LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA17 | Offchurch and Cubbington

November 2013

VOL 2

ES 3.2.1.17

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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 a description of the scheme and of environmental effects in each area.
- Volume 3: Route-wide effects – provides an assessment of the effects of the Proposed Scheme where it is not practicable to describe them within the CFA descriptions in Volume 2.
- Volume 4: Off-route effects – provides an assessment of the off-route effects of the Proposed Scheme.
- Volume 5: Appendices and map books – contains supporting environmental information and associated map books.
- Glossary of terms and list of abbreviations – contains terms and abbreviations, including units of measurement, used throughout the ES documentation

1 Introduction

1.1 Introduction to HS2

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

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

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

1.1.4 Phase Two will involve the construction of lines from Birmingham to Leeds and Manchester; with construction commencing in approximately 2023 and planned to be operational by 2033. 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 Offchurch and Cubbington area (CFA17), see Section 2.4.

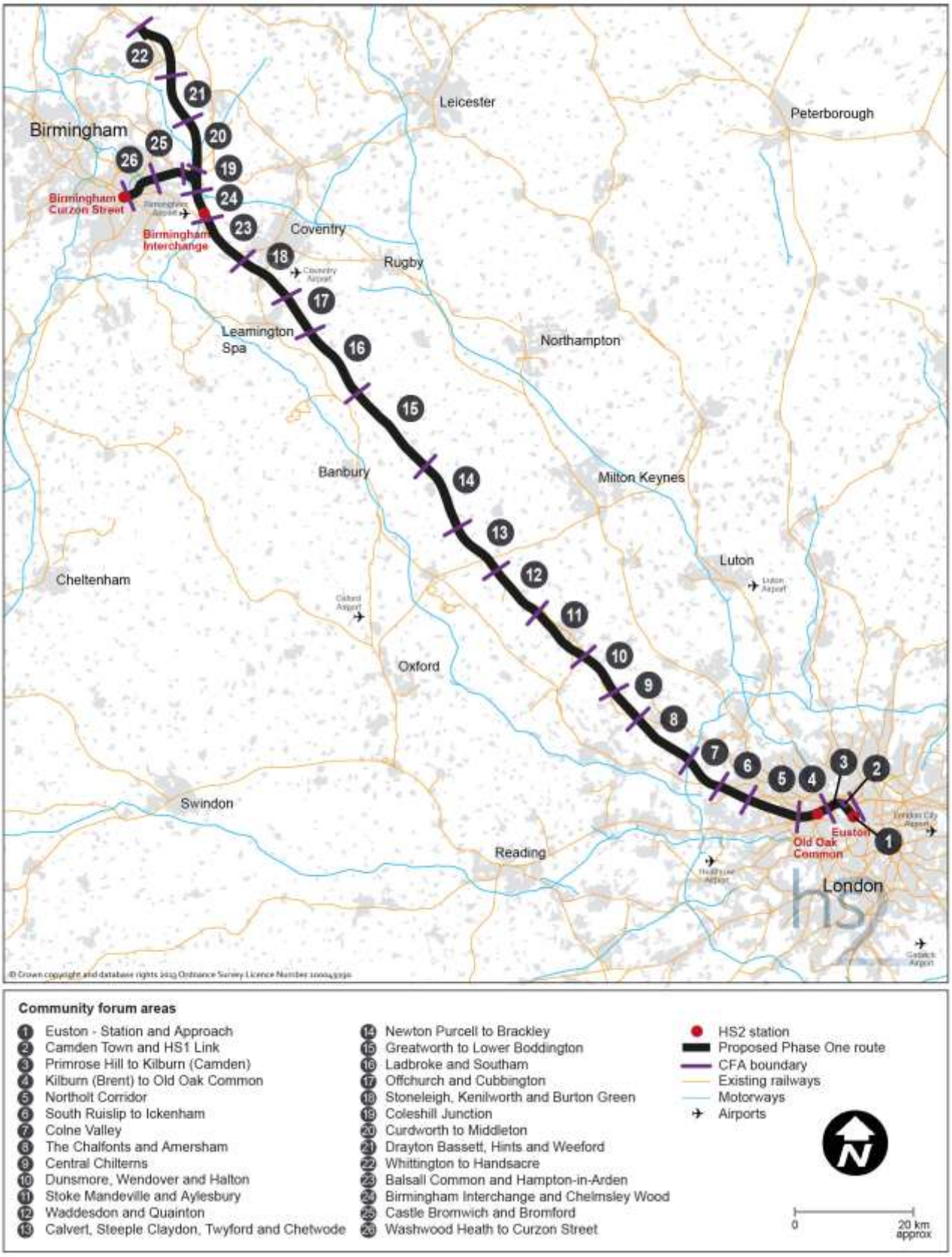
1.1.5 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish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

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

1.2 Purpose of this report

1.2.1 This CFA report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment within CFA17 (Offchurch and Cubbington). The report describes the mitigation measures that are proposed for the purpose of avoiding, reducing or managing the likely significant adverse effects of the Proposed Scheme on the environment within CFA17.

Figure 1: HS2 Phase One route and community forum areas



1.3 Structure of this report

1.3.1 This report is divided into the following sections:

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

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

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

1.3.4 Where appropriate, potential climate change impacts and adaptation measures are discussed in the relevant environmental topic section. Volume 1 and Section 6A of the SMR Addendum also include additional information about climate change adaptation and resilience.

1.3.5 The maps relevant to Offchurch and Cubbington are provided in a separate corresponding document entitled Volume 2: CFA17 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 CT05 (construction) (Volume 2, CFA17 Map Book) and CT-06 (operation) (Volume 2, CFA17 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 Offchurch and Cubbington CFA covers a 7.3km section of the Proposed Scheme in Warwick District, where it passes to the east of Leamington Spa. It extends from the Grand Union Canal in the south to the boundary between Weston-under-Wetherley and Stoneleigh parishes in the north. The area includes land within the parishes of Offchurch, Cubbington and Weston-under-Wetherley (Figure 2).

2.1.2 The area sits between the adjacent CFAs of Ladbroke and Southam (CFA16) to the south and Stoneleigh, Kenilworth and Burton Green (CFA18) to the north.

Settlement, land use and topography

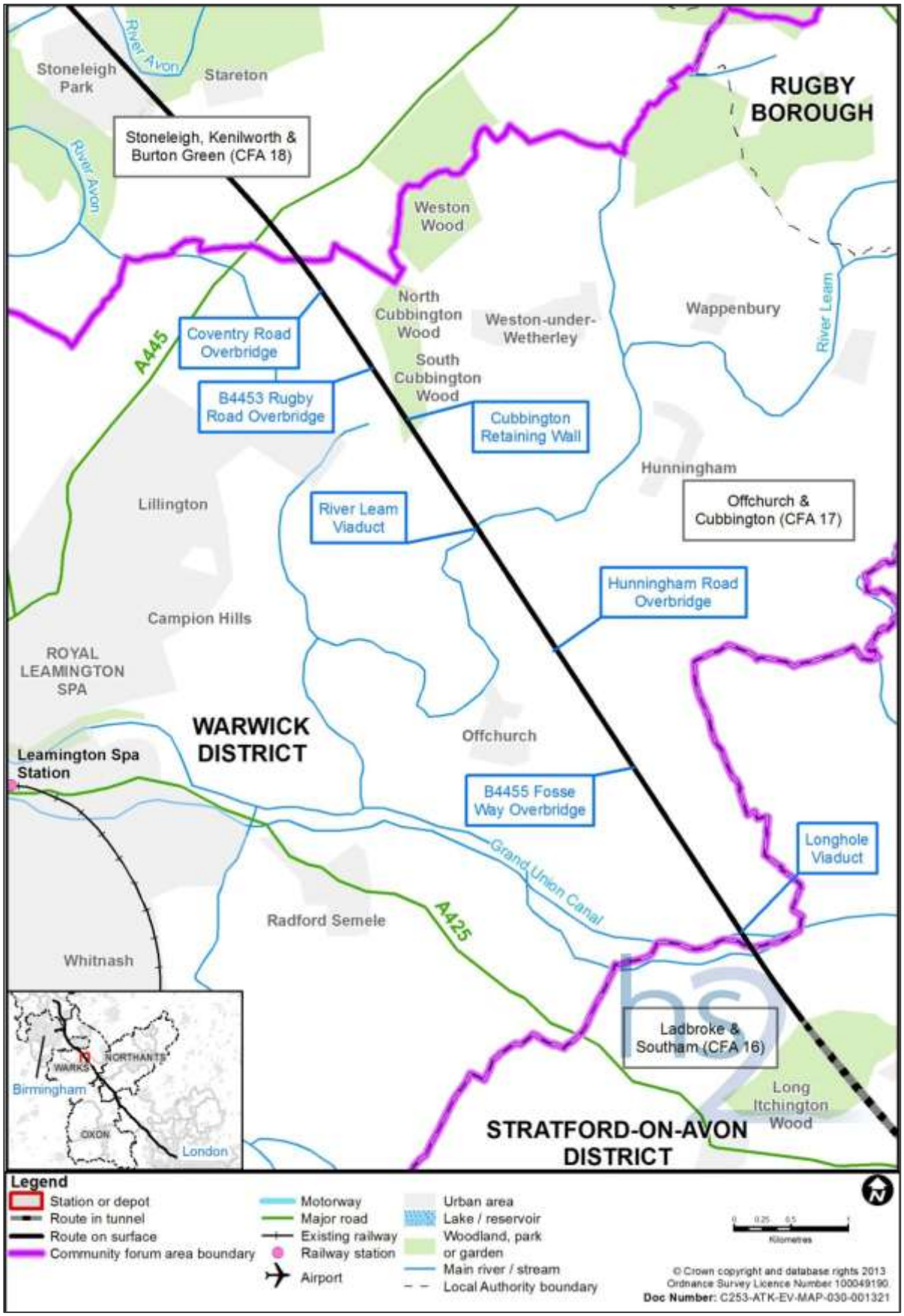
2.1.3 The area is predominantly rural in character, interspersed with small villages and a scattering of isolated dwellings and farmsteads. Agriculture is the main land use. The edge of Leamington Spa lies approximately 2km to the west of the Proposed Scheme.

2.1.4 The villages of Offchurch and Cubbington are the main settlements within the area and both lie to the west of the Proposed Scheme. Offchurch is near the south edge of the area and is a small village with a historic core, set along a group of lanes leading down to the River Leam and related to Offchurch Bury and its park to the west. Cubbington is near the north edge of the area and has expanded from its historic core into a larger village that is now linked to the eastern edge of Leamington Spa.

2.1.5 Hunningham village to the east of the Proposed Scheme comprises a group of farmsteads around a historic core, with some dispersed development towards the River Leam. Weston-under-Wetherley lies to the north and stretches along the B4453 Rugby Road, with an area of more recent development on its southern edge on the site of a former hospital.

2.1.6 The River Leam flows from north-east to south-west on a meandering course that has created a broad valley through the centre of the area at about 50 to 60m above Ordnance Datum (AOD), passing between Offchurch and Cubbington. The land rises to almost 100m AOD away from the valley. The Grand Union Canal lies to the south of Offchurch and follows the valley of a watercourse that defines the southern boundary of the CFA. North Cubbington Wood (Volume 2: CFA17 Map Book, Map CT-10-46, D4/5) and South Cubbington Wood (Volume 2: CFA17 Map Book, Map CT-10-46, E5 and F6) straddle the B4453 Rugby Road and lie on the higher ground between Cubbington and Weston-under-Wetherley.

Figure 2: Area context map



Key transport infrastructure

2.1.7 The B4455 Fosse Way (Volume 2: CFA17 Map Book, Map CT-06-09) in the south and the B4453 Rugby Road (Volume 2: CFA17 Map Book, Map CT-06-091) in the north are the principal highways through the area. These are busy cross-country routes connecting the area with Rugby and Leamington Spa and to the A425 in the north and the A423 in the south. Welsh Road (Volume 2: CFA17 Map Book, Map CT-06-089) runs through centre of the area, connecting Cubbington to Offchurch and continuing south-eastwards to Southam. The existing Banbury to Leamington Spa railway runs approximately 3km to the south-west of Offchurch.

2.1.8 The Grand Union Canal passes through Warwick and Leamington Spa to the west and joins the Oxford Canal to the east at Napton. A well-established network of public footpaths, byways and bridleways provide connections between the villages in the area. The Offchurch Greenway is a popular local route to the south and east of Offchurch village and dedicated car parks have been provided off the B4455 Fosse Way and off Welsh Road. The Lias Line cycle route, which is part of National Cycle Route 41 and runs from Warwick to Rugby, crosses the area to the south of Offchurch, using local roads and part of the Greenway.

Socio-economic profile

2.1.9 To provide a socio-economic context for the area, data for the demographic character area[1] (DCA) of Cubbington is used. In total, the population of the DCAs is approximately 3,000[2]. The area's labour market outperforms England's as a whole; unemployment at 4.2% is significantly lower than the national level of 7%[3].

Notable community facilities

2.1.10 The villages of Offchurch, Hunningham and Weston-under-Wetherley share a limited range of facilities, comprising a church, a public house, a village hall and some areas of public open space. The larger village of Cubbington has a wider range of services, including a small high street with a number of convenience shops, together with a primary school, two nurseries, a number of meeting halls, public open spaces and play areas. Many residents in the area are dependent upon travelling to Cubbington, or to other main centres outside the area, for access to day-to-day services. The catchment for the primary school includes the smaller villages of Offchurch, Hunningham and Weston-under-Wetherley.

2.1.11 Leamington Spa is the nearest main centre for health care and libraries and has a wide range of shopping and leisure facilities. The study area also falls within the catchment area for the North Leamington School at Leamington Spa, which provides secondary education for 11 to 18 year olds. Of the community facilities, the Oakdene Day Nursery at Coventry Road in Cubbington will be the closest to the Proposed Scheme, being approximately 400m to the west of the proposed railway cutting and 130m west of Coventry Road realignment.

[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.
[3] Unemployment percentage based on unemployed divided by total population aged 16-74.

Recreation, leisure and open space

2.1.12 Leamington Spa is the main destination for leisure activities in the area. Public houses and community halls in the villages provide focus for social gatherings and for some village events. The Proposed Scheme will pass approximately 680m south of the Offchurch Sports Club, which has approximately 170 members drawn from Offchurch, Hunningham and surrounding areas. The club has facilities for cricket, netball and tennis and provides a base for approximately 10 sports teams. The Waverley Equestrian Training Centre just north of Cubbington, about 300m west of the Proposed Scheme, provides facilities for riding lessons and trekking holidays and is also a base for the Stoneleigh Park Polo School. Offchurch Bury Park, about 1.3km west of the Proposed Scheme, is home to the Offchurch Bury Polo Club.

2.1.13 There are several public open spaces in the area, mostly in and around Cubbington, providing a mix of public recreation grounds, play areas and allotments. The allotments at Coventry Road will be the closest to the Proposed Scheme, being approximately 370m away.

2.1.14 The Offchurch recreation ground will be approximately 900m west of the Proposed Scheme.

2.1.15 The Centenary Way enters the area from the south along Ridgeway Lane and then follows the Grand Union Canal towards Leamington Spa. The Grand Union Canal Walk also follows the canal. Shakespeare's Avon Way and the Millennium Way follow roads and footpaths through Cubbington and South Cubbington Wood that are popular local walking routes as well as forming part of long distance trails.

Policy and planning context

Planning framework

2.1.16 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.

2.1.17 The following local policies have been considered and referred to where appropriate to the assessment:

- the saved policies of the Warwickshire Structure Plan 1996-2011[4]; and
- the saved policies of the Warwick District Council (WDC) Local Plan[5].

2.1.18 There are a number of key planning designations in the Offchurch and Cubbington area set out in the local plan, as follows. They are shown in Volume 2: CFA17 Map Book, Map Series CT-10:

- much of the countryside is designated as green belt;
- the centres of Offchurch and Cubbington villages are designated as conservation areas;

[4] Warwickshire County Council (2001), *Warwickshire Structure Plan 1996-2011.*
[5] Warwick District Council (2007), *Warwick District Local Plan 2007.*

- there are a number of listed buildings within the villages and in the surrounding countryside;
- North and South Cubbington Wood and Weston Wood are designated as ancient woodland; and
- further development is proposed on the east edge of Leamington Spa and on sites to the north-west and south-west of Cubbington.

2.1.19 Emerging policies are not generally considered within this report, unless a document has been submitted to the Secretary of State for approval, as is the case with the Warwick District Draft New Local Plan Preferred Options[6], which was published for consultation in May 2012.

Committed development

2.1.20 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-004-000/1. 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 environmental effects of the Proposed Scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic.

2.1.21 There are only two committed developments in the Offchurch and Cubbington area:

- ref: PAP/W/12/1243 – on land to the south of Thwaites Works east of Welsh Road, south of Cross Lane and either side of Mill Lane, Cubbington. The development comprises the construction of a flood alleviation scheme including the laying of pipe work and associated headwall construction and earthworks to create attenuation areas; and
- ref: PAP/W/12/0409 – change of use of a barn to a micro-brewery at Manor Farm, Hunningham Road, Offchurch.

2.1.22 Each of the environmental topics has considered these developments as part of their assessment, as appropriate.

2.1.23 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-004-000/2. 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 Offchurch and Cubbington area, including the main environmental mitigation measures. Further generic information on typical permanent features is provided in

[6] Warwick District Council (2012), *Warwick District Council Draft New Local Plan Preferred Options* (May 2012).

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 the Volume 2: CFA17 Map Book, Maps CT-06-088b to CT-06-093a.

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. Further information can be found in Section 2.6:

- an amendment to the junction priority at Welsh Road/Long Itchington Road, in association with the closure of Long Itchington Road;
- introduction of hedges to one or both sides of a number of bridges to maintain habitat connectivity, namely Offchurch Greenway green overbridge and Mill Lane green overbridge; and
- introduction of footpath W129y overbridge into the scheme to the north of Offchurch.

Overview

2.2.5 The Proposed Scheme through this area will be approximately 7.3km in length and will enter in the south by crossing the Grand Union Canal to the north of Ufton, then proceed north-westwards, passing over Welsh Road and under the B4455 Fosse Way, the Offchurch Greenway and Hunningham Road to the north-east of Offchurch. Crossing over the River Leam it will proceed north-westwards through the southern end of South Cubbington Wood and under Mill Lane, to the east of Cubbington. Further north it will then pass beneath the B4453 Rugby Road and Coventry Road just west of Furzen Hill Farm (Volume 2: CFA17 Map Book, Map CT-10-46, B4).

Route description from south to north

Grand Union Canal and Welsh Road

2.2.6 The route will enter the Offchurch and Cubbington CFA in the south (Volume 2: CFA17 Map Book, Map CT 06-088) on Longhole viaduct across the Grand Union Canal (Volume 2: CFA17 Map Book, Map CT 06-088b), and pass onto embankment to just north-east of Welsh Road Farm. Key features of this section, which is approximately 1km long, will include:

- a 140m long viaduct over the Grand Union Canal (Longhole viaduct);
- a 825m long embankment next to the Grand Union Canal reducing in height from a maximum of 9.5m, with raised earthworks on both sides of the railway to provide screening;
- a diversion of Ridgeway Lane under Longhole viaduct to provide continued access to agricultural land and the PRoW network;

- realignment of Welsh Road over a length of about 750m to pass under the rail line approximately 200m south of its current location;
- crossings over diverted gas mains;
- planting on both sides of the rail line to provide visual screening, landscape integration and habitat connectivity; and
- a railway drainage pond to the east.

East of Offchurch: Fosse Way, Offchurch Greenway and Hunningham Road

2.2.7 Continuing to the north-west, the route will run in cutting to the east of Offchurch, passing to the east of Springhill Cottages (Volume 2: CFA17 Map Book, Map CT 10-45, H4) and Highfield (Volume 2: CFA17 Map Book, Map CT 10-45, G7). Key features of this next section of the route, which is approximately 2km long (from Volume 2: CFA17 Map Book, Map CT 06-088, C5; to CT 06-090, H4), will include:

- a 2.1km long cutting at Offchurch with a maximum depth of approximately 20m under the Fosse Way and Offchurch Greenway. From a point approximately 300m north of the Greenway, raised earthworks will be provided on both sides to provide noise and visual screening of the railway for the northern length of shallower cutting;
- a realignment of the B4455 Fosse Way over a length of about 1.4km up to approximately 60m to the west, crossing the rail cutting on a new bridge, with a roundabout added at the junction with Welsh Road and associated realignments of parts of Welsh Road and Long Itchington Road (south);
- a realignment of Welsh Road for approximately 850m to the south of its junction with Long Itchington Road, to provide a suitable through route for traffic diverted to the roundabout;
- permanent closure of a section of Long Itchington Road where it crosses the Proposed Scheme, creating a cul-de-sac to retain access to existing properties adjacent to the Offchurch Greenway (Volume 2: CFA17 Map Book, Map CT-06-089, F3);
- diversion of National Cycle Route 41 (the Lias Line in this area) from Long Itchington Road onto the Greenway and then south-east across the field to cross Fosse Way and rejoin its existing route;
- a new bridge to allow Offchurch Greenway to pass over the rail line on a new bridge at its current location, with Footpath W192 diverted approximately 30m to the south to use the same bridge – this bridge will include hedges along both sides to provide habitat connectivity;
- realignment of Hunningham Road over a length of about 550m approximately 50m to the south of its current location, including a diversion of Footpath W128, and raised approximately 8m above current ground level on a new bridge to pass over the rail line as it comes out of cutting and onto embankment (Volume 2: CFA17 Map Book, Map CT-06-090, H4 and H5); and

- planting on both sides of the rail line to provide visual screening, landscape integration and habitat connectivity, comprising hedgerows along the top of the cutting and small blocks of broad-leaved woodland.

East of Cubbington: River Leam to South Cubbington Wood

2.2.8 North of Hunningham Road, the route will pass on to a short, low embankment and through a shallow cutting followed by a length of embankment. The route will pass over Ash Beds Brook and the River Leam and its floodplain before returning into cutting towards South Cubbington Wood. Key features of this next section of the route, which is approximately 2km long (from Volume 2: CFA17 Map Book, Map CT 06-090, H6; to CT 06-091, E5), will include:

- a 200m long embankment at Ash Beds with a maximum height of 1m with a combination of raised earthworks and noise fence barriers on either side of the rail line to provide visual and noise screening;
- an express feeder auto-transformer station on the west side of the rail line immediately to the north of Hunningham Road (Volume 2: CFA17 Map Book, Map CT-06-090, H7);
- a railway drainage pond adjacent to the express feeder auto-transformer station;
- a new culvert carrying the diverted Ash Beds Brook beneath the railway (Volume 2: CFA17 Map Book, Map CT-06-090, G5 and G6);
- a 50m long cutting at Ash Beds less than 0.5m deep with raised earthworks on both sides of the rail line to provide visual and noise screening;
- a 950m long embankment close to the River Leam – typical height of 1.5m over the first 600m, then increasing in height towards the River Leam floodplain – with raised earthworks on both sides of the rail line to provide visual and noise screening;
- diversion of Footpath W129y to cross over the railway on a new bridge, integrated into the raised earthworks;
- a 110m long viaduct over the River Leam (Volume 2: CFA17 Map Book, Map CT-06-090, A6 and B6);
- a floodplain compensation area to the east side of the rail line adjacent to the River Leam to provide potential additional flood storage to offset any impacts from the Proposed Scheme;
- two railway drainage ponds: one on the east side of the rail line just south of the River Leam crossing (Volume 2: CFA17 Map Book, Map CT-06-090, C6); and one on the west side near Lower Grange (Volume 2: CFA17 Map Book, Map CT-06-091, H4);
- a 700m long embankment at Lower Grange with a maximum height of 10m, reducing towards South Cubbington Wood, with raised earthworks on both sides to provide visual and noise screening; and

- planting on both sides of the rail line to provide visual screening, landscape integration and habitat connectivity, comprising hedgerows along the top of the raised embankments, and small blocks of broad-leaved woodland, including areas of woodland at the western end of Ash Beds Wood and beside the River Leam.

