' in the summary of geology and hydrogeology in Table 23.

13.2.6 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.

13.2.7 The limitations associated with flood risk within this area are described in detail in Volume 5: Appendix WR-003-016.

13.3 Environmental baseline

Existing baseline-surface water resources

Surface water features

13.3.1 The water bodies within this area, apart from the Oxford Canal (Oxford Canal, summit pound, WFD water body (identifier GB70910196), either fall within the Cherwell catchment, which is within the Thames River Basin District (RBD), or the Warwickshire Avon catchment, which is within the Severn RBD, as set out in the River Basin Management Plan (RBMP)[98]. The Oxford Canal (Oxford Canal, summit pound, WFD water body identifier GB70910196) is not assigned to a management catchment but is within the Thames River RBD[99].

13.3.2 The current surface water baseline is shown in Volume 5: Map WR-01-25, 026 and 027 and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-016. Table 22 includes features potentially affected by the Proposed Scheme.

[98] Environment Agency (2009), *Water for life and livelihoods: River basin Management Plan Severn River Basin District.*
[99] Environment Agency (2009), *Water for life and livelihoods: River Basin Management Plan Thames River Basin District.*

Table 22: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (map reference[100])	Classification[101]	WFD water body name and number and current overall status	WFD objective status (by 2027 as per Thames/Severn RBMP, unless stated)	Receptor value[102]
Oxford Canal	At Stoneton Farm (SWC-CFA16-001)	Not applicable	Oxford Canal, summit pound (GB70910196) – Good Potential	Good Potential by 2015	Moderate
Tributary of River Itchen	South of Chapel Bank Cottage (SWC-CFA16-002)	Ordinary watercourse	River Itchen – source to confluence with River Stowe (GB109054044070) – Moderate Status	Good Status	Moderate
Tributary of the River Itchen	At Chapel Bank Cottage (SWC-CFA16-003)	Ordinary watercourse			High
Tributary of River Itchen	At Ladbroke Fox Covert (SWC-CFA16-004)	Ordinary watercourse			Moderate
River Itchen	At Thorpe Bridge (SWC-CFA16-005)	Ordinary watercourse			Moderate
Tributary of River Leam	At Longhole Bridge (SWC-CFA16-006)	Ordinary watercourse	Grand Union Canal, Braunston to Leamington Spa (GB70910511) – Good Potential	Good Potential by 2015	Moderate
20 Ponds	Located within the land required for the construction and operation of the Proposed Scheme.	Not applicable			Low
Two Ponds	Located outside of the land required for the construction and operation of the Proposed Scheme but within the zone of influence.	Not applicable			Low

Water Framework Directive status

13.3.3 The Environment Agency notes that the overall WFD classification of the Oxford Canal is Good Potential and the River Itchen is Moderate Status. The WFD objective status of both water bodies is Good Potential and Good Status respectively. The

[100] Volume 5: Map Book – Water resources, Maps WR-01-035 and WR-01-036.
[101] 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.
[102] For examples of receptor value see Table 43 in the addendum to the SMR (Volume 5: Appendix CT-001-000/2).

objective is to achieve this by 2015 for the Oxford Canal and by 2027 for the River Itchen. The WFD status and objectives of water bodies that do not intersect the Proposed Scheme are shown in Volume 5: Appendix WR-002-016.

Abstractions and permitted discharges

13.3.4 There is one location where surface water is abstracted within 1km of the Proposed Scheme in this area, according to data from the Environment Agency (details in Volume 5: Appendix WR-002-016).

13.3.5 Information from Stratford on Avon District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

13.3.6 There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20 cubic metres per day.

13.3.7 The Envirocheck records indicate that there are 17 current permitted surface water discharges within 1km of the Proposed Scheme in this area (details in Volume 5: Appendix WR-002-016).