East of Cubbington: South Cubbington Wood to Coventry Road

2.2.9 Continuing to the north-west the route will enter a short cutting just to the south of South Cubbington Wood before entering a retained cutting[7] where walls will be used to reduce the loss of ancient woodland in South Cubbington Wood. Coming out of retained cutting just north of Rugby Road, the route will continue in cutting to the end of the area, just north of Coventry Road. Key features of this next section of the route, which is approximately 2.5km long, (from Volume 2: CFA17 Map Book, Map CT 06-091, E5; to CT 06-092, C7), will include:

- a 150m long cutting at Lower Grange increasing in depth to 12m at the start of the retained cutting section (Volume 2: CFA17 Map Book, Map CT-06-091, E5);
- a 900m length of cutting from approximately 9m to 12m deep: the east side of the cutting will be retained by a wall over the full length. The west side will change from a retaining wall to open cutting once north of the woodland. The double retaining walls will be stabilised by horizontal props over the top of the railway. The length of single east side wall is likely to require ground anchors buried behind the wall to maintain its stability;
- a new bridge to carry the diverted Mill Lane and Footpath W129d over the retained cutting at the southern edge of South Cubbington Wood (Volume 2: CFA17 Map Book, Map CT-06-091, E4). This bridge will include hedges on both sides. A length of hedgerow along the existing footpath has been identified for translocation;
- a new bridge will carry the diverted Shakespeare's Avon Way (Footpath W130) over the retained cutting (Volume 2: CFA17 Map Book, Map CT-06-091, C4);
- a diversion of Footpath W130b onto the realigned Rugby Road to cross the railway, and then onto a new path along the west edge of North Cubbington Wood;
- a realignment of Rugby Road over a length of about 750m up to approximately 30m north of its current location which will be raised approximately 4m above current ground level on a new highway bridge, to pass over the cutting (Volume 2: CFA17 Map Book, Map CT-06-092a, I7);
- a 1.6km long cutting at Cubbington with a depth of up to approximately 11m, with raised earthworks on both sides to the length of shallower cutting north of Coventry Road, to provide visual and noise screening;
- a realignment of Coventry Road over a length of about 850m up to approximately 50m south of its current location, which will be raised

[7] A retained cutting is supported by retaining walls. This is in contrast to an open cutting which is supported by earthworks.

approximately 6m above current ground level, to pass over the route on a new bridge (Volume 2: CFA17 Map Book, Map CT-06-092, E7);

- planting areas will be provided on the east and west sides, adjacent to the railway and associated earthworks, to mitigate for loss of ancient woodland and associated habitats, and to provide visual screening, landscape integration and habitat connectivity. These include a large area of woodland planting immediately to the east of South Cubbington Wood (Volume 2: CFA17 Map Book, Map CT-06-091, D2); and
- an area of land to provide a woodland link between North Cubbington Wood and Weston Wood (Volume 2: CFA17 Map Book, Map CT-06-092a, F3 to G1), mitigating for severance and loss of ancient woodland habitat in South Cubbington Wood and to provide for the translocation of ancient woodland soils and woodland habitat creation.

2.2.10 The route will then continue into the Stoneleigh, Kenilworth and Burton Green area (CFA18) in cutting.

2.3 Construction of the Proposed Scheme

2.3.1 This section sets out the strategy for construction of the Proposed Scheme in the Offchurch and Cubbington 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.

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 on the construction Map Series CT-05 (Volume 2). 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
- system testing and commissioning.

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

- the approach to environmental management during construction and the role of the Code of Construction Practice (draft CoCP, Section 4);
- working hours (draft CoCP, Section 5);
- the management of construction traffic (draft CoCP, Section 14); and
- the handling of construction materials (draft CoCP, Section 15).

Advance works

2.3.7 General information about advance works can be found in Volume 1, Section 6. Advance works will be required before commencing construction works and will typically include:

- further detailed site investigations and surveys;
- further detailed environmental surveys;
- advance mitigation works including, where appropriate, contamination remediation, temporary habitat creation and 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, and within land adjacent to the route. This will comprise two broad types of engineering work:

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

2.3.9 The construction of the Proposed Scheme will be subdivided into sections, each of which will be managed from compounds. The compounds will act as the main interface between the construction work sites and the public highway, as well as performing other functions as described later in this section. 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 Offchurch and Cubbington area there will be one main compound, six civil engineering satellite compounds and one railway installation satellite compound which will use a compound previously established for the civil engineering works. There will also be one material transfer stockpile area and one roadhead, both located at the main compound.

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

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

2.3.14 Some compounds will also accommodate additional functions as listed below. Where this is the case they will be included in the description of the compound:

- 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, further details are provided in the relevant area reports;

- 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, and the draft CoCP, Section 5.

Figure 3: Schematic of site compounds for civil engineering works

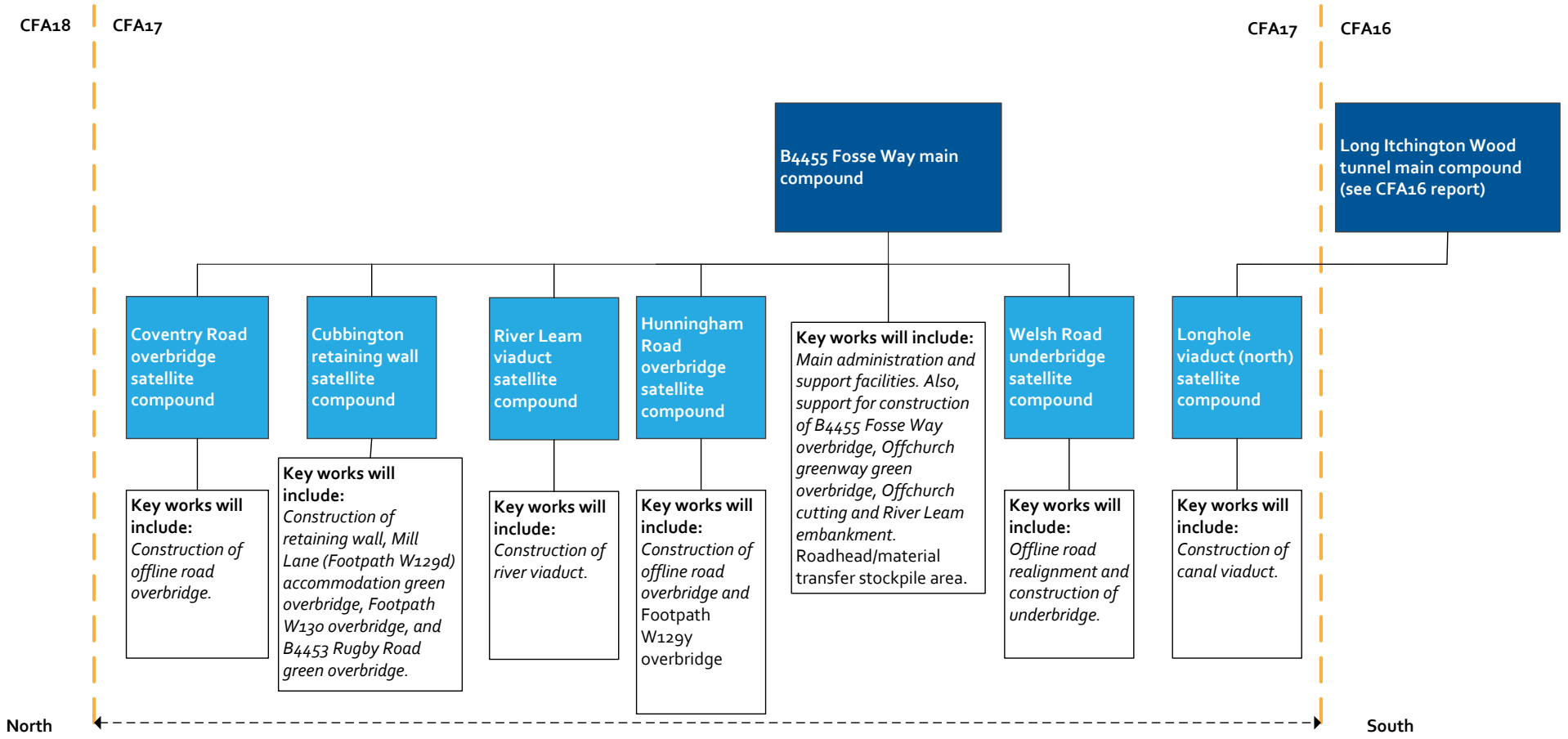
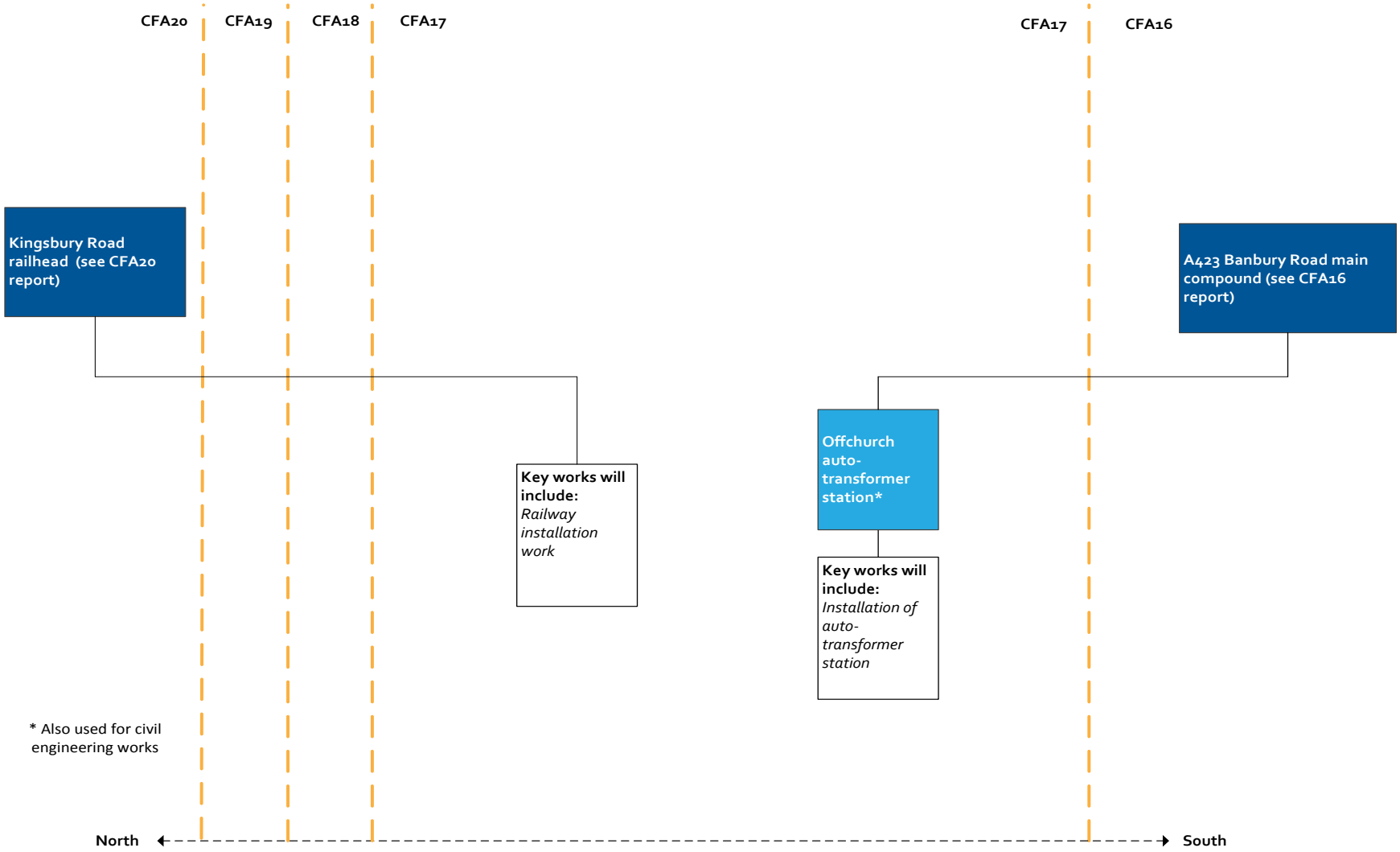


Figure 4: Schematic of site compounds for railway installation works



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 compounds, 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.

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.

Long Itchington Wood tunnel main compound (Volume 2: CFA16 Map Book, Map CT-05-087)

2.3.19 This compound will not be located within this area but will be in the adjacent Ladbroke and Southam area (CFA16).

2.3.20 The construction of the Longhole viaduct over the Grand Union canal is the only element of the works in the Offchurch and Cubbington area that will be managed from the Long Itchington Wood tunnel main compound. Further information on this compound is available in the report for Ladbroke and Southam (CFA16).

B4455 Fosse Way Main Compound (Volume 2: CFA17 Map Book, Map CT-05-114, D2)

2.3.21 This compound will comprise the main area administration and support. It will also be used for construction of B4455 Fosse Way overbridge, Offchurch Greenway green overbridge, Offchurch cutting and River Leam embankment, used as a stockpile area and as a roadhead for import and export of excavated material being transported on the road network.

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

- site clearance and enabling works;
- retaining wall construction;
- viaduct and bridge construction;
- cuttings, embankments and landscape earthworks;
- highway and rights of way reinstatement; and
- topsoiling and landscape planting.

2.3.23 The B4455 Fosse Way main compound will be operational for five years and two months, and will be subject to the contractor's standard working hours. The compound will be accessed directly off the B4455 Fosse Way. Connection from the B4455 Fosse Way to the M40 will be via the B4100 Banbury Road, the A452 and junction 13 and 14 of the M40. Approximately 68 workers average and 115 workers peak will be based at the compound.

Demolition works

2.3.24 The Proposed Scheme will not require any demolition of structures and buildings in this area.

Highway and road diversions

2.3.25 The following roads will be diverted or realigned permanently:

- Ridgeway Lane under the Longhole viaduct;
- Welsh Road to new underbridge;
- the B4455 Fosse Way across new overbridge, with associated diversions of Welsh Road and Long Itchington Road;
- closure of Long Itchington Road and diversion of traffic to the new B4455 Fosse Way overbridge, with associated realignment of Welsh Road;
- Hunningham Road across new overbridge;
- the B4453 Rugby Road across new overbridge; and
- Coventry Road across new overbridge.

Footpath, cycleway and bridleway diversions

2.3.26 The following seven footpaths, cycleways and bridleways will be diverted or realigned:

- temporary realignment of Offchurch Greenway for eleven months whilst the online bridge is being constructed;
- Footpath W192 permanently realigned across Offchurch Greenway overbridge;
- National Cycle Route 41 (the 'Lias Line') diverted onto Offchurch Greenway and then to the south-east to cross the B4455 Fosse Way and rejoin its existing route along Long Itchington Road;
- Footpath W128 permanently diverted to Hunningham Road overbridge;
- Fields Farm footpath (W129y) permanently realigned to a new overbridge, with a temporary alternative route provided for twelve months during construction of the overbridge and the associated mitigation earthworks;
- Mill Lane (footpath W129d) permanently realigned to Mill Lane overbridge, with a temporary alternative route via a scaffold overbridge for eight months;
- Shakespeare's Avon Way (footpath W130) permanently realigned to a new overbridge, with a temporary alternative route via a scaffold overbridge for eight months; and
- Footpath W130b permanently diverted to the realigned B4453 Rugby Road and its overbridge, and then alongside North Cubbington Wood.

Utility diversions

2.3.27 Numerous utilities will need to be diverted for the works, the principal diversions being:

- diversion of National Grid high pressure 900mm and 600mm diameter gas mains near Welsh Road for approximately six months;
- diversion of National Grid high pressure 600mm diameter gas main north of Offchurch Greenway for approximately six months;
- diversion of Severn Trent Water 1000mm diameter water main north of Hunningham Road for approximately six months;
- diversions of overhead Western Power Distribution electricity lines near Offchurch Greenway for approximately three months; and
- the diversion of a number of elements of utility infrastructure as part of highway realignments at Welsh Road, Fosse Way, Hunningham Road, Rugby Road and Coventry Road.

Watercourse diversions

2.3.28 The route of the Proposed Scheme and associated highway works requires two realignments of watercourses:

- a tributary of the River Leam near the existing canal bridge (Longhole Bridge, Volume 5: Map Book – water resources, Map WR-01-028, reference SWC-CFA17-001), to pass under the Longhole viaduct; and
- the diversion of another tributary of the River Leam at Hunningham Road – Ash Beds (Volume 5: Map Book – water resources, Map WR-01-028, reference SWC-CFA17-004), as a result of straightening the watercourse for the Ash Beds culvert.

Finalisation works

2.3.29 Finalisation works will include landscape works and planting.

Satellite compounds

2.3.30 Six satellite compounds will be required to construct the Proposed Scheme in this area. Table 1 details the principal construction activity, start date and approximate duration, number of workers, and highway access route for each associated satellite compound. Unless otherwise noted, after leaving the compound by the route shown in Table 1 they then join the route from the main compound to the M40 described above.

Table 1: Satellite construction site compounds

Compound	Principal construction activity	Start date	Estimated duration of use	No. of workers (ave/peak)	Highways access route
Grand Union Canal and Welsh Road					
Longhole viaduct (north) (Volume 2: CFA17 Map Book, Map CT-05-88b, G6)	Construction of viaduct over the Grand Union Canal.	2018	12 months	20/30	Along haul road to Welsh Road and then the B4455 Fosse Way
Welsh Road underbridge (Volume 2: CFA17 Map Book, Map CT-05-88b, D7)	Offline road realignment. Construction of road underbridge.	2018	16 months	24/25	Welsh Road, continuing onto the B4455 Fosse Way
East of Offchurch: Fosse Way, Offchurch Greenway and Hunningham Road					
Hunningham Road overbridge and Offchurch EFATS (Volume 2: CFA17 Map Book, Map CT-05-090, H8)	Construction of offline road overbridge and footpath W129y overbridge.	2018	22 months	35/40	Hunningham Road, onto Welsh Road, continuing onto the B4455 Fosse Way
	Installation of Offchurch express feeder auto-transformer station.	2022	15 months	27/38	
East of Cubbington: River Leam to Cubbington Wood and Coventry Road					
River Leam viaduct (Volume 2: CFA17 Map Book, Map CT-05-090, B/C 6/7)	Construction of river viaduct.	2018	14 months	20/30	Along Haul route onto Bridlleway W129y, Hunningham Road, Welsh Road continuing to the B4455 Fosse Way
Cubbington retaining wall (Volume 2: CFA17 Map Book, Map CT-05-092a, I8)	Construction of Cubbington retaining wall, Mill Lane (Footpath W129D) Accommodation overbridge, Footpath W130 overbridge and Rugby Road overbridge.	2018	24 months	92/130	B4453 Rugby Road, Kenilworth Road, Westhill Road, Bericote Road continuing onto A452, then A46 to M40
Coventry Road overbridge (Volume 2: CFA17 Map Book, Map CT-05-092a, E8)	Construction of offline road overbridge.	2018	9 months	40/60	Coventry Road, B4453 Rugby Road, Kenilworth Road, Westhill Road, Bericote Road continuing onto A452, then A46 to M40

Material transfer stockpile areas and roadheads

2.3.31 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 that is moved to and from the site on public highways.

2.3.32 There will be one material transfer stockpile area in Offchurch and Cubbington, adjacent to the main construction compound at the B4455 Fosse Way. This stockpile area will also be a roadhead for import and export of excavated material. Additional temporary stockpile sites may be required during work on particular elements of the Proposed Scheme such as Hunningham Road and Rugby Road bridges and will be

adjacent to the works within the existing area of land required for the construction of the Proposed Scheme.

Worker accommodation

2.3.33 Worker accommodation will be located adjacent to the B4455 Fosse Way main compound at Offchurch, to the east of the route (Volume 2: CFA17 Map Book, Map CT-05-089, D9). It will provide living accommodation, welfare facilities and car parking for around 23 workers for five years.

2.3.34 Worker accommodation will adhere to the measures set out within the CoCP.

Kingsbury Road railhead main compound

2.3.35 The Kingsbury Road railhead main compound will not be located within CFA17, but will be situated in the Curdworth to Middleton area (CFA20). It will provide support to all rail installation works.

2.3.36 The Kingsbury Road railhead will facilitate the railway systems installation works in Offchurch and Cubbington:

- permanent way (ballast and/or slab track) installation;
- overhead line equipment installation;
- traction power supply;
- train control;
- signalling; and
- telecommunication fit out.

2.3.37 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. Bulk materials for ballast, track and overhead line equipment will be delivered to site along the line of the Proposed Scheme.

2.3.38 The railway systems installation will have its own mobile welfare facilities for the site staff.

A423 Banbury Road main compound

2.3.39 The A423 Banbury Road main compound will be within the Ladbroke and Southam area (CFA16). This compound will provide rail systems management support to the Offchurch express feeder auto-transformer station compound. Access will be via A243 Banbury Road and A425 Leamington Road.

2.3.40 Further information on the Kingsbury Road railhead is available in the report for the Curdworth to Middleton area (CFA20). Further information on the A423 Banbury Road administration centre is available in the report for Ladbroke and Southam (CFA16).

Railhead satellite compounds

2.3.41 There will be only one satellite railhead compound in the Offchurch and Cubbington area. Hunningham Road satellite compound will be used both for the civil engineering

works to construct Hunningham Road overbridge earlier in the construction programme and also for the installation of Offchurch express feeder auto-transformer station.

2.3.42 Work on the Offchurch express feeder auto-transformer station will take around 12 months and begin in 2023. Between 27 and 38 workers will use the compound during this time, with access from Hunningham Road.

Construction waste and material resources

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

2.3.44 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.

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

2.3.46 The quantity of surplus excavated material originating from the Offchurch and Cubbington area that will require off-site disposal to landfill as excavation waste is shown in Table 2. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for reuse within the Proposed Scheme.

2.3.47 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%.

2.3.48 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 2.

Table 2: Estimated construction, demolition and excavation waste

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for off-site disposal to landfill (tonnes)
Excavation	6,497,354	0
Demolition	0	0
Construction	17,116	1,712
Worker accommodation site	44	22
TOTAL	**6,514,514**	**1,734**

2.3.49 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

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

Construction programme

2.3.51 A construction programme that illustrates indicative periods for each core construction activity 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																																				
Advance works																																				
Civil engineering works																																				
Long Itchington Wood main compound (see CFA16 report)																																				
Satellite compounds:																																				
Longhole viaduct (north)																																				
Fosse Way main compound																																				
Grand Union embankment																																				
Offchurch cutting																																				
Ash Beds embankment																																				
Ash Beds cutting																																				
River Leam embankment																																				
Lower Grange embankment																																				
Lower Grange cutting																																				
Cubbington cutting																																				
Satellite compounds:																																				
Welsh Road underbridge																																				
Hunningham Road overbridge																																				
River Leam viaduct																																				
Cubbington retaining wall																																				
Coventry Road overbridge																																				
Rail infrastructure systems works																																				
Kingsbury Road railhead main compound (see CFA20)																																				
Rail installation works																																				
A423 Banbury Road main compound (see CFA16 report)																																				
Satellite compound:																																				
Offchurch express feeder auto transformer station satellite compound (CFA17)																																				

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
Commissioning																																				
Commissioning																																				

Key

Construction works

Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

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

HS2 services

2.4.2 It is anticipated that initially there would be 11 trains per hour each way passing through the Offchurch and Cubbington 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 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 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. There will be routine preventative maintenance, including grinding and milling of the rails to keep them in good condition, and more periodic heavy maintenance as necessary.

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

Operational waste and material resources

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

2.4.8 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 111 tonnes of operational waste will be reused, recycled and recovered during each year of operation of the Proposed Scheme in the Offchurch and Cubbington area. Approximately 22 tonnes will require disposal to landfill (see Table 3).

Table 3: Operational waste forecast for the Proposed Scheme

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste for disposal to landfill per annum (tonnes)
Railway station and train	0	0
Rolling stock maintenance	0	0
Track maintenance	123	18
Ancillary infrastructure	10	4
TOTAL	**133**	**22**

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.

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

- 29 March 2012 at Offchurch Village Hall;
- 21 June 2012 at the Community Pavilion, Offchurch;
- 9 September 2012 at Offchurch Village Hall;
- 27 November 2012 at Offchurch Village Hall;
- 19 February 2013 at Offchurch Village Hall; and
- 12 September 2013 at Cubbington 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:

- Conservation Area status of villages and the impact of the Proposed Scheme on them;
- height of the alignment;
- severance of wildlife corridors and damage to South Cubbington Wood;
- severance of public rights of way (PRoW);
- construction impacts, including noise and the impact on dust-sensitive farming;
- operational noise;
- impact on River Leam and flooding; and
- mitigation proposals, including the lowering of the alignment, cut and cover or bored tunnel.

2.5.5 In addition to the engagement through the community forums, the draft Environmental Statement and Design Refinement consultations were launched on 16 May 2013 for a period of 8 weeks and closed on 11 July 2013. As part of these consultations, members of local communities and other interested parties were notified, provided with information and invited to engage on issues pertinent to the draft Environmental Statement and the development of the Proposed Scheme. Details of the local consultation events were provided on the HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the Proposed Scheme. In the Offchurch and Cubbington area consultations on the draft Environmental Statement and on the Design Refinement were held on 28 May 2013 at Cubbington Village Hall.

2.5.6 A wide range of HS2 Ltd staff were in attendance at the events, including engineers and environmental specialists, for members of the public to speak to.

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

2.6 Route section main alternatives

2.6.1 The main strategic alternatives to the Proposed Scheme are presented in Volume 1. The main local alternatives considered for the Proposed Scheme within the local area are set out within this section.

2.6.2 Since April 2012, as part of the design development process, a series of local alternatives have been reviewed within workshops attended by engineering, planning and environmental specialists. During these workshops, the likely significant environmental effects of each design option have been reviewed. The purpose of

these reviews has been to ensure that the Proposed Scheme draws the right balance between engineering requirements, cost and potential environmental impacts.

Line raise at Long Itchington Wood to Fosse Way

2.6.3 The January 2012 announced route from the River Itchen (within Ladbroke and Southam, CFA16) to Offchurch Greenway comprised a 1.5km-long tunnel, an embankment either side of the Grand Union Canal crossing and a deep cutting next to Offchurch.

2.6.4 A second option has since been considered for this section of the route, which involves raising the route within Long Itchington Wood tunnel (within Ladbroke and Southam, CFA16) by approximately 5m. This moves the low point of the alignment from within the tunnel to the northern portal, so avoiding the need for a pumping station to remove water from the tunnel and raises the route through Offchurch cutting by a maximum of approximately 3m leaving an average cutting depth of approximately 12m. In addition the embankment between Long Itchington Wood tunnel and Offchurch cutting is raised by up to 3m to allow the reinstatement of Ridgeway Lane under the Grand Union Canal viaduct and the realignment of Welsh Road to pass underneath the railway.

2.6.5 The second option has a lower capital cost, provides a reduced construction impact, has lower operational cost, has less land take, and maintains a broadly similar overall environmental impact during operation as the January 2012 announced route.

2.6.6 This option has therefore replaced the original approach for the River Itchen to Offchurch Greenway section of route within the Proposed Scheme.

Line raise at Cubbington Wood

2.6.7 The January 2012 announced route from the River Leam to Decoy Spinney comprised a retained cutting through South Cubbington Wood, with approach cuttings on either side.

2.6.8 A second option has since been considered for this section of the route, which involves raising the route within the Cubbington retained cutting by approximately 6m leaving an average cutting depth of approximately 9m. It also raises Rugby Road, Coventry Road and Leicester Lane to cross over the railway.

2.6.9 The second option has a lower capital cost, provides a reduced construction impact and maintains a broadly similar overall environmental impact during operation as the January 2012 announced route. There will be a minor increase in the environmental impact of the embankment sections to the south side of Cubbington Wood cutting, also a minor impact from visibility of the raised road crossings of Rugby Road, Coventry Road and Leicester Lane, but these will be largely mitigated by the inclusion of false cuttings and additional planting. This option has therefore replaced the original approach for the River Leam to Decoy Spinney section of route within the Proposed Scheme.

Other proposals considered further

2.6.10 A number of further engineering developments to the Proposed Scheme within the Offchurch and Cubbington section of the route have been investigated since publication of the draft ES:

- an amendment to the junction priority at Welsh Road/Long Itchington Road, in association with the closure of Long Itchington Road, has now been included in the Proposed Scheme; and
- possible changes to road crossings at Fosse Way, Welsh Road, Rugby Road and Coventry Road. After consideration these design elements remain the same as in the draft ES.

2.6.11 Four proposals resulting from stakeholder engagement, were also considered:

- an extension of the Long Itchington Wood tunnel from approximately 1.5km to 4.9km to continue under the vale occupied by the Grand Union Canal and under Offchurch Hill;
- a cut and cover tunnel approximately 1.8km long between Welsh Road and Hunningham Road, combined with a lowering of the alignment across the Leam valley and through South Cubbington Wood;
- a 1.6km long tunnel under South Cubbington Wood and its northern approach; and
- a 2.5km long tunnel under Cubbington Wood, the River Leam and its northern and southern approaches.

2.6.12 In summary, the tunnel options would have led to fewer significant environmental effects, but because of the associated increased construction complexity and construction costs it was concluded that the existing approach should be retained

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)[8] 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 Section 6, Cultural heritage; Section 7, Ecology; and Section 9, Landscape and visual assessments.

3.1.5 The main issue for farm holdings is 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 Offchurch and Cubbington area, are contained in Volume 5: Appendix AG-001-017.

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.

[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*.

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 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 Offchurch and Cubbington 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, Landscape and visual assessment. The proposed route passes into the south-east of the study area across the valley containing the Grand Union Canal. The character of the area is one of dissected rolling topography at 55m to 100m above Ordnance Datum (AOD). The route crosses two low plateaux or ridges of glacial deposits: east and south-east of Offchurch; and east of Cubbington. Between these is the valley of the meandering River Leam. In the north-west, beyond Coventry Road, the ground begins to fall away towards the River Avon.

3.3.3 The River Leam flows south-westwards for 2km through a broad valley towards the River Avon between Warwick and Leamington Spa. It is fed along its course by mainly short tributary streams.

Geology and soil parent materials

3.3.4 The main geological features are described in detail in Section 8, Land quality and summarised in Volume 5: Appendix AG-001-017.

3.3.5 Superficial geology is complex and influenced by the topography along the Proposed Scheme. The Proposed Scheme passes through:

- Alluvium, comprising clay, silt, sand and gravel, and River Terrace Deposits associated with major surface watercourses;
- an area of Head Deposits, comprising poorly sorted and poorly stratified clay, silt, sand and gravel, to the east of Welsh Road Farm;

- sand and gravel underlie the study area at the Offchurch railway cutting and a further two bands of sand and gravel are present towards the southern and northern extents of Cubbington Wood; the sand and gravel include lenses of silt and clay; and
- intermittent Glacial Deposits comprising clays and sand and gravel are present immediately to the south of Offchurch Greenway and to the north and south of Cubbington Wood.

3.3.6 The Mercia Mudstone Group underlies the majority of the Proposed Scheme in this study area and is described as red and green-grey mudstones and subordinate siltstones with widespread thin beds of gypsum/anhydrite. Overlying subsidiary formations, namely the Blue Anchor Formation and Arden Sandstone Formation, outcrop towards the south of the Proposed Scheme. The Bromsgrove Sandstone Formation underlies the Proposed Scheme immediately to the north of the route section.

Description and distribution of soil types

3.3.7 The characteristics of the soils are described by the Soil Survey of England and Wales[9] and shown on the National Soil Map[10]. More detailed published information is also available for part of the study area[11]. They are described in more detail in Volume 5: Appendix AG-001-017 and their distribution is shown on Volume 5: Map Book – Agriculture, forestry and soils, Map AG-02-017. The soils throughout this area are variable according to the topography and geology.

3.3.8 Around Welsh Road, Offchurch, and south of Cubbington Wood the soils developed in the reddish Mercia Mudstone are of the Worcester association with typically reddish-clayey material passing to slowly permeable clay or soft mudstone. There are some similar clay loam over clay soils, that experience slight to moderate seasonal waterlogging and are in Wetness Classes (WC) III-IV[12].

3.3.9 Across lower slopes of the 1.5km to 2km wide Leam valley and through Offchurch east towards Burnt Heath, occur sandy loams and sandy soils of the Wick 1 association; the soils, locally over gravel, are mostly well drained but have slight seasonal waterlogging where affected by groundwater (WC I to II).

3.3.10 Soils of the Hodnet and Whimple 3 associations are mapped on a range of thin drifts over mudstone; they consist of reddish loams over slowly permeable clayey lower subsoils with slight to moderate seasonal waterlogging (WC II to III).

3.3.11 On lower slopes north-west of the Leam are seasonally waterlogged soils of the Brockhurst 1 association developed over mudstone (WC III, rarely IV); similar soils of the Salop association that have slowly permeable subsoils in clayey glacial deposits occur on high ground in and around Cubbington Wood (WC III, rarely IV).

[9] Soil Survey of England and Wales (1984), *Soils and their Use in Midland and Western England*, Bulletin 12.
[10] Cranfield University (2001), *The National Soil Map of England and Wales* 1:250,000 scale, National Soil Resources Institute, Cranfield University, UK.
[11] Whitfield, W. (1974), *Soils in Warwickshire I; SP36 (Leamington Spa).* Rothamsted Experimental Station.
[12]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).

3.3.12 On the floodplains of the River Leam and the valley occupied by the Grand Union Canal occur clayey, non-calcareous alluvial soils of the Fladbury 1 association (WC III to IV).

Soil and land use interactions

Agricultural land quality

3.3.13 The principal soil/land use interaction in the study area is the quality of the agricultural land resource. The ALC is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the site.

3.3.14 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. There are two distinct soil characteristics within the area: the slowly permeable and seasonally waterlogged soils (Fladbury, Brockhurst 1, Salop, Worcester, Whimple 3 and, to a lesser extent, Hodnet associations); and the well drained, light loams and sandy soils of the Wick 1 association, locally developed over gravel. Limitations imposed by soil depth and chemistry are not encountered.

3.3.15 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.

3.3.16 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-001-017. There is only small variation across the CFA. FCDs range from 138 to 143 days, which is just below the average for lowland England (150 days). This is considered to be quite favourable for providing opportunities for agricultural cultivations and soil handling.

3.3.17 Gradient and local topography are not limiting in this area. The risk of flooding can be limiting to agricultural land quality in parts of the West Midlands. Whilst there is potential for flooding in the floodplains of the River Leam, 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 summer or winter.

3.3.18 The principal limiting factors determining agricultural land quality in this area are soil wetness and droughtiness. Overall, the assessment of agricultural land required for constructing and operating the Proposed Scheme indicates that there is a high proportion (83%) of agricultural land, divided between Grade 2 (50%) and Subgrade 3a (33%).

3.3.19 Grade 2 land occurs on the light loamy soils of Wick 1 association and some lighter textured, better drained soils of the Hodnet and Whimple 3 associations, principally at the northern end of the area between North Cubbington Wood and the A445

Leicester Lane. Subgrade 3a land predominates between South Cubbington Wood and Offchurch.

3.3.20 Lower quality Subgrade 3b land occupies the remaining 17% of the agricultural area, mainly on the heavy soils in the vicinity of Cubbington Wood (Salop) and floodplains (Fladbury).

3.3.21 Department for Environment, Food and Rural Affairs (Defra) mapping[13] shows that there is generally a high likelihood of encountering BMV land in the locality, which makes such land a resource of low 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[14] and The Natural Choice: securing the value of nature[15], 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 Leam represents the functional flood environment, as set out in the Section 13 Water resources and flood risk. In terms of river flooding, Environment Agency mapping indicates the River Leam and one of its tributaries are at risk from flooding, 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, Cultural heritage. These include crop-marks, which most likely date to the later prehistoric or Roman periods. There is one single record of early medieval date, namely two Early Saxon burials in Long Itchington. The majority of assets date to the medieval and post-medieval periods, many of which are historic landscape features, such as field boundaries and ridge and furrow earthworks.

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

Land use

Land use description

3.3.26 Agricultural land use in the study area is dominated by arable crops, locally in rotation with potatoes. Arable winter crops are common on heavy land of good to moderate quality in the Midlands, with spring-sown arable crops and potatoes more possible on loamy soils, such as those in the Leam valley and near Offchurch. Interspersing the arable fields is grassland for cattle and sheep.

3.3.27 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone 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 (ELS)) or specifically (the Higher Level Scheme (HLS)) 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 4.

3.3.28 Forestry land includes a large block of woodland in the northern end of the area called South Cubbington Wood. In addition, there is a small parcel of woodland called Burnt Firs and a narrow parcel of woodland (Ash Beds) flanking a tributary of the River Leam. Woodland covers 9% of land in the study area, which is just below the national average of 10%. Therefore, woodland in this area is a resource of medium sensitivity.

Number, type and size of holdings

3.3.29 There are eight holdings in the study area that could be affected, as set out in Table 4. Four are arable enterprises, two mix arable and livestock and two are wholly given over to livestock. Most holdings encompass areas of woodland, the largest of which is South Cubbington Wood. The holdings range in size from 8ha to 526ha. Field drainage is common throughout the study area. One holding (CFA17/1, Burnt Heath Farm), which is irrigated, has its own spring fed reservoir and an abstraction licence. Many farms include diversified activities, including outdoor pursuits, a marquee hire business and letting of surplus buildings for uses such as warehousing and a pre-school nursery.

3.3.30 Table 4 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. The holding/reference name provides a unique identifier and relates to Map AG-01-044b to Map AG-01-046, given in Volume 5: Map Book – Agriculture, forestry and soils.

Table 4: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA17/1 Burnt Heath Farm*	General cropping (cereals and potatoes) – irrigated	526.0	Commercial units; Outdoor pursuits including the Wolf Run (see Section 5)	ELS and HLS	High Irrigation
CFA17/2 Fosse Farm*	Mainly arable	187.0	Equestrian (commercial)	ELS	Medium
CFA17/3 Manor Farm	Mainly livestock (Sheep)	27.9	Woodland; Agricultural let	ELS	Medium
CFA17/5 Fields Farm	Mixed arable and livestock	131.9	Trading (Marquee hire and storage)	ELS	Medium
CFA17/6 Lower Grange Farm	Mainly arable and livestock	384.5	None known	ELS and HLS	Medium
CFA17/7 Weston Hall Farm*	Mainly arable	311.0	Equestrian (commercial); Woodland (part of South Cubbington Wood)	ELS	Medium
CFA17/9 Land adjacent to A445 Leicester Lane	Mainly arable	21.5	None	ELS	Medium
CFA17/10 Oakdene	Grassland	8.3	Commercial units and educational facilities (day nursery)	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 ongoing 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 Offchurch and Cubbington 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, measures have been incorporated to avoid or mitigate severance impacts on agriculture, forestry or soils during construction. Access across the HS2 alignment for agricultural vehicles will be provided by:

- overbridges at B4455 Fosse Way, Hunningham Road, Mill Lane, B4453 Rugby Road, and Coventry Road have been designed with sufficient clearance in height and width to allow their use by agricultural traffic;
- underpass at Welsh Road which allows the movement of agricultural machinery underneath; and
- viaducts over the Grand Union Canal (Longhole viaduct) and the River Leam with sufficient height and width to allow the movement of agricultural machinery underneath.

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 will 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 Code of Construction Practice (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 not only on the land on which permanent works will be sited, but also on the land used temporarily to facilitate the construction of those permanent works.

3.4.6 The land required for the Proposed Scheme and for its construction will, in places, sever and fragment individual fields and operational units of agricultural and forestry land. This will result in potential effects associated with the 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 Proposed Scheme design seeks, however, to minimise this structural disruption[16], 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, Construction of the Proposed Scheme. 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.

[16] Structural disruption is disruption to the existing structure of farm holdings, principally from severance and the loss of key farm infrastructure.

Temporary effects during construction

Impacts on agricultural land

3.4.9 During the construction phase, the total area of agricultural land used will be 186.5ha as shown in Table 5. Of this total, 49.4ha will be restored and available for agricultural use following construction.

Table 5: 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	94.0	50%	31.6
Subgrade 3a	60.9	33%	13.0
BMV SUBTOTAL	154.9	83%	44.6
Subgrade 3b	31.6	17%	4.8
Grade 4	0.0	0%	0.0
Grade 5	0.0	0%	0.0
TOTAL AGRICULTURAL LAND	186.5	100%	49.4

3.4.10 The disturbance during construction to 154.9ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement. Considering BMV land in this local area is a receptor of low 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. If surplus soils are generated, they will be used where land is to be restored to agriculture or other uses with slightly thicker topsoil and subsoil layers, where appropriate.

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[17]. These principals will be followed throughout the construction period. The heavier (clayey and clay loam) and

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

seasonally waterlogged Fladbury, Brockhurst 1, Salop, Worcester, Whimple 3 and, to a lesser extent, Hodnet associations are least able to remain structurally stable when moved in wet conditions or by inappropriate equipment. They are susceptible to compaction and smearing which could impede successful reinstatement.

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 be reduced, 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 6. This table shows the total area of land required on a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that will be returned to the holding following the construction period. The scale of effect 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 Volume 5: Map Book – Agriculture, forestry and soils, Maps AG-01-044b to Map AG-01-046 and Volume 5: Appendix AG-001-017.

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-001-017. Where the total sum of the land required by ALC grade (as shown in Table 7) differs from the total sum of the land required by holding (as shown in Table 8), 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 6: Summary of temporary effects on holdings during construction

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect
CFA17/1* Burnt Heath Farm	80.6ha – 15% Medium	Medium	Negligible	Major/Moderate adverse
CFA17/2* Fosse Farm	16.6ha – 9% Low	Medium	Negligible	Moderate adverse
CFA17/3 Manor Farm	4.8ha – 17% Medium	Medium	Medium	Moderate adverse
CFA17/5 Fields Farm	30.8ha – 23% High	Low	Low	Major/Moderate adverse

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect
CFA17/6 Lower Grange Farm	50.6ha – 13% Medium	Medium	Negligible	Moderate adverse
CFA17/7* Weston Hall Farm	14.9ha – 5% Negligible	Medium	Negligible	Moderate adverse
CFA17/9 Land adjacent to A445 Leicester Lane	0.1ha – 1% Negligible	Negligible	Negligible	Negligible
CFA17/10 Oakdene	0.1ha – 1% Negligible	Negligible	Negligible	Negligible

* No farm impact assessment interview conducted; data estimated.

3.4.17 The effects of temporary severance during construction are judged on the ease and availability of access to severed land. 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-001-017.

3.4.18 Overall, it is considered that six holdings will experience major or moderate temporary adverse effects during construction, which are significant. Most enterprises experience a major or moderate effect due to the high proportion of their holding required for construction. The increased need for farm vehicles to use public highways to access farmland severed during construction is also a factor.

3.4.19 No farm enterprises which are sensitive to noise or vibration emitted during the construction phase have been identified near the proposed scheme.

Cumulative effects

3.4.20 No significant temporary 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

3.4.21 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 and landscape mitigation.

3.4.22 Following construction and restoration, the area of agricultural land that will remain permanently required will be 137.1ha, as shown in Table 7.

Table 7: Agricultural and forestry land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land
Grade 1	0.0	0%
Grade 2	62.4	46%
Subgrade 3a	47.9	35%
BMV SUBTOTAL	110.3	80%
Subgrade 3b	26.8	20%
Grade 4	0.0	0%
Grade 5	0.0	0%
TOTAL	137.1	100%
Forestry land	10.7	n/a

3.4.23 The permanent loss of 110.3ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement. As stated previously, BMV land in this area is a receptor of low sensitivity so that the permanent effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme, which is significant.

3.4.24 Areas proposed for ecological and landscape mitigation, which will be removed from mainstream agricultural production, includes woodland planting and hedgerow improvements to the east of the River Leam viaduct, tree planting to offset severance of woodland at Ash Beds (CFA17/3), and woodland planting to provide compensation for the loss of ancient woodland and species rich grassland to the east of Mill Lane overbridge (both located on CFA17/7, Weston Hall Farm). It is also proposed to plant woodland to compensate for the loss of ancient woodland at the northern end of Cubbington Wood (located on holding CFA17/6, land east of Lower Grange).

3.4.25 Areas engineered to provide additional flood compensation capacity will be subject to marginal downgrading in land quality and include agricultural land adjacent to the River Leam viaduct (CFA17/5).

3.4.26 Areas of woodland that will be permanently affected include Ash Beds and South Cubbington Wood. Overall, the total amount of forestry land required to implement the Proposed Scheme will be 10.7 ha, out of a total permanent land requirement of 189.1 ha (6%). The extent of the forest cover in the study area is slightly less than the average national woodland cover (i.e. medium resource sensitivity) and so, quantitatively, the loss of this woodland (i.e. medium impact magnitude) is considered as a moderate adverse effect, which is significant. The qualitative assessment of loss is addressed in other relevant sections.

Impacts on holdings

3.4.27 The permanent residual effects of the Proposed Scheme on individual agricultural and related interests is summarised in Table 8. 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 scale of effect 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-001-017.