Existing baseline – groundwater resources

Geology and hydrogeology

13.3.8 The location of abstractions and geological formations are shown on Map WR-02 016, Volume 5.

13.3.9 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 23. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 23: Summary of geology and hydrogeology in CFA16

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD objective status (by 2027* as per RBMP)	Receptor value
Superficial deposits						
Alluvium	Spatially limited deposits associated with the river valleys within this CFA.	Clay, silt, sand and gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Head	Occasional pockets are present to the north-west of Long Itchington and Ufton Woods (will not be crossed by the Proposed Scheme).	Clay, silt, sand and gravel with lenses of silt and clay	Secondary undifferentiated aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD objective status (by 2027* as per RBMP)	Receptor value
Bedrock						
Charmouth Formation	Outcrops within this CFA from the south of the route section to the south of Southam.	Predominantly mudstone with occasional limestone	Unproductive strata, with limestone deposits as Secondary undifferentiated aquifer	Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) Good Status	Good Status	Low
Rugby Limestone Member	Outcrops are present within this CFA to the south and south-west of Southam.	Interbedded mudstones and limestone	Secondary A aquifer	Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) Good Status	Good Status	Moderate
Saltford Shale Member	Extends northwards within this CFA from the south and south-west of Southam as far as the northern extent of Long Itchington Wood.	Mudstone	Secondary B aquifer	Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) Good Status	Good Status	Moderate
Langport Member		Limestone	Secondary (undifferentiated) aquifer	Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) Good Status	Good Status	Moderate
Penarth Group		Interbedded argillaceous rock and limestone	Secondary B aquifer	Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) Good Status	Good Status	Moderate
Mercia Mudstone Group	Present within this CFA from the north of Long Itchington and Ufton Woods to the north of the route section.	Mudstone and sandstone	Secondary B aquifer	Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) Good Status	Good Status	Moderate

* Year may vary in different RBMPs.

Superficial deposits

13.3.10 Shallow groundwater in the superficial (alluvium) associated with the valley of the River Itchen and the Head deposits to the north-west of Long Itchington and Ufton Woods is likely to be in continuity with the River Itchen, with flow generally towards the north-west of Snowford Hill.

13.3.11 The alluvium is classified as a Secondary A aquifer while the Head deposits are classified as a Secondary (undifferentiated) aquifer.

13.3.12 The groundwater vulnerability of these superficial aquifers is generally low with areas of intermediate vulnerability. Groundwater, if present within the superficial aquifers, is assumed to be at shallow levels and likely to flow towards local rivers and streams.

Bedrock aquifers

13.3.13 The Rugby Limestone Member and the occasional sandstones of the Mercia Mudstone Group are classified as Secondary A aquifers. The Saltford Shale Member, Penarth Group and Mercia Mudstone Group are classified as Secondary B aquifers and the Langport Member and dolomitic siltstones of the Mercia Mudstone Group are classified as Secondary undifferentiated aquifers.

13.3.14 The Charmouth Mudstone Formation is classified as Unproductive strata.

13.3.15 Groundwater levels within the Principal and Secondary aquifers are unknown but are considered likely to be influenced by topography, in general, with flow towards rivers.

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 groundwater in the study area is summarised in Table 23 and is largely classified as probably at risk, with overall Good Status.

13.3.18 Groundwater within the Ladbroke and Southam area lies primarily within the Warwickshire Avon – Secondary Mudrocks Groundwater Body (GB40902G990900) which is currently designated as being of good overall status and is predicted to remain as being of overall Good Status by 2015. The southernmost area from around Wormleighton southwards lies within the Banbury Jurassic Groundwater Body (GB40602G600200) which is currently designated as being of good overall status and is predicted to be of overall Good Status.

13.3.19 The River Basin Management Plans for the Severn RBD and Thames RBD state that: "For groundwater quality, the main reasons for poor status are high or rising nitrate concentrations, with some failures for pesticides and other chemicals. The main reason for poor quantitative status in groundwater is that abstraction levels – mainly for drinking water – exceed the rate at which aquifers recharge".

Abstractions and permitted discharges

13.3.20 The Environment Agency hold records of one licensed groundwater abstraction and Warwickshire County Council hold records of a further four abstractions used for potable supply within the study area (Volume 5: Map WR-02-016).

13.3.21 There are no Source Protection Zones (SPZ) associated with the abstractions in this area.

13.3.22 Envirocheck data indicates that there is one current permitted discharge to groundwater within the study area, details of which are presented in Volume 5: Appendix WR-002-016 and shown on Map WR-02-016, Volume 5.

Surface water/groundwater interaction

13.3.23 Surface water/groundwater interaction is widespread throughout the area in the form of springs, issues (generally a less defined area of rising groundwater than a spring), ponds, sinks and watercourses. Locations of these features are detailed in Volume 5: Appendix WR-002-016, Table 6. It is likely that shallow groundwater may be present in close proximity to these features.

13.3.24 Ponds which have been identified within the estimated zone of influence of cuttings, or within the land required for the construction and operation of the Proposed Scheme and therefore may potentially be affected by the Proposed Scheme, are summarised in Table 22 and listed in full in Table 6 of Volume 5: Appendix WR-002-016. These ponds are assumed to be in hydraulic connectivity with groundwater unless further assessment suggests that they are situated upon low permeability strata or lined with an impermeable layer.

Water dependent habitats

13.3.25 There are two areas with statutory ecological designations in the study area. These are:

- Ufton Fields Nature Reserve, a SSSI and Local Nature Reserve (LNR); and
- Long Itchington and Ufton Woods SSSI and ancient woodland.

13.3.26 There are a number of potentially water dependent ecological sites within the study area. These are detailed in Table 7 of Volume 5: Appendix WR-002-016 and include:

- Southam Meadow South Local Wildlife Site (LWS);
- Thorpe Rough ancient woodland; and
- Print Wood LWS and ancient woodland.

13.3.27 Further information on the ecological receptors is given in Section 7.

Existing baseline – flood risk

River flooding

13.3.28 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping. This mapping has been supplemented with the use of site specific hydraulic modelling at locations where the Proposed Scheme will cross watercourses.

13.3.29 In the vicinity of Lower Radbourne, the land use within Flood Zone 2 and 3 is categorised as less vulnerable as no there are no residential or other more vulnerable land uses. Land use within Flood Zone 2 and 3 to the south and west of Southam is also categorised as less vulnerable. The FRA in Volume 5: Appendix WR-003-016 provides further details of receptors within the Flood Zones and their vulnerability.

13.3.30 Land use within Flood Zone 2 and 3 at the proposed Lower Radbourne viaducts is categorised as less vulnerable. Land use within Flood Zone 2 and 3 to the south and west of Southam is also categorised as less vulnerable. The FRA in Volume 5: Appendix WR-003-016 provides further details of receptors within the Flood Zones and their vulnerability.

13.3.31 For all watercourses there will be an associated Flood Zone 3b (functional floodplain) denoting a very high risk of river flooding.

13.3.32 Historical flooding, in the study area, has been identified through the Environment Agency Mapping, the Warwickshire SFRA[103] and the Warwickshire PFRA[104]. The Environment Agency mapping indicates historical flooding has occurred 600m east of the proposed River Itchen viaduct, most likely as a result of overtopping from the River Itchen. The Warwickshire SFRA and PFRA indicate that there have been no historical incidents of flooding along the route.

Surface water flooding

13.3.33 The agreed data set for surface water flooding is the Environment Agency Flood Map for Surface Water (FMfSW), as shown on Maps WR-01-025, 026 and 027, Volume 5. These maps have been reviewed to form the basis of the assessment of the impact on the risk of surface water flooding.

13.3.34 The FMfSW show two rainfall events, the 1 in 30 (3.3%) and the 1 in 200 (0.5%) annual probability. The areas susceptible to surface water flooding during the 1 in 200 (0.5%) annual probability event are shown on Maps WR-01-025, 026 and 027, Volume 5. The maps show areas currently at risk of surface water flooding and where surface water can collect in areas of low elevation such as following open drainage channel networks associated with watercourses. These maps are discussed further in Volume 5: Appendix WR-003-016.