Table 8: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Temporary severance	Disruptive effects	Scale of effect
CFA17/1* Burnt Heath Farm	56.6ha – 11% Medium	Medium	High	Major adverse
CFA17/2* Fosse Farm	12.1ha – 7% Low	Medium	Negligible	Moderate adverse
CFA17/3 Manor Farm	4.8ha – 17% Medium	Medium	Negligible	Moderate adverse
CFA17/5 Fields Farm	18.7ha – 14% Medium	Low	Low	Moderate adverse
CFA17/6 Lower Grange Farm	41.0ha – 11% Medium	Medium	Negligible	Moderate adverse
CFA17/7* Weston Hall Farm	14.8ha – 5% Negligible	Medium	Low	Moderate adverse
CFA17/9 Land adjacent to A445 Leicester Lane	0.1ha – 1% Negligible	Negligible	Negligible	Negligible
CFA17/10 Oakdene	0.1ha – 1% Negligible	Negligible	Negligible	Negligible

* No farm impact assessment interview conducted; data estimated.

3.4.28 Overall, a total of six holdings have been identified that will experience major or moderate permanent adverse effects from the construction of the scheme, which are significant. All 6 of these are likely to remain as agricultural or rural businesses. The increased need for farm vehicles to use public highways to access farmland is the most common cause of adverse effect, although the high proportion of land required permanently for the Proposed Scheme is also a key factor. At one holding (Burnt Heath Farm, CFA17/1), a reservoir is lost to the Proposed Scheme.

3.4.29 Although financial compensation will be available, there can be no certainty that this will 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

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

Other mitigation measures

3.4.31 Other mitigation measures that are proposed include drainage works at three holdings (CFA17/1, CFA17/5 and CFA17/6), provisions for the outdoor pursuit course

called the Wolf Run at CFA17/1 (see Section 5) and access provision for South Cubbington Wood (CFA17/6).

Summary of likely significant residual effects

3.4.32 Once the construction process is complete and land required temporarily has been restored, the residual permanent loss of agricultural land will be 137.1ha, of which 110.3ha is BMV. This is assessed as a moderate adverse residual effect which is significant.

3.4.33 A total of six holdings have been identified that will experience major or moderate permanent adverse effects, which are significant. All six of these are 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 residual significant effects

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 significance residual effects

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

4 Air quality

4.1 Introduction

4.1.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme, covering nitrogen dioxide (NO_2), fine particulate matter (PM10 and PM2.5)[18] and dust.

4.1.2 With regard to air quality the main issues are anticipated to result from emissions of dust from the demolition of buildings, 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 during the construction and operation of the Proposed Scheme.

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

- Appendix AQ-001-017;
- Volume 5: Map Book – Air quality, Map AQ-01-017; and
- Volume 5: Map Book – Air quality, Map AQ-02-017.

4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2, CFA17 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-001-017.

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

4.2.3 The assessment of impacts arising from construction dust emissions has been undertaken using the methodology based on that produced by the Institute of Air Quality Management (IAQM)[19]. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on the approximate number of receptors within close proximity to the dust-generating activities. In doing so, it assigns a lower scale of effect to cases where the number of properties is small, e.g. fewer than ten properties. Thus, a single property cannot

[18] 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.
[19] Institute of Air Quality Management (2011), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance*.

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

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

4.3 Environmental baseline

Existing baseline

4.3.1 The environmental baseline reported in this section represents the environmental conditions identified within the study area. The main source of existing air pollution in the Offchurch and Cubbington area is emissions from road traffic. The principal roads in the Offchurch and Cubbington area are the B4455 Fosse Way, the B4453 Rugby Road and the A445 Leicester Lane. The Offchurch and Cubbington area is predominantly rural with few villages, principally Offchurch and Cubbington.

4.3.2 Estimates of concentrations of NO2, PM10 and PM2.5 have been obtained from UK-wide modelled background maps for 2012, published by the Department for Environment and Rural Affairs (Defra)[20] in 2010. These data provide estimates of background concentrations of NO2, PM10 and PM2.5 for 1km grid squares across the UK.

4.3.3 The Offchurch and Cubbington area lies within the West Midlands region, within the boundaries of the administrative area of Warwickshire County Council (WCC) and the local authority area of Warwick District Council (WDC).

4.3.4 There is one continuous air quality monitoring site within the Offchurch and Cubbington area. This site is an urban background site on Hamilton Terrace in Leamington Spa, approximately 4.2km west of the centre line of the Proposed Scheme. WDC also measures annual mean NO2 concentrations using passive diffusion tubes located across its administrative area. There are a number of diffusion tubes located within the Offchurch and Cubbington area. These are roadside sites in Leamington Spa, and are not considered relevant for this assessment. The continuous air quality monitoring data are useful to illustrate local trends. Further details of this monitoring site and the five-year trends in concentrations are available in Volume 5: Appendix AQ-001-017.

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

4.3.5 While the continuous monitoring site can be used to indicate trends in concentrations it is not considered to be representative of the predominantly rural area through which the Proposed Scheme will pass within the Offchurch and Cubbington area. On this basis the Defra background concentrations maps have been used to characterise the baseline air quality for the Offchurch and Cubbington area. These maps indicate that the average background pollutant concentrations across the Offchurch and Cubbington area are within the relevant air quality standards.

4.3.6 The Leamington Spa Air Quality Management Area (AQMA) is within the Offchurch and Cubbington area, but is 4km west of the centre line of the Proposed Scheme.

4.3.7 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 during the construction or operational phases of the Proposed Scheme. These locations are residential properties; on Welsh Road, Offchurch, south of the B4455 Fosse Way; on the B4455 Fosse Way, Offchurch; on Long Itchington Road, Offchurch; at the junction of Welsh Road and Hunningham Road, Offchurch; on Hunningham Road, Offchurch; at Lower Grange Farm on Mill Lane, Cubbington; on the B4453 Rugby Road, Cubbington and the A429 Coventry Road, Cubbington.

4.3.8 There are no ecological receptors with statutory designations within the Offchurch and Cubbington area. There is one non-statutory designated site within the Offchurch and Cubbington area that could potentially be affected by changes in air quality as a result of the Proposed Scheme. This site is South Cubbington Wood Local Wildlife Site (LWS). This site is located south of the B4453 Rugby Road. Further details of this site are provided in Ecology, Section 7.

Future baseline

4.3.9 Section 2.1, Overview of the area and description of the Proposed Scheme; Volume 5: Appendix CT-004-000; and Volume 5: Map Book – Cross Topic Maps, Maps CT-13-044b, CT-13-045 and CT-13-046 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 this area, there are no 'committed developments' that are considered to introduce new receptors requiring air quality assessment.

4.3.10 The data used for the air quality assessment take account of predicted changes in traffic, which are derived from a combination of regional traffic growth factors and consideration of major locally consented schemes, as described in the Traffic and Transport section.

Construction (2017)

4.3.11 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)

4.3.12 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 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 during construction

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

4.4.4 An assessment of construction traffic emissions has also been undertaken for two scenarios in the construction period: a without the Proposed Scheme scenario and b with the Proposed Scheme scenario.

4.4.5 In the Offchurch and Cubbington area dust-generating activities will be associated with construction of new structures; earthworks, including the movement of materials along haul roads along the line of the Proposed Scheme; as well as dust and mud deposited on to public highways from vehicles travelling to and from construction areas. There will be no demolitions in the Offchurch and Cubbington area.

4.4.6 A construction dust assessment was undertaken for sensitive receptors at eight locations where residential properties were present and one ecological receptor, due to their close proximity to the dust generating activities associated with the Proposed Scheme. These eight locations were: Welsh Road, Offchurch, south of the B4455 Fosse Way; on the B4455 Fosse Way, Offchurch; on Long Itchington Road, Offchurch; at the junction of Welsh Road and Hunningham Road, Offchurch; on Hunningham Road, Offchurch; at Lower Grange Farm on Mill Lane, Cubbington; on the B4453 Rugby Road, Cubbington; and on the A429 Coventry Road, Cubbington. The ecological receptor is South Cubbington Wood LWS.

4.4.7 Given the application of the mitigation contained within the draft CoCP, the construction dust assessment determined that of the locations where residential properties were present, the magnitude of impact will be negligible at all identified residential properties. The magnitude of impact will also be negligible at South Cubbington Wood LWS.

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-001-017.

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 Offchurch and Cubbington area met the criteria for assessment of change in traffic emissions during the construction phase. These locations were the B4455 Fosse Way, between Welsh Road and the A425 Southam Road; and Long Itchington Road, Offchurch. The increase in construction traffic was sufficient to require an assessment at receptors around these roads. The assessment found that the magnitude of impact will be negligible at all receptors assessed for NO_2 and PM10.

4.4.11 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-001-017.

Permanent effects from construction

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 significant residual 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 significant residual effects are considered likely.

4.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

4.5.2 There are no direct atmospheric emissions from the operation of trains that will cause an impact on air quality. Indirect emissions from sources such as rail wear and brakes have been assumed to be negligible.

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

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

4.5.5 Three locations within the Offchurch and Cubbington area met the criteria for assessment of emissions from traffic during the operational stage, following completion of the Proposed Scheme. These locations were on the B4455 Fosse Way, Offchurch; on Hunningham Road, Offchurch and on the B4453 Rugby Road, Cubbington. There will be permanent road realignments at all these locations which required assessment of changes in concentrations at receptors around these roads. The assessment found that the magnitude of impact will be negligible at all receptors assessed for NO_2 and PM_{10}.

4.5.6 The effect on air quality following completion of the Proposed Scheme will not be significant. The basis for this conclusion is presented in full in Volume 5: Appendix AQ-001-017.

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 significant residual effects

4.5.9 No residual significant effects are anticipated for receptors as a consequence of changes to air quality in this area during operation of the Proposed Scheme.

5 Community

5.1 Introduction

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

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

- impacts on amenity for people living close to the construction works for the Proposed Scheme or to construction traffic routes;
- the impacts on amenity for people using community facilities close to the construction works for the Proposed Scheme;
- the permanent and temporary impacts on users of promoted recreational public rights of way (PRoW), other routes and open spaces, including the Grand Union Canal Walk, the Centenary Way, the Sustrans National Cycle Route (NCR No. 41), the Offchurch Greenway, the Shakespeare's Avon Way and the Millennium Way; and
- disruption to local journeys and access to community facilities in the area, due to construction works, road closures, rerouting of roads and traffic management measures during the works.

5.1.3 Further details of the community assessments and write-ups of open space surveys and recreational public rights of way (PRoW) surveys undertaken within the area are contained in Volume 5: Appendix CM-001-017.

5.1.4 Community assessment maps are provided in Volume 5: Maps CM-01-105b to CM-01-107.

5.1.5 The assessment draws upon information gathered from local and regional sources including from Warwickshire County Council (WCC) and engagement with local organisations.

5.2 Scope, assumptions and limitations

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

5.2.2 Construction worker accommodation will be located at the Fosse Way 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.

5.3 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 residual significant effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routing of construction traffic and takes account of catchment areas for community facilities, which could be affected where crossed by the Proposed Scheme. Overall, the study area is taken as the area of land which encompasses the likely significant effects of the Proposed Scheme.

5.3.3 The villages of Offchurch and Cubbington are the main settlements within the area and both lie to the west of the Proposed Scheme. Leamington Spa is located further west and is the main centre for secondary education, health care, recreation, leisure and shopping facilities for the wider area. The small villages of Hunningham and Weston-under-Wetherley lie to the east of the Proposed Scheme. As a predominantly rural area, there are few residential properties and community facilities close to the Proposed Scheme. Most of the land required to build the Proposed Scheme is agricultural and the main settlements in the area are typically more than 500m from the boundary of the land required for the construction of the Proposed Scheme.

Offchurch

5.3.4 The village of Offchurch has a limited range of community facilities, notably a church, a village hall, a recreation ground and a public house. The Offchurch Sports Club is located about 1km to the north of the village, between Offchurch and Hunningham. Offchurch has no primary school or GP surgery, but falls within the catchment area for the Cubbington Church of England Primary School and GP surgeries at Leamington Spa. The village also lies within the catchment area for the North Leamington School for secondary education. All of the community facilities within the village lie beyond the area of land required for the construction and operation of the Proposed Scheme and are sufficiently far away so as not to be affected by a combination of significant amenity impacts. Routes between the village and the school at Cubbington or facilities in Leamington Spa will not be crossed by the Proposed Scheme.

5.3.5 There are a number of open spaces and recreational routes in the area to the south and east of Offchurch. The most notable is the Offchurch Greenway, which is a shared cycle path and footpath following the route of the disused Rugby to Leamington Spa Line between Radford Semele and the Fosse Way. The western section of the Greenway also forms part of the Sustrans National Cycle Network NCR No. 41 – the Lias Line – which runs from Warwick to Rugby, mostly following local roads in the area, including Long Itchington Road to the east of Offchurch. The Proposed Scheme crosses the Offchurch Greenway, to the east of Offchurch Village. It will also require

the permanent stopping up of Long Itchington Road, which forms part of the Sustrans NCR No. 41.

5.3.6 The Centenary Way and Grand Union Canal walk pass through the southern part of the area. The Centenary Way is a 157km long distance route, which runs from the Gloucestershire borders in the south to Kingsbury in the north, passing through Leamington Spa, Kenilworth and Stoneleigh. Within this area, the Centenary Way runs along the towpath for the Grand Union Canal from the Leamington Spa direction until Longhole Bridge in the east, where it crosses the canal and heads south towards Ufton in the Ladbroke and Southam area. The Grand Union Canal Walk is part of a 230km trail from London to Birmingham following the towpath of the canal. Both routes are included within or adjoining the area of land required for the construction and operation of the Proposed Scheme in the vicinity of Longhole Bridge, to the south of Welsh Road. The Grand Union Canal is part of the Warwickshire Cruising Ring, a connected series of canals forming a circuit around the West Midlands area.

5.3.7 Land on either side of Welsh Road, at Welsh Road Farm near Offchurch, also lies within the area required for the construction and operation of the Proposed Scheme. The land is used twice each year for a major cross-country running event, known as the 'Wolf Run'. The event attracts in the order of 2,500 participants as well as a large number of spectators.

Hunningham

5.3.8 The small village of Hunningham lies more than 1.5km to the east of the Proposed Scheme and is therefore beyond the study area for the assessment of land required for the construction and operation of the Proposed Scheme and significant amenity impacts. However, it is recognised that its residents are dependent upon access to Cubbington and Leamington Spa for some of their day-to-day services. The village lies within the catchment area for the primary school at Cubbington and secondary schools at Leamington Spa. The Proposed Scheme cuts across all connecting transport routes that are used to access these facilities on a daily basis.

Weston-under-Wetherley

5.3.9 Weston-under-Wetherley is just over 1km to the east of the Proposed Scheme and, like Hunningham, is beyond the study area for assessing the effects of land required for the construction and operation of the Proposed Scheme and significant amenity impacts. However, having only a limited range of facilities, the village is also dependent upon facilities at Cubbington (for primary schooling) and Leamington Spa (for secondary schooling, health care and other services). The Proposed Scheme cuts across routes used to access those facilities on a daily basis.

Cubbington

5.3.10 Cubbington village has a modest range of facilities, including a small high street with a number of convenience shops, together with a primary school, two nurseries, meeting halls, recreational open spaces, allotments and play areas. Most of these facilities are some distance from the Proposed Scheme and are beyond the study area within which a combination of significant amenity impacts could potentially occur. The facilities closest to the scheme and which have been included in the study area include

the Cubbington Church of England Primary School, the play area at Church Hill and the Oakdene Day Nursery at Coventry Road.

5.3.11 As noted previously, the catchment for the Cubbington Church of England Primary School covers much of the area, including the smaller villages of Offchurch, Hunningham and Weston-under-Wetherley. Cubbington itself falls within the catchment area for secondary schools and GP surgeries at Leamington Spa.

5.3.12 There are a number of open spaces, recreational facilities and routes to the north and east of Cubbington. To the north are the Coventry Road allotments and Waverley Equestrian Training Centre on Coventry Road, which lie to the west of the Proposed Scheme. The Shakespeare's Avon Way and the Millennium Way long distance footpaths share the same route through Cubbington along footpath W130 and are crossed by the Proposed Scheme at South Cubbington Wood. The Shakespeare's Avon Way is a 140km trail that follows the River Avon from its source in Northamptonshire to the River Severn at Tewkesbury. The Millennium Way is a 160km marked trail that runs from Worcestershire to Northamptonshire, passing through Hunningham, Cubbington, Leamington Spa and Kenilworth. This footpath is also a popular local walking route as well as forming part of the two long distance trails.

Future baseline

Construction (2017)

5.3.13 Volume 5: Appendix CT-004-017/1 provides details of the developments which are assumed to have been implemented by 2017. No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for the community assessment.

Operation (2026)

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

5.4 Effects arising during construction

Avoidance and mitigation measures

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

- extending the length of the viaduct structure over the Grand Union Canal to ensure sufficient space beneath the spans to maintain the route of the Grand Union Canal Walk on the towpath and the continuity of Ridgeway Lane PRoW, which runs to the north;
- siting the Fosse Way compound and materials stockpiling area away from large numbers of residential properties yet ensuring convenient access for delivery vehicles and site operatives;

- provision of permanent and in some instances temporary rerouting for PRoW and recreational routes to limit disruption and maintain continuity of use throughout the works;
- routing of construction traffic away from the main residential areas of Offchurch and Cubbington and away from Hunningham and Weston-under-Wetherley;
- incorporating slight realignments of local highways within the scheme design so that disruption to road users can be minimised during the construction period, through the careful phasing and sequencing of site works;
- provision of noise barriers around the worksites to the east of Cubbington to reduce noise impacts on Cubbington Church of England Primary School and on Oakdene Day Nursery; and
- early implementation of planting and other landscape measures where practicable, including adjacent to the Offchurch Greenway/PRoW W192 and in the vicinity of South Cubbington Wood.

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-003-000/1):

- appointment of community relations personnel (draft CoCP, Section 5);
- community helpline to handle enquires from the public (draft CoCP, Section 5);
- sensitive layout of construction sites to minimise nuisance (draft CoCP, Section 5);
- where reasonably practical, maintenance of PRoW for pedestrians, cyclists and equestrians around the perimeter of construction sites and across entry and exit points (draft CoCP, Section 5);
- monitoring and management of flood risk and other extreme weather events which may affect community resources during construction (draft CoCP, Sections 5 and 16);
- specific measures in relation to air quality and noise will also serve to reduce impacts for the neighbouring communities including discretionary noise insulation for sensitive community resources and, in special circumstances, temporary rehousing (draft CoCP, Sections 7 and 13); and
- where practicable, the avoidance of large 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-00-017. Each assessment form presents information that explains the rationale for determining the rating for sensitivity of the affected community resource, magnitude of impact and the assessment of significance.

Offchurch and surrounding area

Temporary effects during construction

Residential properties

5.4.4 Five residential properties in the vicinity of the junction of the B4455 Fosse Way and Welsh Road will be affected by a combination of significant traffic and visual effects during construction, including from works to realign the Fosse Way slightly to the north of its current position. It is anticipated that there will be a significant increase in the volume of HGV traffic using Welsh Road during the construction period, primarily associated with traffic destined for the Fosse Way compound to the north and for other construction works at Hunningham Road. Works to realign the B4455 Fosse Way and its junction with Welsh Road are expected to take about 16 months to complete, whilst the Fosse Way compound is likely to be operational for a period of up five years. The combination of significant HGV traffic and visual effects on the residents of the five properties will give rise to a major adverse amenity effect, which is therefore significant. The affected properties are:

- numbers 1-4 Springhill Cottages, Fosse Way, Offchurch; and
- Brickyard Cottage, Welsh Road, Offchurch.

5.4.5 Access to these properties will be maintained throughout the construction period.

5.4.6 A group of five residential properties at Hunningham Road, to the north of Offchurch village will be affected by a combination of significant traffic and visual effects during construction. Works in this area will include the construction of Hunningham Road overbridge, together with the construction of an express feeder auto-transformer station and railway drainage balancing pond and works to divert utilities in the vicinity of Fields Farm. Hunningham Road overbridge compound will be sited alongside the property Valley Fields and will be operational for the duration of the works, which are anticipated to last for approximately 14 months. A combination of significant visual and HGV traffic effects will give rise to a major adverse amenity effect on local residents, which is therefore significant. The affected properties are:

- Valley Fields, Hunningham Road, Offchurch;
- Ashlawns, Hunningham Road, Offchurch;
- 1 and 2 Fields Farm Cottages, Hunningham Road, Offchurch; and
- the residential property at Fields Farm, Hunningham Road, Offchurch.

5.4.7 The boundary of land required temporarily for the construction of the Proposed Scheme also extends in to the curtilage of Valley Fields at Hunningham Road. The temporary loss of land from a single residential property to facilitate utilities connections to the adjacent compound is not significant, at a community level.

Open Space and Recreational PRoW

5.4.8 The Proposed Scheme will cut across land at Welsh Road Farm, which is used for a 10km cross-country running event known as the "Wolf Run". This event is held on two weekends per year and attracts in the order of about 2,500 runners, as well as large numbers of spectators each time. It necessitates the closure of Welsh Road to allow

the runners, who set off in groups of about 150 at a time, to cross and follow the course on both sides of the road. During construction, it is assumed that it will not be practical to accommodate the event given the extent and nature of the works required on land in this area. The works will obstruct linkages between the two severed sections of the course on either side of the road, including the track (known as Ridgeway Lane) which runs between Longhole Bridge and Welsh Road and is also part of the Wolf Run course. Overall, as a well-attended, albeit infrequent event, the temporary cessation of the Wolf Run during the construction period, which is expected to last in the order of about 15 months, is assessed as giving rise to a moderate adverse effect on its users which is significant.

5.4.9 Approximately 350m of the Offchurch Greenway, which is one of Warwickshire County Council's Country Parks, situated to the east of Offchurch village, falls within the area of land required for the construction and operation of the Proposed Scheme. During construction, the Greenway will be re-routed very slightly around the works for the new Greenway overbridge to avoid any loss of use of the route during this time. This section of the temporarily re-routed Greenway will be shared by users of the Sustrans NCR No.41 (Lias Line), which will be permanently re-routed via the Greenway.

5.4.10 Pedestrians and cyclists will however be affected by significant adverse visual effects, due to the works to build the railway and the Greenway overbridge and the proximity of the Fosse Way Compound and materials stockpiling and treatment area. This will effectively impair the visual amenity of approximately one third of the entire length of the Greenway. In addition, the significant increase in HGV traffic using Welsh Road, which crosses the Greenway route, will also impact on the amenities of users and create a barrier effect between the two sections of the Greenway on either side of this road. As a well-used recreational resource, the change in amenity during construction due to a combination of significant visual and HGV traffic effects is assessed as a major adverse effect, which is therefore significant. It is recognised that users of the Greenway will also be subject to noise impacts as a result of proximity to the construction works for the Proposed Scheme. Given the transitory nature of the route, the noise impacts on users are not regarded as being significant at a community level.

Permanent effects from construction

Residential properties

5.4.11 A total of three residential properties in the Offchurch area will be affected by a slight permanent loss of land from their boundaries due to works to realign adjacent local highways. These effects have been assessed as not significant and further details are provided in Appendix CM-001-017. The properties affected are:

- the residential property at Welsh Road Farm, Welsh Road, Offchurch;
- Brickyard Cottage, Welsh Road, Offchurch; and
- Lowfield, Long Itchington Road, Offchurch.