13.3.35 Six areas identified to be at risk of surface water flooding are classed to be at a high risk, with five locations identified to be at a medium risk. The areas at risk of surface water flooding can be categorised into three types:

- areas associated with existing watercourses;
- overland flow paths; or
- isolated areas.

13.3.36 The main areas at risk from surface water flooding are associated with the River Itchen and its tributaries. Other areas at risk from surface water flooding are associated with small land drains and isolated areas along the route. The isolated areas are often in the upstream reaches of catchment where drainage channels are not evident; at water bodies such as ponds and generally low areas in the topography.

13.3.37 In this area there are nine locations where overland flow paths are evident on the Environment Agency's FMfSW which do not follow a watercourse. These are generally associated with upstream areas of catchments where drainage channels are not evident. A description of the location of these areas at risk is included in the FRA (Volume 5: Appendix WR-01-016).

[103] Warwickshire County Council (2008), *Warwickshire Strategic Flood Risk Assessment*.
[104] Warwickshire County Council (2011), *Warwickshire Preliminary Flood Risk Assessment*. Completed by Royal Haskoning on behalf of Warwickshire County Council.

13.3.38 The Environment Agency Mapping, Warwickshire SFRA and Warwickshire PFRA indicate that there have been no incidents of historical surface water flooding either at or within 1km of the route.

Sewer flooding

13.3.39 The agreed data sets for sewer flooding are the Warwickshire SFRA, the Warwickshire PFRA. In this location, Severn Trent Water asset mapping has also been used.

13.3.40 There are two locations where the Proposed Scheme will cross the sewer network, with one of these locations also crossing an inspection cover and hence being a surcharge location. However, at neither of these locations are there flood flow paths that would be affected by the Proposed Scheme, therefore there will be no impact on flood risk from this source.

13.3.41 The Environment Agency Mapping, Warwickshire SFRA and Warwickshire PFRA indicate that there have been no incidents of historical sewer water flooding either at or within 1km of the route.

Artificial water bodies

13.3.42 The agreed dataset for reservoir flooding is the Environment Agency reservoir inundation mapping. OS mapping has been used to determine the location of canals within the study area.

13.3.43 Flooding from artificial drainage systems may occur from failure of a retaining structure which impounds water or during events that are below the design capacity of the system, if the system capacity is temporarily reduced due to blockage by debris. The following man-made features have been identified within the FRA (Volume 5, Appendix WR-003-016) as being an artificial source of flood risk:

- the canal system; and
- reservoir failure.

13.3.44 The route crosses the Oxford Canal (Volume 5: Map WR-01-025, SWC-CFA16-001) to the north of Wormleighton and the Grand Union Canal (Volume 5: Map WR-01-027, SWC-CFA16-006) immediately to the north of the Ladbroke and Southam area. Through the use of LiDAR it is considered that these canals, at the crossing locations, have embankments which potentially impound water during periods of high water levels. Therefore, if structural breaching occurs during periods of high water levels, flooding may occur. Water levels in canals are maintained and the risk from this source is considered to be low.

13.3.45 The probability of flooding occurring from the failure of a reservoir or large water body created by impoundment of water, by a dam or other retaining structure is extremely low. There is one location in this area identified to be at risk, based on the Environment Agency reservoir inundation maps. This is at the location of the River Itchen viaduct. If Napton Reservoir (located 7km upstream of the route crossing) fails, flood water would flow along the River Stowe and through the town of Offchurch before reaching the River Itchen and the proposed viaduct. At this location, the inundation mapping shows smaller flood extents than Flood Zone 2 and 3.

13.3.46 Due to the strict regulations and high level of maintenance associated with reservoirs, breaching is considered very unlikely. In addition, the Proposed Scheme will not increase the risk of flooding from this source. Therefore the risk from this source of flooding is categorised as low.

13.3.47 The Environment Agency Mapping, Warwickshire SFRA and Warwickshire PFRA indicate that there have been no historical incidents of reservoir or canal flooding either at the location of the route or within 1km of the route.