5.4.12 The boundary of land required for the construction and operation of the Proposed Scheme also extends over the access points to eight dwellings in the Offchurch area. It is anticipated that highway works in the vicinity of these properties can be undertaken

within the current highway boundary and will not result in the loss of land from adjacent residential properties. The properties affected are:

- 1-4 Springhill Cottages which are located at the junction of the B4455 Fosse Way and Welsh Road;
- Burnt Heath Farm;
- Long Itchington Road; and
- Ashlawns, 1 and 2 Fields Farm and Fields Farm at Hunningham Road.

Recreational PRoW

5.4.13 The Proposed Scheme will require the permanent loss of land from the Wolf Run course. The effects of this are assessed as minor given the potential to divert the course around the perimeter of the railway boundary upon completion of the works (refer to Volume 5: Appendix CM-001-017 for further details).

5.4.14 The Proposed Scheme makes provision for a new overbridge and to avoid any permanent severance of the Offchurch Greenway. Whilst the modification of the junction between Welsh Road and Long Itchington Road will change arrangements for people crossing this road to use both sections of the Greenway, no significant effects on users have been identified.

5.4.15 The Proposed Scheme will require the stopping-up of Long Itchington Road and the permanent re-routing of the Sustrans NCR No. 41 via the Offchurch Greenway and a new dedicated link to connect back to Long Itchington Road to the east of the Fosse Way. This re-routing will not give rise to any significant adverse permanent effects on users and could potentially offer a slight long-term benefit by offering an off-road alternative and making provision for improved crossing facilities at the Fosse Way.

Hunningham and Weston-Under-Wetherley

5.4.16 No temporary or permanent significant effects on community resources have been identified for the Hunningham and Weston-under-Wetherley areas during construction of the Proposed Scheme (refer to Volume 5: Appendix CM-001-017). Whilst the residents of both of these settlements are dependent upon access to community facilities at Cubbington and Leamington Spa on a daily basis, the disruption and isolation effects on these communities due to the works at Hunningham Road and the B4453 Rugby Road will not be significant.

Cubbington

Temporary effects during construction

Recreational PRoW

5.4.17 The Proposed Scheme will cross the route of the Shakespeare's Avon Way and Millennium Way public footpath (PRoW No. W130) to the east of Cubbington at South Cubbington Wood. Approximately 150m of the footpath lies within the area of land required for the construction and operation of the Proposed Scheme. The Proposed Scheme makes provision for a slight permanent realignment of the route and a new footbridge to carry the route over the railway. As the works can be phased, no temporary closures are likely to be necessary during construction. It is recognised that

users of the route will be subject to noise impacts and visual effects as a result of proximity to the construction works for the Proposed Scheme. However, given the transitory nature of the impact there will not be a combination of significant residual amenity effects on users.

Permanent effects from construction

5.4.18 No significant permanent effects on community resources in the Cubbington area have been identified as a result of construction of the Proposed Scheme.

5.4.19 The works will require the very slight permanent loss of land from one residential property to the south of Cubbington, namely Lower Grange, at Mill Lane, Cubbington, but the effects are assessed as not significant. Works to the B4453 Rugby Road to the east of Cubbington will extend across the front of the entrances to four residential properties near South Cubbington Wood, namely Sandalwood, Lonewood, Wychwood and Broadoaks, but no direct loss of land from these properties will be required and access will be maintained during construction.

5.4.20 The Proposed Scheme makes provision to reinstate the Shakespeare's Avon Way and Millennium Way at South Cubbington Wood close to its current alignment and a new bridge to carry the footpath over the railway will prevent any permanent severance of the route.

Cumulative effects

5.4.21 No temporary or permanent inter-project or community wide cumulative effects have been identified for any of the areas during construction.

Other mitigation measures

5.4.22 The assessment has concluded that construction of the Proposed Scheme will result in a small number of significant adverse effects on community resources in this area. These are all temporary in nature and are mostly due to impacts on amenity during construction works. No further measures are proposed.

Summary of likely significant residual effects

5.4.23 As no further mitigation is proposed, the effects will remain as described previously.

5.4.24 At Welsh Road Farm, due to land required for the construction of the Proposed Scheme the Wolf Run will be subject to significant effect as a result of temporary cessation of the event.

5.4.25 There will be a combination of effects on the amenity of residents of a few residential properties at Welsh Road/B4455 Fosse Way Junction and Hunningham Road arising temporarily from the construction of the Proposed Scheme. Similarly the amenity for users of the Offchurch Greenway will be affected significantly when construction takes place.

5.5 Effects arising from operation

Avoidance and mitigation measures

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

- the grading of earthworks to help assimilate the Proposed Scheme into the landscape, reduce visual impact and to assist with noise mitigation in the Offchurch area; and
- the retention of existing vegetation where possible and the provision of new landscaping areas to mitigate against visual impacts, including on users of the Offchurch Greenway.

Assessment of impacts and effects

5.5.2 No significant effects have been identified during operation.

Cumulative effects

5.5.3 No inter-project cumulative effects have been identified for any of the areas during operation.

Other mitigation measures

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

Summary of likely residual significant effects

5.5.5 No residual significant effects have been identified.

6 Cultural heritage

6.1 Introduction

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

6.1.2 With regard to heritage assets, the main issue is the extent to which designated and non-designated assets are affected by the Proposed Scheme. Impacts on assets as a result of the Proposed Scheme will occur largely through 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, Map Series CH-01 CH-02 and CH-03. 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-001-017: Baseline report;
- Appendix CH-002-017: Gazetteer of heritage assets;
- Appendix CH-003-017: Impact assessment table; and
- Appendix CH-004-017: Survey reports.

6.1.4 Throughout this section, assets within the study areas are identified with unique reference code, OFCXXX; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-017.

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 within 2km of the centre line of the Proposed Scheme has been considered. The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out is defined as the land required, temporarily or permanently, for the construction of the Proposed Scheme plus 500m.

6.2.3 The cultural heritage methodology includes the consideration of the 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[21] data examined did not encompass the full extent of the study area; and
- all areas of survey as identified in the archaeological risk model[22] were available for survey.

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-001-017.

6.3.2 In addition to collation of this baseline data, the following surveys were undertaken:

- walkover and site reconnaissance from areas of public access or in locations where access was granted. This was undertaken to understand the character and form of heritage assets and the historic landscape; to review the setting of assets; and to identify previously unknown assets; and
- desk-top review of remote sensing data including LiDAR, aerial photographs and hyperspectral data (see Volume 5: Appendix CH-004-017).

Designated assets

6.3.3 No designated heritage assets lie 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-01-105b to CH-01-107).

6.3.4 The following designated assets are located within 2km of the centre line (see Volume 5: Map Book – Cultural Heritage, Maps CH-02-104 and CH-02-105):

- two Grade I listed buildings: Church of Saint Mary, Cubbington (within Cubbington Historic Settlement and grouped in OFC043) and Church of Saint Michael, Weston-under-Wetherley (grouped within Weston-under-Wetherley Historic Settlement OFC049); both are parish churches;

[21] Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.
[22] 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.

- three Grade II* listed buildings: Hunningham railway bridge (OFC019), Offchurch Bury (OFC021) and the Church of Saint Gregory in Offchurch (grouped with the historic settlement of Offchurch under OFC022);
- 29 Grade II listed buildings: many of these are within the main settlements, including Offchurch (OFC022) and Cubbington (OFC043), though some are isolated farms etc, including Snowford Farmhouse (OFC020) and New House Farmhouse (OFC502);
- two conservation areas: one at Offchurch (OFC022) and one at Cubbington (OFC043); and
- one area of ancient woodland at South Cubbington Wood (OFC45).

Non-designated assets

6.3.5 The Bytham River (OFC041), a Palaeolithic river channel, is the only non-designated asset of high 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 non-designated assets of moderate value lie wholly or partially within the land required, temporarily or permanently, for the construction of the Proposed Scheme:

- three lengths of important hedgerow: Fosse Way hedgerow (OFC015), Cubbington/Stoneleigh parish boundary (OFC053) and Cubbington/ Weston-under-Wetherley parish boundary (OFC037);
- the Longhole Bridge (OFC001) and Grand Union Canal (OFC004);
- Fosse Way Roman road (OFC012); and
- Ridgeway Lane (OFC002).

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

- two buildings or structures: Dismantled Railway (OFC018) (now partly Offchurch Greenway) and Lower Grange (OFC035); and
- five archaeological assets: False Coventry (OFC034); Ridgeway Lane (OFC002); and three ridge and furrow sites (OFC027, OFC036, OFC047).

6.3.8 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-002-17, and identified on Volume 5: Map Books – Cultural Heritage, Maps CH-01-105b to CH-01-107. There are a number of built heritage assets, the settings of which have been considered, for example:

- Ridgeway Lane (OFC002);
- buildings between Print Farm and Welsh Road Farm (OFC003);
- Grand Union Canal (OFC004);
- Bunkers Hill Farm (OFC006);

- Welsh Road Farm (OFC007);
- Brickyard Cottages, south of Springhill Cottages (OFC008);
- Burnt Heath Farm, south side of road (OFC010);
- Fosseway Cottage (OFC013);
- Fosse Farm (OFC017);
- Manor Farm (OFC025);
- Fields Farm (OFC030); and
- buildings to northwest of Fields Farm (OFC031).

Cultural heritage overview

6.3.9 A Palaeolithic site of national, and potentially international, importance has been identified at Waverley Wood Farm Pit where a concentration of Lower Palaeolithic artefacts along with the remains of a straight-tusked elephant have been identified within organic deposits associated with the palaeochannel. These finds have been dated to circa 500,000 Before Present (BP)[23]. Although the site is located approximately 2.1km to the north-east of the centre line the former river channel, the River Bytham, on which it is located, runs across the study area and under the land required for the construction of the Proposed Scheme, following a band of Mercia mudstone[24]. This raises the possibility of further discoveries within the land required for the construction of the Proposed Scheme along the line of the lost Bytham River (OFC041). This river crossed southern Britain on a north-east – south-west axis in the Pleistocene period (circa 500,000 BP). The course of this lost river is now partially followed by the River Avon. It is widely believed that the Bytham river valley was one of the main entry points for the first humans who inhabited the area. The Bytham appears to have been destroyed during the Anglian glaciation which commenced circa 480,000 BP.

6.3.10 There are no known assets in the study area dating from the Later Palaeolithic to the Early Bronze Age. This may be due to a lack of archaeological investigation in the area rather than an absence of settlement and activity.

6.3.11 A group of possible round barrows, possibly of Bronze Age date, are located just outside the CFA to the west of Print Wood, approximately 500m to the east of the boundary land required to construct the Proposed Scheme. Four cropmark sites which may be prehistoric in origin have also been identified within the study area. An incomplete circular enclosure containing a small rectangular enclosure (OFC009) has been identified to the south-east of Burnt Heath Farm while a second incomplete enclosure has been noted to the south of Fosse Farm (OFC014). A U-shaped linear cropmark (OFC028) crossed by a second linear and forming a rough A-shaped feature is located to the north-east of Field's Farm, while a series of five incomplete circular enclosures (OFC029) have been noted immediately to the north-west.

[23] Shotton, F.W., Keen D.H., Coope, C.R., Currant, A.P., Cibbard, P.L., Aalto, M., Peglar, S.M. and Robinson, J.E. (1993), The Middle Pleistocene deposits of Waverley Wood Pit, Warwickshire, England. *Journal of Quaternary Science,* Vol. 8, 293-325.
[24] Ibid.

6.3.12 The only known evidence for Roman activity in the study area is the former Roman road known as the Fosse Way (OFC012), which crosses the land required to construct the Proposed Scheme on a south-west – north-east alignment to the south of Offchurch. Although the Roman road itself no longer survives as a surface feature, deposits associated with it may be sealed by both medieval and post-medieval road surfaces. There may also be related remains within the land either side of the road.

6.3.13 There are no known Early Medieval sites in the study area but the Fosse Way remained in use as a routeway up to the present day and for centuries remained an important artery. The later medieval period saw a steady growth in population, the expansion of the main villages of Offchurch and Cubbington, the development of the manorial system and the growth in power of the church (Hunt, 2011)[25], together with the attendant development of the parishes (Offchurch, Weston-under-Wetherley and Cubbington) that are crossed by the Proposed Scheme.

6.3.14 The wider region is rich in medieval settlements and field systems, reflecting the intensity of medieval activity in the West Midlands as a whole. Two villages with medieval cores have been identified within the study area. These are at Offchurch (OFC022) and at Cubbington (OFC043), located to the south-west of the boundary of land required to construct the Proposed Scheme. The remains of a shrunken village at Manor Farm lie adjacent to the land required for the Proposed Scheme (OFC024).

6.3.15 To the north of the Offchurch and Cubbington area the land was long dominated by the powerful monastic house of Stoneleigh Abbey, which held large areas of land in the north of the county. Weston Mill (OFC038) appears to have served the Abbey as a corn mill and survives as a series of foundations and watercourses by the River Leam, 70m to the east of the land required for the Proposed Scheme.

6.3.16 A total of five plots of surviving ridge and furrow earthworks have been recorded in the study area (OFC027, 036, 044, 047, 048). Further medieval earthworks have been identified at Offchurch (OFC023). These appear to form an enclosure approximately 230m south-west of the land required for the Proposed Scheme. Other medieval earthworks and deposits associated with extant built heritage are likely to survive in the village cores and particularly near the medieval churches, these may have survived as boundaries or garden features.

6.3.17 Two post-medieval transport sites survive within the area; part of the route of the Warwick-Napton Canal (now part of the Grand Union Canal) at the southern limit of the study area, while the route of the former Rugby to Leamington Spa Line (OFC018) crosses the route approximately 2.3km to the north-west of this. In the post-medieval period much of the farmland was enclosed creating the present fieldscape.

6.3.18 The route of the Grand Union Canal (OFC001) is crossed by the Proposed Scheme. The canal was opened in 1829, but a number of its elements were added later.

6.3.19 Apart from the churches and excluding any unidentified phasing all of the buildings within the area are post-medieval in origin, including numerous dwellings and farms.

[25] Hunt, J. (2011), The Medieval period. In: S. Watt, ed. *The Archaeology of the West Midlands: A Framework for Research*. Oxford: Oxbow Books, pp. 173-210.

The majority of these are in the main settlements, although others survive in more isolated locations.

6.3.20 The 20th century saw the continued rapid expansion of industrial centres such as Coventry and Rugby as well as smaller settlements such as Leamington Spa. The growing population of the region, combined with the arrival of commuters working in the cities and living in the suburbs and surrounding villages, also saw a rapid rise in the populations of the small nucleated settlements across the area, with new housing estates constructed around the fringes of both Offchurch and Cubbington.

6.3.21 The Second World War 'Starfish' or bombing decoy site (OFC034) is perhaps the most significant 20th century site within the study area. Little however seems to have survived and, by their very nature, such sites were often ephemeral, consisting of bonfires, lighting and other pyrotechnics.

6.3.22 The landscape within the parishes of Offchurch, Weston-under-Wetherley and Cubbington retained some of its post-medieval enclosed character through the 20th and into the 21st century. Arable cultivation was dominant, particularly following changes to governmental agricultural policy at the onset of the Second World War, which encouraged a rapid expansion of cereal cropping. This drive to grow grain continued through the post-war years and only began to decline into the 21st century. The effect on the landscape during this period was for fields to be expanded in size with the removal of hedgerows and the thinning out of the post-medieval landscape, which, while retaining its framework, has created a less intensive pattern.

6.3.23 The woodland at North and South Cubbington Wood continued to be managed through the 20th and into the 21st century. A reservoir was constructed at Burnt Firs to the south east of Offchurch in the last half of the 20th century.

Future baseline

Construction (2017)

6.3.24 Section 2.1 of this report 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 construction of the Proposed Scheme. The potential for these developments to alter the current cultural heritage baseline has been reviewed as part of this assessment.

6.3.25 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)

6.3.26 Section 2.1 of this report 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. No committed developments have been identified in this local area that will materially alter the baseline conditions in 2026. The potential cumulative impact arising from committed

developments on heritage assets affected by the construction and operation of the Proposed Scheme have been considered as part of this assessment.

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 in Section 8 include the following (see Volume 5: Appendix CT-003-000):

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

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

- planting and earthworks in the vicinity of the Grand Union Canal (OFC004), an asset of moderate value, designed to reduce visual impact on the setting of the canal, together with a longer viaduct to enable continued use of Ridgeway Lane (OFC002), an asset of low value, across the canal;
- extensive earthwork forms and associated planting to the east and north-east of Offchurch (OFC022), an asset of moderate value, designed to reduce impact on the setting of the historic settlement;
- retained cutting in South Cubbington Wood (OFC045), an asset of high value, designed to reduce loss of ancient woodland; and
- alterations in depth of cuttings in the north section to reduce the potential for impact on deeply buried Bytham River deposits (OFC041), an asset of high value.

Assessment of impacts and effects

Temporary effects during construction

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; as well as other construction factors.

6.4.4 The significant effects that will occur as a result of temporary impacts on the setting of designated or non-designated heritage assets within the study area are described below:

- Longhole Bridge (OFC001), an asset of moderate value, will be situated adjacent to worksites, plant and materials storage and satellite compounds. The presence of these features and the construction of the adjacent viaduct and railway will have a marked temporary impact on the rural setting of the bridge and its relationship with the Grand Union Canal. Construction activities at the Longhole Bridge are anticipated for a duration of approximately 57 weeks. Construction activities at the nearby Welsh Road embankment are anticipated for approximately 39 weeks. These changes will constitute a temporary high adverse impact resulting in a major adverse effect; and
- Grand Union Canal (OFC004), an asset of moderate value, will have its existing rural setting altered along one short stretch by construction activity and the presence of construction compounds and material storage areas. Construction activities affecting this asset are the same as for the Longhole Bridge (OFC001, above) and are anticipated to last for an anticipated 96 weeks. These changes will constitute a temporary medium adverse impact resulting in a 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 from construction

6.4.6 The significant effects that 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 are described below.

6.4.7 Archaeological remains associated with the Fosse Way Roman road (OFC012), an asset of moderate value, will be removed to a width of approximately 100m to facilitate construction of cuttings, with additional work to the south to allow the creation of a new road layout. This will constitute a high adverse impact and a major adverse effect.

6.4.8 Parts of an important hedgerow along the Fosse Way (OFC015), an asset of moderate value, will be removed to allow the construction of the Proposed Scheme. This will include the removal of an approximately 200m length of the asset to allow the construction of the mainline and its associated earthworks. The addition of a roundabout and works to the road to the south of the main line will result in additional loss of the hedgerow and its line. This will constitute a medium adverse impact and moderate adverse effect.

6.4.9 Part of an important hedgerow along the Cubbington and Stoneleigh parish boundary (OFC053), an asset of moderate value, will be removed to allow the construction of the Proposed Scheme. In total approximately 100m will be removed. This will constitute a medium adverse impact and moderate adverse effect.

6.4.10 Part of the ancient woodland at South Cubbington Wood (OFC045), an asset of high value, will be removed to allow construction of the Proposed Scheme and associated earthworks. The woodland will be cut though at the southern end by a new retained cutting, this will entail the loss of part of the woodland and its associated archaeological features. This will constitute a high adverse impact and a major adverse effect.

6.4.11 Elements of the River Bytham Palaeolithic river alignment (OFC041), an asset of high value, could potentially be removed by cuttings and ground works during the construction of the Proposed Scheme. These deposits could be encountered during construction of the cuttings required at the northern end of the area. If so, this will constitute a high adverse impact and a major adverse effect.

6.4.12 An area of ridge and furrow at Valley Fields (OFC027), an asset of low value, will be removed in order to construct the main line and temporary works. This will constitute a high adverse impact and a moderate adverse effect.

6.4.13 An area of ridge and furrow at Rugby Road (OFC047), an asset of low value, will be removed in order to construct the main line and temporary works. This will constitute a high adverse impact and a moderate adverse effect.

6.4.14 The significant effects that will occur as a result of a permanent impact on the setting of heritage assets are described below:

- Longhole Bridge (OFC001), an asset of moderate value, will be situated within 40m of the new line where it crosses the Grand Union Canal on viaduct and next to the graded out earthworks. The Proposed Scheme will considerably change the rural setting of the bridge and its relationship with the Grand Union Canal. This will constitute a high adverse impact and major adverse effect;
- Fields Farm Cottages (OFC030), an asset of low value. The rural setting of the farm will be changed by the construction of large embankments approximately 150m to the south-west. This will constitute a high adverse impact and moderate adverse effect; and
- Buildings to the northwest of Fields Farm (OFC031), an asset of low value. The rural setting of these agricultural buildings will be changed by the close proximity of the line, changing the rural setting which contributes to the asset's significance. This will constitute a high adverse impact and moderate adverse effect.

Permanent cumulative effects

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

Other mitigation measures

6.4.16 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

6.4.17 No mitigation beyond that described has been identified the residual effects are the same as those reported in the permanent effects section.

6.4.18 A range of archaeological assets will be permanently lost due to the construction of the Proposed Scheme; these assets include the Fosse Way Roman Road, the River Bytham ancient river alignment, and Valley Fields and Rugby Road Ridge areas of ridge-and-furrow. A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.19 The Proposed Scheme will sever elements of the historic landscape, for example hedgerows and ancient woodland. Parts of important hedgerow along the Fosse Way and at the boundary of the historic Cubbington and Stoneleigh parish boundaries will be permanently removed, as will a portion of the ancient woodland at South Cubbington Woods. In addition, elements of the Proposed Scheme such as cuttings and embankments will affect the setting of historic settlements and buildings such as the Longhole Bridge, the Grand Union Canal, Fields Farm and the buildings to the north-west of Fields Farm, and several non-designated buildings and groups of buildings. Further consideration will be given to the historic vegetation and landscapes as part of the planting and landscape design plans that will be further prepared for HS2.

6.5 Effects arising during operation

Avoidance and mitigation measures

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

- noise mitigation measures and landscape earthworks have been included within the Proposed Scheme design to reduce potential impacts on some identified assets, including Burnt Heath Farm (OFC010) and the major villages; and
- landscape planting will increasingly reduce impacts on the setting of the assets within the study area as it matures during the operational phase.

Assessment of impacts and effects

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

the setting of an asset from the presence of the constructed scheme and its operation, this is reported in the assessment of operation.

6.5.3 Significant environmental effects will occur as a result of permanent changes to the setting of heritage assets arising from the impacts of railway operation, as described in the following paragraphs.

6.5.4 Longhole Bridge (OFC001), an asset of moderate value. Trains will be visible and audible passing on the Longhole viaduct. The operation of the Proposed Scheme will result in a medium adverse impact. There will also be high adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and major adverse effect.

6.5.5 Fields Farm Cottages (OFC030), an asset of low value. The assets will be subject to train noise and there may also be views of trains on embankments to the south and west. These changes will alter the quiet rural setting of the asset resulting in a high adverse impact. The presence of the Proposed Scheme will also change the visual setting of the asset through the creation of large embankments. The combined presence and operation of the Proposed Scheme will adversely affect the rural setting of the farm, resulting in a high adverse impact and moderate adverse effect.

6.5.6 Buildings to the northwest of Fields Farm (OFC031), an asset of low value. Noise levels at and around the asset will rise following commencement of operation and trains will be visible, particularly whilst planting matures. This will affect the rural setting of the buildings and will result in a medium adverse impact. There will also be high adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will adversely alter key characteristics of the setting of this asset, resulting in a high adverse impact and moderate adverse effect.

6.5.7 South and North Cubbington Woods (OFC045), an asset of high value. The operational scheme will run through part of the wood and introduce train noise. This will affect the quiet rural character of the woodland, particularly in the southern part of the asset. These changes to the character and rural nature of the wood will constitute a medium adverse impact. Woodland loss as a result of the construction of the Proposed Scheme will result in high adverse impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and major adverse effect.

Cumulative effects

6.5.8 It is not considered that there will be any cumulative effects from temporary impacts on heritage assets within the study area as a result of the committed developments described previously.

Other mitigation measures

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

Summary of likely residual significant effects

6.5.10 No mitigation beyond that described above has been identified and consequently the residual effects are the same as those reported in the assessment of impacts and effects.

6.5.11 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 Longhole Bridge, Fields Farm cottages, buildings to the north-west of Fields Farm and South and North Cubbington Woods ancient woodland. Operational noise will be controlled through noise barriers and landscaped earthworks build up alongside the tracks that will keep the operational noise effect within reasonable limits.

7 Ecology

7.1 Introduction

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

7.1.2 The principal ecological issues in this area are: loss of habitat where the route of the Proposed Scheme passes in cutting through South Cubbington Wood Local Wildlife Site (LWS) and ancient semi-natural woodland; severance of woodlands at Offchurch Greenway and at Ash Beds; loss of barn owls from one territory; and loss of natural channel habitats in one unnamed tributary watercourse of the River Leam associated with Ash Beds.

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

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

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; and Butterfly Conservation (Warwickshire Branch).

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 the SMR Addendum (Volume 5: Appendix CT-001-000/2). Further details, including the study area for individual surveys, are provided within the SMR Addendum (Volume 5: Appendix CT-001-000/2). The assessment methodology is summarised in Section 8 of Volume 1 of the ES, along with route-wide assumptions and limitations. Limitations associated with particular surveys are described within the relevant baseline survey report in Volume 5: Appendices EC-001-003, EC-002-003, EC-003-003 and EC-004-003.

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 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 plantation woodland and a small reservoir at Burnt Firs close to Burnt Heath Farm, Offchurch Greenway (partial survey due to limited access) and the majority of South Cubbington Wood and Waverley and Weston Woods. Further details are provided in Volume 5: Appendices EC-001-003, EC-002-003, EC-003-003 and EC-004-003.

7.2.4 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.

7.2.5 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 survey reports and maps presented in Volume 5: Appendices EC-001-003 to EC-004-003 and Map Book – Ecology, Maps EC-01 to EC-12. Statutory and non-statutory designated sites are shown on 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 arable farmland with open hedgerows and tree lines. There are limited areas of woodland, notably near Longhole Bridge adjacent to the Grand Union Canal, Burnt Firs close to Burnt Heath Farm, Ash Beds along an unnamed tributary watercourse of the River Leam and South Cubbington Wood. The Grand Union Canal, the River Leam and two unnamed tributary watercourses of the River Leam, are crossed by the route of the Proposed Scheme.

Designated sites

7.3.3 There are no statutory designated sites located within 500m of the land required for the construction of the Proposed Scheme.

7.3.4 There are two Local Wildlife Sites (LWS) relevant to the assessment in the Offchurch and Cubbington area; each is of county/metropolitan value. They are:

- South Cubbington Wood LWS – designated for woodland. The site is ancient semi-natural woodland that is an excellent example of traditional Warwickshire woodland and is part of the Princethorpe Woods Complex, the largest concentration of semi-natural woodland in Warwickshire. The southern part of the wood, which lies within the land required for the construction of the Proposed Scheme, supports ash woodland of a type that is locally rare in Warwickshire; and
- Waverley and Weston Woods LWS – designated for woodland. The LWS is an ancient woodland site that is part of the Princethorpe Living Landscape area[26], as defined by the Warwickshire Wildlife Trust, a large group of ancient semi-natural woodlands. The LWS was replanted with conifers (Waverley Wood) and deciduous species (Weston Wood) following clear felling in the early 1950s. The LWS is of county value for the dormouse population (Weston Wood), for breeding woodland birds, for moths (particularly those associated with damp ancient woodland), and is one of the best woods in Warwickshire

[26] Living Landscapes are areas where The Wildlife Trusts are targeting landscape-scale conservation efforts to halt the decline of wildlife and restore the natural environment.

for its fungi. The LWS is partially within the land required for the construction of the Proposed Scheme.

7.3.5 In addition to the areas of ancient woodland which fall within designated sites, North Cubbington Wood is ancient replanted woodland, lying immediately north of South Cubbington Wood and adjacent to the land required for construction of the Proposed Scheme. Although not part of the adjacent South Cubbington Wood LWS, it forms part of the Princethorpe Woodlands Living Landscape area that also includes Waverley and Weston Woods LWS. These ancient woodlands represent an irreplaceable resource.

Habitats

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

Woodland

7.3.7 South Cubbington Wood contains ancient semi-natural woodland. National Vegetation Classification (NVC)[27] survey shows this woodland has abundant pedunculate oak, with ash frequent and silver birch, sycamore, aspen and rowan present at low abundance. The ground flora is dominated by bluebell. Wood millet and yellow archangel are present; both are notable plants in Warwickshire[28]. The woodland most closely resembles the ash woodland community W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis*. This is consistent with the LWS citation and the wood anemone sub-community of the W8 woodland is locally rare in Warwickshire, although the habitat in certain parts of the woodland is a closer match to other woodland communities. The woodland is lowland mixed deciduous woodland, a habitat of principal importance identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[29]. This habitat is of county/metropolitan value.

7.3.8 Waverley and Weston Woods were not accessed for survey, although a description is available for the LWS. This habitat is of county/metropolitan value.

7.3.9 Secondary broadleaved woodland and scrub habitats, including Sutton Spinney, have developed along the Offchurch Greenway, a disused railway which was formerly part of the Rugby to Leamington Spa Line. The woodland is a species-poor ash woodland community W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis*. The woodland forms a linear corridor of habitat through an otherwise arable landscape and connects to several other woodland and scrub habitats in the area. The woodland is lowland mixed deciduous woodland, a habitat of principal importance. This habitat is of district/borough value.

7.3.10 The secondary broadleaved woodland at Ash Beds associated with a tributary of the River Leam shows a slow transition from scrub to woodland and is a close match with both the ash woodland community W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis* and the hawthorn scrub community W21 *Crataegus monogyna-Hedera helix.*

[27] NVC is a detailed survey and classification system that is used to compare plant communities with a range of defined community types.
[28] 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.
[29] *Natural Environment and Rural Communities Act 2006* (Chapter 16). Her Majesty's Stationery Office.

The woodland is lowland mixed deciduous woodland, a habitat of principal importance. This habitat is of district/borough value.

7.3.11 The secondary broadleaved woodland near Longhole Bridge on the Grand Union Canal where a field boundary meets an unnamed tributary of the River Leam is a small wet woodland composed almost entirely of crack willow trees. The canopy also contains scattered common hawthorn and elder shrubs. This woodland community is a young stand of the alder woodland community W6 *Alnus glutinosa-Urtica dioica.* The relatively dry conditions have allowed typical scrub species to become frequent or abundant, particularly bramble and hawthorn. Wet woodland is a habitat of principal importance but this woodland is degraded in habitat quality. The woodland has local/parish value.

7.3.12 A small woodland plantation is present at Burnt Firs agricultural reservoir, but no survey work has been undertaken. The woodland is assumed to be of local/parish value.

Hedgerows

7.3.13 Twenty-six hedgerows have been noted within the land required for the construction of the Proposed Scheme that meet the wildlife and landscape criteria under the Hedgerow Regulations 1997[30]. Of these, five also qualify under the archaeological and historical criteria defined in the Hedgerow Regulations 1997 as explained in Section 6 (Cultural Heritage). There is also one species-rich hedgerow 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.

7.3.14 The remaining hedgerows surveyed are species-poor and common within the landscape, and they are individually of local/parish value. However, due to the wildlife corridors created by hedgerows, the hedgerow network within the land required for construction of the Proposed Scheme is considered to be of district/borough value.

Water bodies

7.3.15 There are six water bodies within the area of land required for the construction of the Proposed Scheme, none of which have been surveyed.

7.3.16 As a precautionary assessment in the absence of field data, it is considered that water bodies within the land required for the construction of the Proposed Scheme could be up to district/borough value.

Watercourses

7.3.17 The Grand Union Canal and the River Leam are the main watercourses that will be crossed by the route of the Proposed Scheme, as well as two unnamed tributary watercourses of the River Leam (one associated with the woodland at Ash Beds and the other just south of the Grand Union Canal).

[30] *The Hedgerow Regulations 1997* (1997 No. 1160). London. Her Majesty's Stationery Office.

7.3.18 The River Leam supports an abundant assemblage of common aquatic macrophytes and the watercourse is sinuous; the river is a habitat of principal importance and has district/borough value.

7.3.19 The unnamed tributary of the River Leam associated with Ash Beds woodland is heavily shaded with no in-channel aquatic vegetation, but the watercourse retains natural features, a sinuous nature and a diverse range of habitats; such a watercourse is a habitat of principal importance and is of district/borough value.

7.3.20 The Grand Union Canal supports eutrophic standing water, a habitat of principal importance, but supports only small patches of relatively uncommon emergent aquatic communities and has local/parish value.

7.3.21 Access constraints have prevented survey of the unnamed tributary of the River Leam just south of the Grand Union Canal, but OS mapping and aerial photography show it is heavily modified and has a uniform longitudinal profile lacking habitat diversity. It is considered as being up to local/parish value.

Grassland

7.3.22 There is no evidence for the presence of notable grasslands within the area. There is anecdotal information[31] of remnant calcareous grassland along Ridgeway Lane (track) between Print Wood and the Grand Union Canal, which is partly within the land required for the construction of the Proposed Scheme. This habitat is likely to be of up to local/parish value.

Other habitats

7.3.23 The Phase 1 habitat data from aerial mapping 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

7.3.24 A summary of the species relevant to the assessment is provided in Table 9.

[31] Anecdotal information obtained from local recorders during meetings arranged by Warwickshire County Council and Warwickshire Wildlife Trust in 2012.

Table 9: Protected and/or notable species

Species/ Species group	Value	Receptor	Baseline and rationale for evaluation
Bats	Up to regional	Potential assemblage of bats associated with tree roosts at the southern section of South Cubbington Wood	No access has been available to this section of South Cubbington Wood to survey potential tree roosts. Activity and static surveys within adjoining parts of South Cubbington Wood confirms a range of activity by species including *Myotis* species, noctule and Leisler's which may roost within trees within the southern section of South Cubbington Wood. Leisler's bat, along with many *Myotis* species, is considered to be a rarer bat within England and rare within Warwickshire. Taking a precautionary approach, it is assumed that the woods at the southern section of South Cubbington Wood could support maternity roosts of both common and 'rarer'[32] species based upon the assemblage recorded within the area and could have up to regional value.
Bats	County/ metropolitan	Population of Natterer's, common pipistrelle and soprano pipistrelle roosting in a residential building along Welsh Road.	The presence of Natterer's bat within the roost was confirmed through DNA analysis of droppings only and the roost is likely to be a small maternity roost or small summer (non-breeding) roost. The same building was found to support a small summer (non-breeding) roost for common pipistrelle and soprano pipistrelle. It is likely that Natterer's, common pipistrelle and soprano pipistrelle bats present within the building roost will use habitats along the Grand Union Canal as a commuting route and foraging area as discussed in the adjoining Ladbroke and Southam area (CFA16). Natterer's bat is a rarer bat species in England. Common pipistrelle and soprano pipistrelle are both common and widespread within the UK.
	County/ metropolitan	Assemblage of bats using roosting, foraging and commuting habitat associated with Field's Farm including Ash Beds and the River Leam, north of Offchurch.	Common pipistrelle, soprano pipistrelle, brown long-eared bat, Daubenton's and *Myotis* species identified by activity surveys in habitats crossed by the route of the Proposed Scheme. Whiskered bat was identified using a roost in a barn, near Hunningham Road, north of Offchurch. Whiskered bat is a rarer bat species in the UK and the building is considered likely to support a summer (non breeding) roost for individual bats. A brown long-eared bat summer (non-breeding) roost was found through DNA analysis of droppings at a second building near Hunningham Road. The proximity of both building roosts to the River Leam makes it likely that these species may use the river and connecting hedgerows for commuting and foraging. Brown long-eared bat is a species of principal importance. A review of desk records identified one maternity colony of brown long-eared bats in a building adjacent to the River Leam, approximately 2km beyond the route of the Proposed Scheme, north-west of the village of Hunningham. It is likely that brown long-eared bats from the roost will use habitats along the River Leam as a commuting route and foraging area. No access was available to survey bat activity associated with a farm near to the River Leam, north of Offchurch, which lies within 100m of land required for the construction of the Proposed Scheme. However, a review of surveys carried out for committed developments found confirmed activity by Brandt's/whiskered bats associated with these habitats. A low density of trees with high and moderate potential to be used by roosting bats are present in the woodland at Ash Beds within land required for the construction of the Proposed Scheme.

[32] Numbers of bats between 10,000 and 100,000 individuals based on Wray S, Wells D, Long E and Mitchell-Jones T. (2010), *Valuing bats in ecological impact assessment*. In Practice. December 2010. P23-25.

Species/ Species group	Value	Receptor	Baseline and rationale for evaluation
	District/ borough	Assemblage of bats using foraging and commuting habitats associated with the accessible areas of South Cubbington Wood (land lying to the south east of Rugby Road).	Static surveys within South Cubbington Wood (land lying to the south east of Rugby Road), have confirmed activity by commoner species of bat (common pipistrelle and soprano pipistrelle) as well as recording noctule and *Myotis* species. One call was also confirmed as Leisler's bat. There were no trees within the accessible parts of South Cubbington Wood supporting confirmed bat roosts
	Local/parish	Assemblage of bats using foraging and commuting habitats associated with field boundaries within land between North Cubbington Wood and Coventry Road.	Moderate levels of activity by commoner species (common pipistrelle and soprano pipistrelle) confirmed during transect surveys of habitats within land required for the construction of the Proposed Scheme.
	Local/parish	Assemblage of bats using foraging and commuting habitats associated with field boundaries within land between North Cubbington Wood and Coventry Road.	Moderate levels of activity by commoner species (common pipistrelle and soprano pipistrelle) confirmed during transect surveys of habitats within the Proposed Scheme.
Birds	County/ metropolitan	Breeding barn owl to the north of Offchurch	A traditional barn owl nest site was identified within a farm to the north of Offchurch. The nest site is outside of the land required for construction of the Proposed Scheme. A pair of barn owl constitutes more than 1% of the estimated county breeding population. Barn owl is Schedule 1 species[33].
	County/ metropolitan	Population of Lapwing at Field's Farm, north of Offchurch	Up to four lapwing breeding territories (three confirmed, one probable/possible). The number of lapwing recorded is greater than 1% of the estimated county breeding population. Lapwing is a species of principal importance.

[33] 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 wintering lesser spotted woodpecker at Grand Union Canal	Lesser spotted woodpecker, a species of principal importance, was recorded singly on one occasion at the Grand Union Canal, which will be crossed by the route of the Proposed Scheme. This site is considered to fall within part of the species' wide-ranging winter territory.
	District/ borough	Population of wintering willow tit at Grand Union Canal.	Willow tit, a species of principal importance, was recorded singly on one occasion at the Grand Union Canal, which will be crossed by the route of the Proposed Scheme. This site is considered to fall within part of the species' wide-ranging winter territory.
	Local/parish	Assemblage of breeding birds within farmland between Cubbington and Furzen Hill Farm, to the north of Cubbington.	Field surveys recorded 55 bird species of which 27 are notable. Fifteen notable species are thought to have bred on the site, including species such as bullfinch and marsh tit, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Assemblage of breeding birds at Field's Farm, north of Offchurch.	Field surveys recorded 66 bird species within this area of which 34 are notable. Twenty-one notable species are thought to have bred on the site, including species such as grey partridge, a species of principal importance, and kingfisher, a Schedule 1 species. Species recorded (with the exception of lapwing 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 or important populations were recorded.
	Local/parish	Assemblage of breeding birds using two small pockets of woodland near South Cubbington Wood.	Field surveys recorded 34 bird species within this area of which 12 are notable. Seven notable species are thought to have bred on the site, including species such as grey wagtail and song thrush, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Assemblage of wintering birds at Grand Union Canal	Field surveys recorded 48 bird species within this area of which 18 are notable, including species such as green woodpecker and lesser redpoll. Lesser redpoll is a species of principal importance. Species recorded (with the exception of lesser spotted woodpecker and willow tit whose populations at the site are of district/borough value) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Assemblage of wintering birds at Field's Farm, north of Offchurch	Field surveys recorded 49 bird species within this area of which 23 are notable, including species such as kingfisher, a Schedule 1 species, and golden plover. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.

Species/ Species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Assemblage of wintering birds using two small pockets of woodland near South Cubbington Wood	Field surveys recorded 18 bird species within this area of which five are notable, including species such as bullfinch and lesser redpoll, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
Amphibians	Up to County/ metropolitan	Great crested newt meta-population AMP7[34] to north of South Cubbington Wood.	This metapopulation has a total of five water bodies; one of which supports a great crested newt (small population size class, peak count of two) as well as a low population size class of smooth newts and a low population size class of common frog (based on an incomplete survey). One other pond received a single presence/absence survey recording common toad only and the other two have not been visited due to access restrictions. The metapopulation is assumed to support breeding great crested newt and could support a medium population size class. The records provided from Warwickshire Biological Records Centre indicate that great crested newt, a species of principal importance, appears to be abundant within Warwickshire and is likely to be widespread within the area. The Warwickshire selection criteria for LWS[35] give breeding populations of great crested newts as a reason for selection of LWS which are of county/metropolitan value.
	Up to County/ metropolitan	All water bodies not subject to full survey.	Using a precautionary approach, water bodies which have not been surveyed could support breeding populations of great crested newts of medium population size class.
	District/ borough	Amphibian population in pond to east of River Leam that includes palmate newt and smooth newt and which lies outside of a great crested newt metapopulation.	This water body supports a good population size class of smooth newt and a low population size class of palmate newt. The amphibian population does not meet the Warwickshire selection criteria for LWS. However, there are very few records of palmate newt within Warwickshire or within the local area.
	Local/parish	Amphibian population in a pond to east of Highfield.	Low population size class of smooth newt. This species are considered to be widespread within Warwickshire and within the area.
	Local/parish	Amphibian population in a pond to north of South Cubbington Wood.	Low population size class of common toad, a species of principal importance. This species is considered to be widespread within Warwickshire and within the area.

[34] 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.

[35] 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
Otter	District/ borough	Population using Grand Union Canal and River Leam.	Evidence of presence found on Grand Union Canal and River Leam. Species with large home range and which has increasing populations nationally and in Warwickshire. Otter is a species of principal importance.
Aquatic macro-invertebrates	District/ borough	Assemblage within unnamed tributary watercourse of River Leam at Ash Beds woodland.	Assemblage with one species that is nationally scarce, the beetle *Agabus conspersus*.
	Local/parish	Assemblage within the River Leam.	Assemblage has taxon richness and one species of restricted distribution is present, the caddis *Brachycentrys subnubilis*.
Fish	District/ borough	Assemblage within River Leam.	Species-rich, mixed coarse fish assemblage containing notable species and species of conservation interest, namely bullhead and brook lamprey, at a survey location 0.6km upstream of the route of the Proposed Scheme.
	Up to local/parish	Assemblages on other watercourses in the study area	No other watercourses were identified, in discussion with the Environment Agency, as requiring survey although they may provide suitable habitat for commonly occurring species.
Notable plants	District/ borough	Veteran wild pear tree in hedge south of South Cubbington Wood.	Although there are a number of wild pear trees identified within hedgerows in Warwickshire, veteran wild pear trees are scarce nationally. The wild pear tree present in the hedgerow south of South Cubbington Wood is reputedly the oldest and largest recorded wild pear in England.
	Up to district/ borough	Population of short-styled field-rose in the woodland at Ash Beds	Located from desk study only on the northern side of the woodland at Ash Beds. This species is rare in Warwickshire[36].
	Local/parish	Veteran wild pear tree on south verge of Welsh Road between Fosse Way and Grand Union Canal Bridge, just west of Welsh Road Farm.	Although there are a number of wild pear trees identified within hedgerows in Warwickshire, veteran wild pear trees are scarce nationally.
Terrestrial invertebrates	District/ borough	Assemblage at South Cubbington Wood.	South Cubbington Wood is known to support populations of white admiral, a species of principal importance that is mentioned in the LWS citation. The nationally scarce brown ant was found during surveys, otherwise there is a lack of deadwood and a poor fungal representation, a key component of woodlands for autumnal fungus gnats and craneflies.

[36] Warwickshire rare plants are those found in three sites or fewer in the county.

Species/ Species group	Value	Receptor	Baseline and rationale for evaluation
Badger	Local/parish	Badger population within the area.	Three outlier setts identified which may be part of the same badger social territory. 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 even of the district population.
Reptiles	Local/parish	Grass snake population at Field's Farm, north of Offchurch.	Single grass snake, a species of principal importance, indicative of low population size class recorded.
	Up to local/parish	Potential reptile populations in suitable habitat.	Habitats along the River Leam near Lower Grange east of Cubbington and along the Grand Union Canal, with rough grassland and bank side habitat with habitat links to wider landscape through the river corridor all offer suitable habitat for commoner reptile species but could not be surveyed.
Hazel dormouse	Negligible	Potential populations in suitable habitat within the area.	Although access was restricted within South Cubbington Wood, there was no survey evidence of dormice and there are no desk study records from South Cubbington Wood. South Cubbington Wood was thought to have the highest potential for dormouse within the land required for the construction of the Proposed Scheme due to its proximity to Weston Wood (part of Waverley and Weston Woods LWS), which is of county importance, due in part, to its dormouse population. No survey evidence was found in hedgerows adjacent to Grand Union Canal which are linked to South Cubbington Wood.
Water vole	Negligible	Potential populations using watercourses in the area.	No confirmed evidence of water vole, a species of principal importance, on the River Leam, the unnamed tributary watercourse of the River Leam at Ash Beds or the Grand Union Canal in this area. A further five tributary watercourses and four water bodies within this area have not been surveyed due to access restrictions. Most recent desk study records of this species in the area are from 2001 on the River Leam. The presence of mink, which predates water vole and outcompetes the species for resources, was also recorded on this reach of the River Leam and reduces the likelihood of water voles being present within the land required for the construction of the Proposed Scheme. Current absence of water vole is assumed. Water vole populations are restricted in distribution within the UK due to limited extent of suitable habitat, and vulnerable to a range of factors. Water voles are uncommon within Warwickshire and there has been continued decline of this species throughout the county.
White-clawed crayfish	Negligible	Potential populations on watercourses within this area.	Four watercourses are crossed by the route of the Proposed Scheme. Signal crayfish, which out-compete the native species, found in Grand Union Canal and white clawed crayfish very unlikely to be present. River Leam where crossed is unsuitable for white clawed crayfish, as is the unnamed tributary watercourse of River Leam at Ash Beds. The unnamed tributary watercourse of River Leam associated with Grand Union Canal was not surveyed, but connectivity with the Grand Union Canal which contains signal crayfish means that a white clawed crayfish population is very unlikely to be present.