Groundwater flooding

13.3.48 The agreed data set for groundwater flooding is the Warwickshire PFRA. The Warwickshire Strategic PFRA does not report any significant groundwater flooding within the study area. The Warwickshire Strategic Flood Risk Assessment (SFRA)[105] does not report any significant groundwater flooding within the area.

Future baseline

13.3.49 Section 2.1 and Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The 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.

Construction (2017)

13.3.50 All committed developments are required to comply with the National Planning Policy Framework (NPPF)[106], development plans and other legislation and guidance. As such committed developments are not expected to have a material effect on the water resources and flood risk baseline.

13.3.51 WFD future status objectives are set out in Table 22 and Table 23. These changes are not considered to result in significant changes to the reported effects from the Proposed Scheme changing in significance.

Operation (2026)

13.3.52 For the reasons stated above for construction, the cumulative development will not result in a change in significance of the effects from operation of the Proposed Scheme.

Climate change

13.3.53 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

[105] Halcrow Group Limited (2008), *Warwickshire County Council, Strategic Flood Risk Assessment for Local Development Framework. Level 1 Volume 1. P41.*
[106] Department for Communities and Local Government (2012), *National Planning Policy Framework.*

are not considered to result in the reported effects from the Proposed Scheme changing in significance.

13.3.54 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.

13.3.55 When considering the influence that climate change may have on the future baseline against which impacts that the Proposed Scheme on flood risk has been evaluated, the assessment has used the recommended precautionary sensitivity ranges of key parameters, as given in Table 5 in the Technical Guidance to the NPPF. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

13.3.56 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Sections 7 and 8 of Volume 1 and Table 13 of Volume 5: Appendix CT-009-000.

13.4 Effects arising during construction

Avoidance and mitigation measures

13.4.1 The general approach to mitigation is set out in Volume 1.

13.4.2 The following 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: Appendices WR-002-016 and WR-003-016.

13.4.3 It is proposed to culvert a section of a tributary of the River Itchen at Ladbroke Fox Covert (Volume 5: Map WR-01-035, SWC-CFA16-004).

13.4.4 Culvert lengths have been minimised 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)[107] 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.

13.4.5 It is proposed to realign a tributary of the River Leam at Longhole Bridge (Volume 5: Map WR-01-035, SWC-CFA16-006) around the proposed embankment for the viaduct at that location. Consideration will be given to incorporate meanders and natural banks in the new channel in consultation with the Environment Agency.

[107] Construction Industry Research and Information Association (2010), *Culvert Design and Operation Guide C689*.

13.4.6 Consideration will be given in the design to the objectives of the WFD as described in the River Basin Management Plan. This may include the use of soft engineering solutions for bank design, and the inclusion of natural forms such as berms or incorporation of a two-stage channel, riffles and pools and marginal planting, where reasonably practicable.

13.4.7 Railway drainage will be managed using sustainable drainage techniques. In this area surface water discharges are proposed to:

- the Oxford Canal (Volume 5: Map WR-01-035, SWC-CFA16-001) at Stoneton Farm;
- the River Itchen (Volume 5: Map WR-01-035, SWC-CFA16-005) at Thorpe Bridge;
- tributaries of the River Itchen south of Chapel Bank Cottage and at Chapel Bank Cottage (Volume 5: Map WR-01-035, SWC-CFA16-002 and 003) and at Starbold Farm; and
- a tributary of the River Leam (Volume 5: Map WR-01-035, SWC-CFA16-006) at Longhole Bridge.

13.4.8 Railway run-off will be attenuated with balancing ponds and restricted prior to discharge to emulate the existing environment by reducing run-off to existing greenfield rates.