Future baseline

Construction (2017)

7.3.25 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 of this report, with further details provided in Volume 5: Appendix CT-000. It is not anticipated that these developments will significantly affect the character and value of ecological resources in this area.

Operation (2026)

7.3.26 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:

- Cubbington retaining wall within South Cubbington Wood LWS will reduce the land required for the construction of the Proposed Scheme. Construction access will be restricted to the western side of the Proposed Scheme, with the haul route running outside the wood, to further reduce loss of woodland habitat;
- raising the vertical alignment of the Proposed Scheme near Offchurch thus reducing the land required for the construction of the Proposed Scheme through Offchurch Greenway and avoiding Sutton Spinney;
- avoidance of in-channel structures associated with the Longhole viaduct over the Grand Union Canal and the realigned section of an unnamed tributary of the River Leam, and with the River Leam viaduct, will prevent impacts to watercourse habitat, form and function;
- the construction of two new viaducts over the Grand Union Canal and the River Leam will allow bat foraging and commuting activity to continue beneath the Proposed Scheme and will reduce habitat severance at these locations;
- diversion of the unnamed tributary watercourse of the River Leam associated with the Grand Union Canal to avoid culverting, in conjunction with the incorporation of meanders and natural banks; 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 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 land required for the construction of the Proposed Scheme will cause the loss of approximately 2ha of ancient woodland (an irreplaceable resource) from the southern part of South Cubbington Wood LWS, representing approximately 13% of the 15.0ha LWS. The south-west end of the woodland will be severed from the main woodland. The remaining woodland on either side of the route of the Proposed Scheme will be smaller in size and more vulnerable to degradation through edge effects, such as encroachment of scrub and wind throw during storms. There are no significant effects on ecological features in the LWS expected as a result of changes to ground water or surface water (see Volume 5, Appendix WR-002-017). These impacts on South Cubbington Wood LWS and the ancient woodland that is the reason for its designation will result in a permanent adverse effect on the integrity of the LWS that is significant at a county/metropolitan level.

7.4.4 The rush pasture at the south end of Waverley and Weston Woods LWS will be retained within an ecological compensation area. No negative impacts are expected on Waverley and Weston Woods LWS.

Habitats

7.4.5 There will be approximately 2ha of broadleaved woodland habitat lost from South Cubbington Wood, as described above. This will result in a permanent adverse effect on the conservation status of the ancient woodland which will be significant at a county/metropolitan level.

7.4.6 Woodland and scrub habitat will be lost and severed where the route intersects the woodland at Longhole Bridge on the Grand Union Canal (1.7ha of woodland lost), at Offchurch Greenway (1.3ha of woodland and scrub lost), and at Ash Beds (1.3ha of woodland lost). This will result in a permanent adverse effect on the conservation status of these woodlands: the adverse effect on the woodland at Offchurch Greenway and on the woodland at Ash Beds will be significant at a district/borough level.

7.4.7 Losses of woodland that will be significant at a local/parish level are reported in Volume 5: Appendix EC-005-003.

7.4.8 There are 23km of hedgerows within the land required for the construction of the Proposed Scheme. This includes 4.5km from 26 individual hedgerows that meet the wildlife and landscape criteria of the Hedgerow Regulations 1997. 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. The majority of hedgerows that will be lost are species-poor. Hedgerows form wildlife corridors within a largely arable landscape and are therefore important for habitat connectivity. The combined loss and severance of hedgerows within the Proposed Scheme will cause an adverse impact on the conservation status of hedgerows which will be significant at a district/borough level.

7.4.9 Construction of the Longhole viaduct over the Grand Union Canal and the River Leam viaduct has the potential to affect watercourse functioning and riparian corridor value

as a result of shading and habitat severance. No in-channel abutments are proposed and no changes to watercourse hydro-morphology are expected. The extent and severity of the shading is related to the height to width ratio of the deck span and its alignment and height: width ratios of less thano.7 have been identified as having significant effects on below deck primary and secondary productivity and may locally alter aquatic macro-invertebrate community structure and species distribution. For the Longhole viaduct (height to width ratio of 0.36) and the River Leam viaduct (height to width ratio of 0.66), this is likely to result in reduced primary and secondary productivity immediately below the viaduct deck habitats. In respect of watercourse function and ecological connectivity of the Grand Union Canal and the River Leam, these impacts are not considered to have adverse effects on the conservation status of the watercourse habitats and are not significant.

7.4.10 The culverting and severance of the unnamed tributary watercourse of the River Leam associated with Ash Beds woodland spanning an approximate watercourse length of 75m will have a permanent adverse effect on the conservation status of the watercourse habitats that will be significant at a district/borough level.

7.4.11 There are six water bodies within the land required for the construction of the Proposed Scheme; one of these is within a habitat creation area and will not be lost. The final number of water bodies 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 there will be permanent loss of the five remaining water bodies. Taking a precautionary approach to assessment due to the lack of habitat survey data, this impact could have a permanent adverse effect on the conservation status of the water bodies that will be significant at up to a district/ borough level.

7.4.12 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

7.4.13 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.

7.4.14 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.

7.4.15 Due to a lack of access within the southern section of South Cubbington Woods, there may be loss of trees within this section of woodland which may be used by rare bats as maternity roosts. A diverse assemblage of bat species was recorded within adjacent

accessible parts of the woodland including Leisler's bat. The loss of maternity roosts used by rarer bat species will lead to an adverse effect on the conservation status of the potential assemblage of roosting bats concerned that will be significant at up to a regional level.

7.4.16 There is a residential property along Welsh Road which was found to support a population of Natterer's bat, potentially as a small maternity or summer (non-breeding) roost, as well as by common and soprano pipistrelle bats as a summer non-breeding roost. Construction works adjacent to the roost may result in disturbance of bats using this roost, and could lead to temporary displacement of bats from the roost. However, the adoption of measures within the draft CoCP will provide controls to reduce the risk of displacement of bats and the loss of this roost, and thus no significant effects on the conservation status of roosting Natterer's, common pipistrelle or soprano pipistrelle are expected. It is likely that Natterer's bat using the building roost will use the Grand Union Canal as key commuting and foraging habitat. Habitats associated with the Grand Union Canal were found to be used by a diverse assemblage of bats including Natterer's, *Myotis* species, noctule, Leisler's and Nathusius' pipistrelle and this assemblage is discussed further within the report for the Ladbroke and Southam area (CFA16).

7.4.17 The habitats associated with Fields Farm, including Ash Beds, and the River Leam, north of Offchurch, are used by a diverse assemblage of bats including Daubenton's, whiskered and Leisler's. There is a barn found to support a whiskered summer (non-reeding) roost and a second building found to support a summer (non-breeding) brown long-eared bat roost within 100m of land required for the construction of the Proposed Scheme. The proximity of construction works to these roosts may result in disturbance of bats and could lead to temporary displacement of bats from the roost. However, the adoption of measures within the draft CoCP will provide appropriate controls to prevent displacement of bats and loss of these roosts.

7.4.18 Although no confirmed tree roosts will be lost, a low density of trees with high and moderate potential to be used by roosting bats are present within land required for the construction of the Proposed Scheme including those within woodland at Ash Beds and in surrounding hedgerows. Given the number of trees to be removed and the scarcity of woodland within Warwickshire, this could remove a large proportion of the available roosting resource for the assemblage of bats recorded using Ash Beds and surrounding habitats.

7.4.19 The Proposed Scheme will result in the permanent loss and severance of key commuting routes along woodland edge and hedgerows although connectivity along the River Leam will be retained. It is considered likely that whiskered bats using the building roost near Hunningham Road will use these hedgerows as commuting routes between foraging habitats along the River Leam. These severance impacts may deter bats from using the habitats and move bat populations away from preferred foraging and commuting habitats. While the impacts on areas of key foraging and key commuting habitat will be localised, the woodlands and surrounding habitat support a diverse assemblage of bats, some of which are rare within the UK.

7.4.20 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.

7.4.21 There will be no loss of water bodies supporting the assumed great crested newt metapopulation AMP7 to the north of South Cubbington Wood, nor fragmentation or isolation of these water bodies, and negligible loss of terrestrial habitat. No significant effect on the conservation status of this great crested newt metapopulation is expected.

7.4.22 None of the six water bodies within the land required for the construction of the Proposed Scheme have been surveyed. Should amphibians be present within these water bodies, their loss will result in an adverse effect on the conservation status of amphibian populations which could be significant at up to a county/metropolitan level.

7.4.23 The loss of the veteran pear tree in the hedgerow to the south of South Cubbington Wood will result in a permanent adverse effect on its conservation status which will be significant at a district/borough level.

7.4.24 The roost sites and the potential nest site for barn owls north of Offchurch lie outside the land required for the construction of the Proposed Scheme and will not be lost during construction. However, there will be loss of suitable foraging habitat. Barn owls generally remain within their established home range throughout their lifespan. Displacement from their home range due to loss of foraging habitat may result in unsuccessful breeding in an alternate location. Taking a precautionary approach to assessment, it is assumed that the construction works will cause loss of the pair of barn owls resulting in a permanent adverse effect on the conservation status of the barn owl population that will be significant at a county/metropolitan level.

7.4.25 There will be no impacts on hazel dormouse populations as a result of the construction of the Proposed Scheme. However, there will be loss and fragmentation of woody habitat within South Cubbington Wood that has the potential to support hazel dormouse.

7.4.26 Temporary impacts during construction of the Proposed Scheme will occur to otters using the four watercourses crossed by the Proposed Scheme, but the effects on the conservation status of the otter populations will not be significant.

7.4.27 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

7.4.28 This section describes additional elements measures to reduce or compensate for significant ecological effects. These include habitat creation, habitat enhancement and green bridges.

7.4.29 Ancient woodland is irreplaceable. The loss of ancient woodland within South Cubbington Wood LWS will result in a permanent adverse effect on the integrity of the LWS that will be significant at a county/metropolitan level. However, this loss of woodland will be compensated through a range of measures. Ancient woodland soil

with its associated seed bank will be salvaged and translocated to a 5.3ha receptor site between North Cubbington Wood and Weston Wood. The receptor area will create a woodland link between North Cubbington Wood and Weston Wood, whilst retaining the degraded rush pasture in the southern part of Waverley and Weston Woods LWS. This will increase the connectivity of fragmented ancient woodland parcels. Other measures such as planting native tree and shrub species of local provenance and translocation of coppice stools and dead wood may also be appropriate.

7.4.30 A number of specific areas are proposed throughout the Proposed Scheme in order to deliver compensation for loss of habitats and species. By creating large-scale compensation areas, multiple complex habitats can be created with links to the surrounding landscape and as well as minimising habitat loss and will benefit species groups such as amphibians, birds, water voles, otters, hazel dormouse, reptiles and bats.

7.4.31 Compensation for the loss of woodland habitats within this area will be through creation of woodland at these locations:

- adjacent to the retained sections of the woodland at Longhole Bridge on the Grand Union Canal (0.9ha). The target habitat will be wet woodland, a habitat of principal importance;
- adjacent to retained woodland at Burnt Firs (2.3ha). The target habitat will be the habitat of principal importance, lowland mixed deciduous woodland. This will replace plantation woodland and will be linked to Offchurch Greenway and Sutton Spinney via woodland planted along the embankments of the Proposed Scheme;
- adjacent to retained parts of wet woodland at Ash Beds and along the unnamed tributary watercourse of the River Leam to its confluence (0.5ha). The target habitat will be wet woodland, a habitat of principal importance; and
- adjacent to the retained section of South Cubbington Wood as well as south-east of the retained section of South Cubbington Wood and on both sides of the route to the south-east of the realignment of Mill Lane Footpath W129d and Mill Lane accommodation overbridge and along the River Leam (14.0ha). The target habitat will be the habitat of principal importance, lowland mixed deciduous woodland. The woodland compensation planting near South Cubbington Wood will extend the size of the retained woodland to the east of the Proposed Scheme. The planting will also link woodland habitats between this retained section of South Cubbington Wood and existing woodland pockets on the banks of the River Leam increasing woodland connectivity.

7.4.32 In addition there will also be woodland and scrub landscape planting in the following areas, which will also create woodland habitats and links:

- on either side of the realigned Welsh Road between the Grand Union Canal and just north of Welsh Road Farm (13.0ha); and
- between the B4455 Fosse Way and Offchurch Greenway (2.3ha).

7.4.33 There will be temporary adverse effects whilst the new woodlands become established and mature, 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 scrub planting is likely to establish within 10 years of planting. This compensation planting, will result in permanent beneficial effects on the conservation status of the woodland habitats which will be significant at a district/borough level.

7.4.34 Compensation for the impacts of the culverting and severance of the unnamed tributary watercourse of the River Leam associated with Ash Beds woodland include habitat enhancements upstream and downstream. Nevertheless, the presence of the culvert spanning an approximate watercourse length of 75m will remain a residual permanent adverse effect on the conservation status of the watercourse habitats that will be significant at a district/borough level.

7.4.35 New hedgerow creation will be undertaken and connected habitat is provided within the landscape scheme to compensate for losses of wildlife corridors that hedgerows provide. There will be temporary adverse effects whilst the new hedges become established and mature. However, many species will be able to use the new hedges prior to maturation (approximately 15 years). However, many species will be able to use the new hedges prior to maturation. Following establishment and maturation of planting, it is expected that any adverse impacts on hedgerows and the wildlife corridors they create will be reduced to a level which will not result in any significant effect on the conservation status of the habitat.

7.4.36 To reduce the effect of habitat severance and provide habitat connectivity, there will be wider bridges to accommodate hedges at Offchurch Greenway green overbridge and Mill Lane (Footpath W129d) accommodation overbridge.

7.4.37 Additional measures to those within the draft CoCP will be implemented to reduce impacts on roosting bats in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). The woodland creation, hedgerow creation and green bridges will create new commuting and foraging links to mitigate for the severance of hedgerows and commuting routes, in particular in relation to South Cubbington Wood and adjoining hedgerows. Whilst the created habitats establish and mature, there will be a temporary residual effect from the loss of foraging and commuting habitat for bats. However, some bats will be able to use the woodland creation areas for foraging and commuting prior to these habitats reaching maturity as scrub habitat and young woodland can still support invertebrates as a food source and be used as a navigable feature by bats. Artificial bat roost features will be provided in the vicinity of retained sections of South Cubbington Wood and the woodland at Ash Beds to replace the loss of potential roost features in accordance with the principals of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). Following the implementation of these measures, it is likely 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.

7.4.38 Compensation for the loss of the veteran wild pear tree present in the hedgerow south of South Cubbington Wood will include propagation of cuttings (grafting) along with seed collection from the tree to retain the genetic material from the tree. Although a

suitable option to try and retain the genetic material will be progressed, success cannot be guaranteed. Taking a precautionary approach to assessment, there could be a residual adverse effect on its conservation status that will be significant at up to a district/borough level. The veteran pear tree is hollow at the base; therefore translocation is extremely unlikely to be successful and is not proposed. The felled pear tree will be moved to the woodland creation area adjacent to South Cubbington Wood to provide deadwood habitat.

7.4.39 Adoption of measures within the draft CoCP will provide controls on noise and vibration which will act to limit disturbance and displacement of breeding birds and other animals within South Cubbington Wood LWS during construction. Opportunities will also be explored to provide any necessary screening of constructions works from retained sections of South Cubbington Wood in line with the principles of ecological mitigation within the SMR Addendum (Volume 5: Appendix CT-001-000/2).

7.4.40 The woodland creation areas, including the woodland translocation to form a link between North Cubbington Wood and Weston Wood, will compensate for the loss and fragmentation of woody habitat that has the potential to be colonised by hazel dormouse and will provide connectivity with known populations of hazel dormouse in the Princethorpe Woods complex including Weston Wood, which may have a beneficial effect on the species.

7.4.41 Compensatory habitat to address impacts on water bodies, great crested newt and other amphibian populations in the area will be provided within the aforementioned ecological compensation areas, in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix EC-008-001). This will include the provision of replacement ponds, terrestrial habitat and hibernation habitat sufficient to maintain the favourable conservation status of the populations affected.

7.4.42 Mitigation measures to address the potential killing, injury and disturbance of badgers will be provided in accordance with the principles of ecological mitigation 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.

7.4.43 There will be an adverse effect on the conservation status of barn owl at the county/metropolitan level due to loss of one territory north of Offchurch. To offset the likely loss of barn owls from the vicinity of the Proposed Scheme, opportunities to provide barn owl nesting boxes in areas greater than 1.5 km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures will be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

Summary of likely residual significant effects

7.4.44 The mitigation, compensation and enhancement measures described above reduce the adverse effects to a level that is not significant except for ancient woodland at South Cubbington Wood LWS, to an unnamed tributary watercourse of the River Leam associated with Ash Beds woodland, and to a veteran wild pear tree in a hedgerow to the south of South Cubbington Wood. The permanent loss of a barn owl

territory north of Offchurch represents a residual significant effect. However, if the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl will be reduced to a level that is not significant.

7.4.45 Compensation for the loss of woodland habitat including extensive new woodland planting will result in a permanent significant beneficial effect.

7.5 Effects arising from operation

Avoidance and mitigation measures

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

- measures to reduce the effect of habitat severance and provide habitat connectivity at the construction stage will reduce operational effects. These include the vegetated links across Offchurch Greenway green overbridge and Mill Lane (Footpath W129d) accommodation overbridge to provide habitat connectivity and reduce the risk of collision with the trains for some species, including bats;
- carrying the Proposed Scheme on the Longhole viaduct over the Grand Union Canal and the realigned section of an unnamed tributary watercourse of the River Leam, and on the River Leam viaduct, will retain wildlife corridors along these watercourses and maintain ecological functions and habitat connectivity for plants and animals (including bats, birds and otters); and
- placement of the route within deep cutting east of Offchurch and where the route crosses South Cubbington Wood will screen noise, visual impacts and wind pressure impacts generated by moving trains from adjacent habitats and will reduce the risk of bat and bird species crossing over the Proposed Scheme in the path of moving 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 will 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 will bisect, or will be 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 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 that could be particularly at risk of collision with trains have been identified within the area through surveys and desk study: whiskered, Natterer's, noctule, Daubenton's, Leisler's, common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, 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 The installation of viaducts over the Grand Union Canal and the River Leam will cross habitats used by foraging and commuting bats. Most bat species will fly underneath structures by following the watercourse under them whilst the higher flying noctule, Leisler's bat 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 there is not likely to be a significant effect 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-others songs. However, this is not expected to occur with the Proposed Scheme as the trains will pass quickly. The effect of train noise on the conservation status of breeding birds is therefore considered not significant.

7.5.9 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

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

Summary of likely residual significant effects

7.5.11 Taking into account mitigation, compensation and enhancement proposed, no significant residual ecological effects during operation are predicted.

8 Land quality

8.1 Introduction

8.1.1 This section of the report presents the baseline conditions that exist along the Proposed Scheme in relation to land quality and reports the likely impacts and any significant effects 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 the Offchurch and Cubbington area relevant to this topic include the Grand Union Canal, the River Leam and widespread areas of bedrock-derived building stone, brick clay, coal and sand and gravel, all of which represent important mineral resources.

8.1.4 The main land quality issues in this area include the presence of the following within the land required for the construction and operation of the Proposed Scheme:

- Offchurch Cutting and Disused Railway Cutting historical landfills; and
- five mineral safeguarding areas (MSA) – two for building stone, one for brick clay, one for coal and one for sand and gravel. (Volume 5: Map Book – Land Quality, LQ-01-044b and LQ-01-045 to 046).

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-001-017: Land quality appendix.

8.1.6 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 13 Water resources and flood risk assessment. 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 (EA) regarding contaminated land and with Warwickshire County Council (WCC) regarding mineral resources.

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

8.2.2 Baseline data were reviewed for the area of land required to construct the Proposed Scheme together with a buffer extending out for a minimum of 250m, but in the case of groundwater data up to 1km. This is defined as the study area.

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 made 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. Site visit notes are presented in Volume 5: Appendix LQ-001-017 Section 4.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless stated otherwise, all features described in this land quality section are presented on Volume 5: Map Book – Land quality, Maps LQ-01-044b and LQ-01-045 to 046.

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 on Volume 5: Map Book – Water resources and flood risk assessment, Map WR-02-17.

8.3.3 The presence of made ground is not indicated on British Geological Survey (BGS) mapping, but there is likely to be made ground associated with Offchurch railway cutting (now Offchurch Greenway) and various small areas of infilling, including the infilled pits and infilled ponds scattered throughout the study area. Although not shown on geological mapping, there are likely to be other areas of made ground associated with highways and roads that will be intersected by the Proposed Scheme.

8.3.4 Offchurch railway cutting is partially infilled and listed as two historical landfills. Inert, industrial and commercial and household wastes are recorded as having been accepted. There are no other landfills located in the study area.

8.3.5 Superficial geology is complex and influenced by the topography along the Proposed Scheme. The Proposed Scheme passes through:

- alluvium, comprising clay, silt, sand and gravel, and River Terrace Deposits associated with major surface watercourses;
- an area of Head Deposits, comprising poorly sorted and poorly stratified clay, silt, sand and gravel, to the east of Welsh Road Farm;
- sand and gravel underlie the study area at the Offchurch railway cutting and a further two bands of sand and gravel are present towards the southern and northern extents of Cubbington Wood; the sand and gravel include lenses of silt and clay; and
- intermittent Glacial Deposits comprising clays and sand and gravel are present immediately to the south of Offchurch Greenway and to the north and south of Cubbington Wood.

8.3.6 The Mercia Mudstone Group underlies the majority of the Proposed Scheme in this study area and is described as red and green-grey mudstones and subordinate siltstones with widespread thin beds of gypsum/anhydrite. Overlying subsidiary formations, namely the Blue Anchor Formation and Arden Sandstone Formation, outcrop towards the south of the Proposed Scheme. The Bromsgrove Sandstone Formation underlies the Proposed Scheme immediately to the north of the Offchurch and Cubbington study area.

Groundwater

8.3.7 There are four categories of aquifer identified within the study area. The Bromsgrove Sandstone Formation at the northern extent of the Offchurch and Cubbington study area is classified as a Principal aquifer and the Arden Sandstone Formation, located just north of Welsh Road Farm to the west of the Proposed Scheme, is classified as a Secondary A aquifer. The Mercia Mudstone Group underlying the majority of the Proposed Scheme is classified as a Secondary B aquifer and the Blue Anchor Formation, located further north of Welsh Road Farm, is a Secondary (undifferentiated) aquifer.

8.3.8 Where present, River Alluvium, sands and gravels, and River Terrace Deposits are classified as Secondary A aquifers. Head Deposits are classified as a Secondary B aquifer and the Glacial Deposits are all classified as unproductive strata.

8.3.9 The northern extent of the Proposed Scheme, to the southwest of Furzen Hill Farm, lies within a Total Catchment Source Protection Zone (SPZ) 3.

8.3.10 There is one licensed groundwater abstraction within the study area, located north-east of the Proposed Scheme at Toe Hill, used for agricultural purposes (Volume 5: Map Book – Water Resources and Flood Risk, Map WR-02-17).

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

Surface waters

8.3.12 The Grand Union Canal is aligned from east to west across the southern end of the Offchurch to Cubbington area and will be crossed by the Proposed Scheme close to Longhole Bridge. The Proposed Scheme will also cross Burnt Firs Reservoir to the south east of Offchurch Village and south of Burnt Heath Farm.