13.4.9 The realignment of one major road (the A423 Banbury Road), the reinstatement of one major road (the A425 Leamington Road) over the Long Itchington Wood green tunnel and the realignment of two minor roads (Windmill Lane and the B4451 Kineton Road) are required as part of the Proposed Scheme in the area. The receiving watercourses for road run-off are as follows:

- a tributary of the River Itchen at Ladbroke Fox Covert (Volume 5: Map WR-01-035, SWC-CFA16-004) to which it is assumed Windmill Lane outfalls;
- a tributary of the River Itchen at Starbold Farm to which it is assumed the A423 and the B4451 Kineton Road outfall; and
- the River Itchen at Thorpe Bridge (Volume 5: Map WR-01-035, SWC-CFA16-005) to which it is assumed the A425 outfalls.

13.4.10 Appropriate sustainable drainage mitigation will be provided for minor roads to address the risks to the receiving watercourses (for both flow and water quality) and will be selected using the Design Manual for Roads and Bridges)[108] and CIRIA[109] guidance. For the major roads (identified through the application of the criteria set out within the SMR), further specific assessments will be made using the guidance from the Design Manual for Roads and Bridges through the detailed design phase.

13.4.11 Five viaducts: the Oxford Canal viaduct, Lower Radbourne South viaduct, Lower Radbourne North viaduct, River Itchen viaduct and Longhole viaduct, are located

[108] DMRB, *Volume 4 Section 2*.
[109] CIRIA (2006), *c648 Control of water pollution from linear construction projects*.

within this area. These viaducts avoid the requirement for culverts and usually allow the watercourse to remain within its existing channel, although this is not the case for Longhole viaduct where a minor diversion of the watercourse SWC-CFA16-006 is necessary.

13.4.12 The alignment has been raised in the vicinity of Ladbroke Grove embankment that has removed the need for a cutting in the area. This means that potential adverse impacts on several ponds have been avoided.

13.4.13 Long Itchington Wood tunnel is proposed to be constructed by boring, therefore dewatering of the aquifer is unlikely to be necessary and groundwater levels within the aquifer are unlikely to decrease, resulting in minimal impact to neighbouring receptors with respect to groundwater.

13.4.14 The earthworks in the vicinity of the issues that are immediately south-east of Church Farm, approximately 1.6km north of Wormleighton have been re-designed to avoid these.

13.4.15 Sustainable drainage systems (SuDS) and infiltration trenches are to be put in place to facilitate recharge to the groundwater to help maintain groundwater levels within the Principal and Secondary aquifers. SuDS will also reduce the risk of any potential contamination from accidental leaks or polluted surface water runoff from reaching the groundwater and, therefore, prevent deterioration in groundwater quality status. These SuDS and infiltration trenches will be located in areas where gravity transfer is achievable.

13.4.16 Replacement floodplain storage areas will be provided to mitigate the impact of the Proposed Scheme on river flood risk in consultation with the Environment Agency. At the Lower Radbourne South viaduct, an area of land has been identified that is suitable to provide replacement floodplain storage, therefore reducing the change in flood risk.

13.4.17 Where the Proposed Scheme will interrupt surface water flow paths, the drainage will be designed to intercept and manage this water. This will be achieved through collecting water prior to being discharged to the associated watercourse, with flow balancing provided if needed. This will allow the water to follow similar a path to the existing situation.

13.4.18 Section 16 of the draft Code of Construction Practice (CoCP) sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (Volume 5: Appendix CT-003-000). It will provide effective management and control of the impacts during the construction period.

13.4.19 The following measures in Section 16 of the draft CoCP will reduce potentially significant effects on water resources and flood risk to levels that will not be significant:

- stationary plant will be used with secondary containment measures such as plant nappies to retain any leakage of oil or fuel, and reduce the risk of surface water or groundwater pollution;
- spill kits shall also be provided where appropriate at the two main construction

compounds; Boddington, Radbourne and Stoney Thorpe auto-transformer stations; and worksites to reduce the risk of surface water or groundwater pollution;

- the use of oil interceptors, if required by the Environment Agency, at site offices and work compounds;
- appropriate measures such as the use of bunds of non-erodible material or silt or sediment fences adjacent to watercourses;
- implementing a surface water or groundwater monitoring plan, particularly in relation to works which may affect aquifers, for example excavations and piling; and
- contractors are also required to monitor and manage other extreme weather events which may affect water resources during construction.

13.4.20 Measures defined in the draft CoCP Section 16 will reduce the risk of the works causing an increase in river flood risk through constricting and altering flood flow paths.

13.4.21 Measures defined in the draft CoCP Section 16, including detailed method statements, will ensure that there will be no effect on surface water quality or flows associated with construction; this will include release to surface waters sewers in the surrounding receptors, principally the Severn Trent Water sewer network.

13.4.22 In accordance with the draft CoCP, Section 16, monitoring will be undertaken in consultation with the Environment Agency prior to, during and post construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed temporary and permanent mitigation measures.

Assessment of impacts and effects

13.4.23 This section describes the significant effects following the implementation of avoidance and mitigation measures.

13.4.24 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-002-016 and Flood Risk Assessment in Volume 5: Appendix WR-003-016.

13.4.25 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).

13.4.26 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

13.4.27 The assessment shows that there will be no significant temporary adverse effects on surface water resources during the construction period.

13.4.28 As no significant effects on surface water features have been identified, no significant effects on abstractions or discharges will arise.

Groundwater

13.4.29 The assessment shows that there will be no significant temporary adverse effects on groundwater during the construction period.

13.4.30 The assessment shows that there will be no likely temporary significant effects on abstractions and permitted discharges during construction.

13.4.31 The assessment shows that there will be no likely temporary significant effects on surface water/groundwater interaction during construction.

13.4.32 The assessment shows that there will be no likely temporary significant effects on water dependent habitats.

Flood risk

13.4.33 The assessment has identified no significant increase in risks resulting from all sources of flooding during the construction process and therefore no significant temporary effects will arise.

Cumulative effects

13.4.34 No committed developments have been identified that will result in significant cumulative effects.

Permanent effects

Surface water

13.4.35 The assessment shows that there will be no permanent adverse significant effects on surface water features from assets constructed for the Proposed Scheme.

13.4.36 Further details of the assessment, including the determination of the potential impacts that will not have significant effects are provided in Volume 5: Appendix WR-002-016.

Groundwater

13.4.37 The assessment shows that there will be no likely permanent significant effects on groundwater.

13.4.38 The assessment shows that there will be no likely permanent significant effects to abstractions and permitted discharges.

13.4.39 The assessment shows that there will be no likely permanent significant effects on surface water/groundwater interaction.

13.4.40 The assessment shows that there will be no likely permanent significant effects on water-dependent habitats.

Flood risk

13.4.41 The assessment shows that there will be no likely permanent adverse significant effects on flood risk as a result of the Proposed Scheme.

13.4.42 Further details of the assessment, including the determination of the potential impacts that will not have significant effects are provided in Volume 5: Appendix WR-003-016.

Cumulative effects

13.4.43 There are no committed developments that have been identified which will result in significant cumulative permanent effects.

Other mitigation measures

13.4.44 No other mitigation measures are envisaged for surface water, groundwater and flood risk.

Summary of likely residual significant effects

13.4.45 There are considered to be no residual significant effects on water resources and flood risk.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 Generic examples of design measures that will mitigate potentially significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1.

13.5.2 The sustainable drainage solutions used for drainage from the Proposed Scheme (predominantly balancing ponds) may have an additional benefit of providing some treatment for water quality of the runoff before it is discharged into the environment.

13.5.3 Generic examples of management measures during operation and management of the Proposed Scheme that will reduce potentially significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies are described in Volume 1 and in the draft operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.

13.5.4 Operation and management of the Proposed Scheme is not likely to have a significant adverse effect on flood risk anywhere in the catchments through which it passes. Generic examples of management measures that may mitigate flood risk are described in Volume 1.

Assessment of impacts and effects

13.5.5 There are considered to be no significant adverse effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

Other mitigation measures

13.5.6 There are considered to be no further measures required to mitigate adverse effects on surface water resources, groundwater resources or flood risk.

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