8.3.13 The River Leam flows from north-east to south-west across the Offchurch to Cubbington area and will be intersected by the Proposed Scheme 550m to the east of Lower Grange Farmstead, approximately 1.5km to the north of the village of Offchurch. A tributary of the River Leam also flows alongside the Proposed Scheme from Offchurch railway cutting to the Fosse Way.

8.3.14 Minor surface water features include a spring to the south of South Cubbington Wood and numerous ponds.

8.3.15 There is one current, licensed surface water abstraction within the study area. This is from a spring/drain located close to Burnt Heath Farm which is fed into the Burnt Firs Reservoir. The abstracted water is used for spray irrigation.

8.3.16 Further information on surface waters is provided in Section 13, Water resources and flood risk assessment.

Current and historical land use

8.3.17 All potentially contaminated sites (identified from both current and historical land uses) are shown on Volume 5: Map Book – Land Quality, Maps LQ-01-044b and LQ-01-045 to 046. Each potentially contaminative land use is annotated on the maps using the code 17-XX, where 17 denotes the CFA number and XX denotes the individual site reference.

8.3.18 Current potentially contaminative land uses include a timber yard located in the south-west corner of North Cubbington Wood, see Volume 5: Map Book – Land Quality, Map LQ-01-46, E5.

8.3.19 The principal historical potentially contaminative land use is the Offchurch Cutting and Disused Railway Cutting historical landfills (now Offchurch Greenway), see Volume 5: Map Book – Land Quality, Map LQ-01-45, F6.

8.3.20 Other historical land uses identified within the study area with the potential to have caused contamination include infilled domestic water wells and infilled ponds. The domestic water wells and pond may have been manually infilled with a variety of waste materials and could also give rise to landfill gases such as methane, carbon dioxide and volatile organic compounds (VOC).

8.3.21 All potentially contaminated sites (identified from both current and historical land uses) are shown on Maps LQ-01-044b to 046 (Volume 5, Map Book – Land quality).

Other regulatory data

8.3.22 Regulatory data reviewed include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated

Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). A number of these have been recorded in the study area, the most notable being an environmental permit (shown as IPPC) relating to timber processes within miscellaneous industries at the location of the timber yard in North Cubbington Wood.

Mining/mineral resources

8.3.23 The Minerals Local Plan for Warwickshire[37] aims to safeguard parcels of land where there are mineral resources of economic or conservation value (Policies MPS1 and MPS5). The Warwickshire Minerals Development Framework (MDF) Core Strategy is currently in development.

8.3.24 There are no active mining or mineral sites or Preferred Areas (PA)[38] within the study area.

8.3.25 Five MSA are within the area which the Proposed Scheme will cross. An MSA for sand and gravel and an MSA for deep coal cover almost the whole of the study area. There is an MSA for brick clay and an MSA for building stone at the northern end of the study area, north of Coventry Road (Volume 5: Map Book – Land Quality Map LQ-01-046. Both of these relate to the Bromsgrove Sandstone Formation. There is another MSA for building stone to the south of Offchurch between Welsh Road Farm and Burnt Firs reservoir, this relates to the Arden Sandstone Formation in this location (Volume 5: Map Book – Land Quality Map LQ-01-045)

Geo-conservation resources

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

Receptors

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

[37] Warwickshire County Council (1995), *Minerals Local Plan for Warwickshire.*
[38] Areas where mineral deposits are known to exist and where the County Council considers there will be least planning objection to mineral extraction taking place.

Table 10: Summary of receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents	High
		Workers	Moderate
	Controlled waters	Principal aquifer	High
		Secondary A aquifers	High
		Secondary B aquifers	Moderate
		Rivers	High
		Other 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
		Brick Clay MSA	Moderate
		Coal MSA	Low
		Sand and Gravel MSA	Moderate
Impacts on mining/mineral sites (severance and sterilisation of mineral sites)	Mining/mineral sites	Building Stone MSA	Moderate
		Brick Clay MSA	Moderate
		Coal MSA	Low
		Sand and Gravel MSA	Moderate

Future baseline

8.3.28 There are currently no identified committed development sites within the study area that are likely to change the land quality baseline. The committed development sites do not correspond with areas identified as having a current or historical potentially contaminative land use and are outside of the area of land required to build the Proposed Scheme. All the committed developments described in Section 2.1, Overview of the area and description of the Proposed Scheme are expected to be complete by 2017 when construction starts. Committed development are also listed in Volume 5: Appendix CT-004-000.

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

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

8.4.3 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. This appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with Sustainable Remediation Forum UK's publication A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010)[41]. The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

8.4.4 Contaminated soils excavated from the site, wherever feasible, will be treated as necessary to remove or render any contamination inactive and reused within the

[39] Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination*.
[40] *British Standard BS10175 Investigation of Potentially Contaminated Sites* (2011).
[41] Sustainable Remediation Forum UK (2010), A Framework for Assessing the Sustainability of Soil and Groundwater Remediation.

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.

Assessment of impacts and effects

8.4.5 The main construction features of the Proposed Scheme in the Offchurch and Cubbington area include viaducts crossing the Grand Union Canal and the River Leam, a deep cutting intersecting the former Offchurch railway cutting (now Offchurch Greenway) and a retained cutting through South Cubbington Wood.

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

8.4.7 Construction compounds for the Offchurch to Cubbington area will be located at various points along the Proposed Scheme (see Section 2.3). The compounds will 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, 35 areas were considered during this screening process; seven of these areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. All areas assessed are shown on Volume 5: Map Book – Land Quality, Maps LQ-01-044b and LQ-01-045 to 046 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 six areas taken to Stage C and D assessments. The detailed CSM are provided in Volume 5: Appendix LQ 001-017, 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 assessments:

- whether the area is within or beyond the area of land required for the construction of the Proposed Scheme or associated offline works; e.g. road realignments;
- 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 are provided in Table 11. The impacts and baseline risks quoted are before any mitigation is applied. The assessed baseline risk is based on the information provided at the time of the assessment. Where limited information is available, it is based on precautionary, worst case assumptions and may therefore report a higher risk than that which actually exists.

Table 11: 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
17-04 (Volume 5: Map Book – Land quality, Map LQ-01-045,H7)	Infilled well	Potential impact to off-site human receptors, groundwater and property receptors.	Low
17-08 (Volume 5: Map Book – Land quality, Map LQ-01-045,F6)	Offchurch cutting historical landfill	Potential impact on groundwater.	Moderate***/ low
17-10 (Volume 5: Map Book – Land quality, Map LQ-01-045,F7)	Infilled well	Potential impact on groundwater.	Low
17-16 (Volume 5: Map Book – Land quality, Map LQ-01-045,C5)	Infilled pond	Potential impact to off-site human receptors, groundwater and property receptors.	Low
17-17 (Volume 5: Map Book – Land quality, Map LQ-01-046, I6)	Infilled pond	Potential impact on groundwater.	Low
17-31 (Volume 5: Map Book – Land quality, Map LQ-01-045, H5)	Burnt Heath Farm	Potential impact to off-site human receptors and groundwater receptors.	Low
17-34 (Volume 5: Map Book – Land quality, Map LQ-01-46, E5)	Timber yard	Potential impact to current on-site human receptors (site users), off-site human receptors (residents), groundwater and surface water receptors. N.B. Environmental Permit in place for the Timber yard.	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-001-017).
*** The moderate risk identified reflects the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported moderate existing baseline risk in the absence of site investigation a precautionary, worst case risk is reported in the table.

Temporary effects

8.4.11 An assessment of the effects of contamination has been undertaken by comparing the CSM developed for potential contaminated 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 12 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment has taken into account the requirements of the draft CoCP to which construction will adhere. The details of these comparisons are presented in Volume 5 (Appendix LQ 001-017).

8.4.13 The baseline and construction CSM have been compared to determine the change in level of risk to receptors during the construction stage, and thus to define the level of effect at the construction stage. Where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be negligible even if the risk is assessed to remain as high. This will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside land required for the Proposed Scheme.

Table 12: Summary of temporary (construction) effects

Area ref	Area name	Main baseline risk	Main construction risk*	Temporary effect and significance
17-04 (Volume 5: Map Book – Land quality, Map LQ-01-045,H7)	Infilled well	Low	Low	Negligible (not significant)
17-08 (Volume 5: Map Book – Land quality, Map LQ-01-045,F6)	Offchurch Cutting and Disused Railway Cutting historical landfills	Moderate/low	Moderate	Minor adverse (not significant)
17-10 (Volume 5: Map Book – Land quality, Map LQ-01-045,F7)	Infilled well	Low	Low	Negligible (not significant)
17-16 (Volume 5: Map Book – Land quality, Map LQ-01-045,C5)	Infilled pond	Low	Low	Negligible (not significant)
17-17 (Volume 5: Map Book – Land quality, Map LQ-01-046, I6)	Infilled pond	Low	Moderate/low	Minor adverse (not significant)
17-31 (Volume 5: Map Book – Land quality, Map LQ-01-045, H5)	Burnt Heath Farm	Low	Low	Negligible (not significant)
17-34 (Volume 5: Map Book – Land quality, Map LQ-01-46, E5)	Timber yard	Low	Moderate/low	Minor adverse (not significant)

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

8.4.14 Table 12 indicates that based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination. However the following types of temporary risks have been identified:

- risks to groundwater where the historical landfills at Offchurch will be intersected by the Proposed Scheme;

- risks to groundwater where the infilled pond to the south of the River Leam (ref 17-17) will be disturbed during construction; and
- risks to groundwater where potential contamination originating from the timber yard may be disturbed during construction.

8.4.15 These risks relate to the potential for temporary mobilisation of contaminants during construction allowing an increase in migration of contaminants to groundwater. The risks are assessed as temporary minor adverse effects.

8.4.16 These risks will be addressed by measures detailed in the draft CoCP. As an example, should the ground investigation identify waste within the area required to construct the Proposed Scheme at Offchurch Cutting historical landfill, this will be removed during construction. In addition, ground (landfill) gas and/or leachate control systems will be constructed where needed to prevent ingress to the Proposed Scheme or control migration pathways external to the works where pathways have been affected by the construction.

8.4.17 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.

8.4.18 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 location of these construction site compounds can be found in Section 2.3.

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

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

Permanent effects

8.4.21 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.

8.4.22 Table 13 includes the summary of the permanent (post-construction) effects obtained from a comparison of the baseline and post-construction impacts and whether these are significant. The details of these comparisons are presented in Volume 5: Appendix LQ 001-017.

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

Area ref	Area name	Main baseline risk	Main post-construction risk	Post-construction effect and significance
17-04 (Volume 5: Map Book – Land quality, Map LQ-01-045,H7)	Infilled well	Low	Low	Negligible (not significant)

Area ref	Area name	Main baseline risk	Main post-construction risk	Post-construction effect and significance
17-08 (Volume 5: Map Book – Land quality, Map LQ-01-045,F6)	Offchurch Cutting and Disused Railway Cutting historical landfills	Moderate/low	Low	Negligible to minor beneficial (not significant)
17-10 (Volume 5: Map Book – Land quality, Map LQ-01-045,F7)	Infilled well	Low	Low	Negligible (not significant)
17-16 (Volume 5: Map Book – Land quality, Map LQ-01-045,C5)	Infilled pond	Low	Low	Negligible (not significant)
17-17 (Volume 5: Map Book – Land quality, Map LQ-01-046, I6)	Infilled pond	Low	Very low	Negligible to minor beneficial (not significant)
17-31 (Volume 5: Map Book – Land quality, Map LQ-01-045, H5)	Burnt Heath Farm	Low	Low	Negligible (not significant)
17-34 (Volume 5: Map Book – Land quality, Map LQ-01-46, E5)	Timber yard	Low	Low	Negligible (not significant)

8.4.23 In Table 13, the permanent effect and significance has been determined by calculating the change in risk between the main baseline risk (present risk under current conditions) and the main post-construction risk. Therefore, where there is no change between the main baseline risk and main post-construction risk, the post-construction effect significance is deemed to be negligible. This will be the case where the construction of the Proposed Scheme does not alter the risks for an existing potentially contaminated site that is outside the land required for the Proposed Scheme.

8.4.24 Table 13 indicates that following remediation, there will be overall neutral to minor beneficial impacts. 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.

8.4.25 An example would be Offchurch Cutting and Disused Railway Cutting historical landfills, which will be intersected by the Proposed Scheme. Any waste or contaminated material encountered during construction which will be in cutting will be removed. This will result in a reduction in the volume of contaminants present in the soil and the potential for the generation of ground (landfill) gas and leachate, providing a minor beneficial effect. Similar beneficial effects are anticipated at the infilled pond located to the south of the River Leam.

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

Mining/mineral resources

8.4.27 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[42] that may occur during the construction phase of the Proposed Scheme, possibly continuing through to the operation.

Temporary effects during construction

8.4.28 Temporary adverse effects are anticipated on MSA where land will be temporarily used for construction and returned to the landowner after construction. In the Offchurch to Cubbington area this includes satellite construction compounds. A satellite construction compound is proposed to the south of Furzen Hill Farm overlying the building stone MSA and brick clay MSA at the north of this area. Other satellite construction compounds overly the coal MSA and sand and gravel MSA which cover the whole of the study area.

8.4.29 Table 14 presents a summary of the assessment of temporary effects on the mining and mineral resources identified. As the satellite construction compounds cover a very small area of the MSA for a temporary period the magnitude of impact is assessed as minor.

Table 14: Summary of temporary effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land north of Coventry Road (Volume 5: Map Book – Land quality, Map LQ-01-046)	Mineral Safeguarding Area	Mineral Safeguarding Area for building stone extraction	Moderate	Negligible	Negligible (not significant
Area of land to the south of Offchurch between Welsh Road Farm and Burnt Firs reservoir (Volume 5: Map Book – Land quality, Map LQ-01-044b)	Mineral Safeguarding Area	Mineral Safeguarding Area for building stone extraction	Moderate	Negligible	Negligible (not significant)
Area of land in north of Coventry Road Volume 5: Map Book – Land quality, Map LQ-01-046)	Mineral Safeguarding Area	Mineral Safeguarding Area for brick clay extraction	Moderate	Minor	Negligible (not significant
Land underlying majority of Proposed Scheme in the study area	Mineral Safeguarding Area	Mineral Safeguarding Area for coal extraction	Low	Minor	Negligible (not significant)
Land underlying majority of Proposed Scheme in the study area	Mineral Safeguarding Area	Mineral Safeguarding Area for sand and gravel extraction	Moderate	Minor	Negligible (not significant)

[42] 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 will be required to work the whole site.

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

8.4.31 There are anticipated to be no significant cumulative effects from construction on the mineral resource.

Permanent effects from construction

8.4.32 Construction of the Proposed Scheme will affect the small building stone MSA to the south of Offchurch and the building stone and brick clay MSA in the north of the study area, resulting in a minor adverse effect. The effect is assessed as not significant because the majority of the resources lie outside of the land required to build the Proposed Scheme.

8.4.33 There will be negligible effect on the coal and sand and gravel MSA. The effect is assessed as not significant because there will only be a partial loss of a large local resource.

8.4.34 Table 15 presents a summary of the assessment of effects on the mining and mineral resources identified.

Table 15: Summary of permanent effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area south of Offchurch between Welsh Road Farm and reservoir at Burnt Firs (Volume 5: Map Book – Land quality, Map LQ-01-044)	Mineral Safeguarding Area	Mineral Safeguarding Area for building stone extraction	Moderate	Moderate	Minor adverse (not significant)
Area of land in north of Coventry Road (Volume 5: Land Quality Map Book, Map Volume 5: Map Book – Land quality, Map LQ-01-046)	Mineral Safeguarding Area	Mineral Safeguarding Area for building stone extraction	Moderate	Moderate	Minor adverse (not significant)
Area of land in north of Coventry Road (Volume 5: Map Book – Land quality, Map LQ-01-046)	Mineral Safeguarding Area	Mineral Safeguarding Area for brick clay extraction	Moderate	Moderate	Minor adverse (not significant)
Land underlying majority of Proposed Scheme in the study area	Mineral Safeguarding Area	Mineral Safeguarding Area for coal extraction	Low	Minor	Negligible (not significant)
Land underlying majority of Proposed Scheme in the study area	Mineral Safeguarding Area	Mineral Safeguarding Area for sand and gravel extraction	Moderate	Minor	Negligible (not significant)

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

8.4.36 There are anticipated to be no significant cumulative effects from construction or operation on the mineral resource. The 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

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

Other mitigation measures

8.4.38 At this stage, no additional mitigation measures are considered necessary to mitigate risks from land contamination at construction phase beyond those set out in the draft CoCP and instigated as part of required remediation strategies. In addition to the excavation and treatment of contaminated soils, it may also be necessary to install ground (landfill) gas and leachate control systems at Offchurch Cutting and Disused Railway Cutting historical landfills, on a temporary or permanent basis, to ensure that ground (landfill) gas and leachate migration pathways are controlled and do not adversely affect the Proposed Scheme or the wider environment as a consequence of the Proposed Scheme.

8.4.39 Mitigation of the effects on mineral resources can include prior extraction of the resource for use within the project 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 and agreed 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 location of the affected MSA.

Summary of likely residual significant effects

8.4.40 No likely residual significant adverse 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 Offchurch auto-transformer station will be situated off Hunningham Road to the north-east of Offchurch village. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer station, in common with other modern substations, will use secondary containment appropriate to the level of risk.

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

8.5.5 It is unlikely that there will be any cumulative effects on land quality receptors 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 Offchurch to Cubbington area.

8.5.7 There may be ongoing monitoring requirements following remediation works carried out during construction; this is particularly relevant to the historical landfills at Offchurch. 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 the agricultural landscape pattern 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; realigned highways, 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 – Cultural Heritage. Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in Volume 5: Appendix LV-001-017, which comprises the following parts:

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

9.1.5 The extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages has been discussed with WCoC and WDC. Summer field surveys, including photographic studies of LCAs 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-07-069b to LV-07-072a and LV-08-069b to LV-08-072a. The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-0001-000/2), 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.

9.2.5 Within the limitations identified, the information obtained is considered sufficient to undertake a landscape and visual assessment and to provide robust information for the purpose of this EIA.

9.3 Environmental baseline

Existing baseline

Landscape baseline

9.3.1 The meandering and narrow River Leam forms a broad valley bordered by short steep slopes through an undulating landform. Land use within the valley floor is predominantly arable with small scale nucleated (clustered around a central point) settlements at Offchurch and larger residential areas at Cubbington, both on the higher ground. The settlements within the area are linked by the main roads of the B4455 Fosse Way, Welsh Road and the B4453 Rugby Road. Historic landscape elements include registered parks and gardens within Leamington Spa, the Grand Union Canal and the former Rugby to Leamington Spa Line. This former rail line is now a PRoW known as the Offchurch Greenway (PRoW W192).

9.3.2 Fields in the area are generally large in scale and bordered by intermittent or gappy hedgerows often including mature trees. Additional vegetation cover is distributed in small pockets along the River Leam, and also along the main roads and the Offchurch Greenway (PRoW W192). South Cubbington Wood, an ancient woodland, is located in the north of the area. It is one of the larger woodlands in the area and is separated from North Cubbington Wood by the B4453 Rugby Road. A network of PRoW crosses the area, often in proximity to the River Leam and a number through South Cubbington Wood. These include National Cycle Route 41 (known as the Lias Line in

this area), the Centenary Way and Shakespeare's Avon Way (PRoW W130), which is a national trail.

9.3.3 Landscape character areas have been determined with reference to Natural England's National Character Areas, (NCA)[43] and The Warwickshire Landscape Guidelines[44].

9.3.4 Descriptions of all LCAs are provided in Volume 5: Appendix LV-001-017 Part 2. For the purposes of this assessment the study area has been sub-divided into six discrete LCAs, four of which are most likely to be affected. A summary of these LCAs is provided below. The LCAs are shown in Volume 2, CFA17 Map Book, Maps, LV-02-069b to LV-02-072a.

Ufton Vale Farmlands LCA

9.3.5 The rural character of this LCA derives from the geometric pattern of medium scale fields; the fields are often loosely bounded by hedgerows with mature trees in fair condition. The field pattern overlays a low lying, typically flat landform either side of the Grand Union Canal which is crossed by the Welsh Road. 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; and also the towpath along the Grand Union Canal. The settlement pattern is predominantly characterised by individual farms and cottages, connected to the LCA's agricultural land use. This primarily agricultural land use, 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

9.3.6 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 landform 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 Hunningham Road, which in conjunction with Long Itchington Road, Welsh Road 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.

[43] Natural England, NCA Profile: 96 Dunsmore and Feldon, http://www.naturalengland.org.uk/publications/nca/default.aspx, accessed: 2012.
[44] Warwickshire County Council and The Countryside Commission (1993), *The Warwickshire Landscape Guidelines*, Warwickshire County Council, Warwick.

Bubbenhall Plateau Farmlands LCA

9.3.7 The character is mainly rural, influenced by an almost flat plateau-like landform. This is most evident to the south of the LCA, adjacent to Cubbington, with the geometric pattern of hedged fields and the ancient woodlands of South and North Cubbington. These key elements are in fair condition. The southern part of the area is crossed by a few main roads including the B4453 Rugby Road and Coventry Road; and lanes such as Mill Lane. There is a number of PRoW, including Shakespeare's Avon Way (PRoW W130). The rural character is disrupted in the north of the LCA, where there is a noticeable presence of urban development; with major infrastructure at Coventry airport. Overall the presence of this major infrastructure results in a low tranquillity to the area. The LCA is likely to be valued at a regional level due to the green belt designation (covering all the LCA). Therefore, the area has a medium sensitivity to change.

Stoneleigh Parklands LCA

9.3.8 The majority of this LCA is located within the adjacent CFA18 (Stoneleigh, Kenilworth and Burton Green). Within the Offchurch and Cubbington CFA, the LCA is located to the north of the A445 Leicester Lane. Overall the land use is predominantly agricultural, comprising an enclosed gently undulating landform with a pattern of large fields bounded by hedgerows with trees and woodland edges. The Rivers Avon and Sowe meander across the south of the LCA. Woodlands are typically large in scale and many, such as Crackley Wood, are ancient woodland. These key components are in fair condition. Other land uses include business parks, golf courses and sewage works. There are a number of transport routes crossing the LCA, with the A46 Kenilworth Bypass, the A429 Kenilworth Road and the Coventry to Leamington Spa Line forming the main linkages between Kenilworth and Coventry. These latter two transport routes also cross a key characteristic setting within the area, a narrow 500m wide strip of open fields between Kenilworth and Coventry at Gibbet Hill. There is a network of PRoW, including the Kenilworth Greenway, Coventry Way and Centenary Way.

9.3.9 The tranquillity of the LCA is considered to be medium due to the fairly intense agricultural activities and some larger transport routes. Historic influences within the study area are evident, with parklands (including a registered park and garden) and mediaeval and later historic architecture at Stoneleigh Abbey. The LCA is considered to be valued at a regional level due to these historic influences, the green belt designation (covering the majority of the LCA) and the network of PRoW. Therefore, this area has a medium sensitivity to change.

Visual baseline

9.3.10 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-017 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: CFA17 Map Book, MapsLV-03-069b to LV-03-072a and LV-04-069b to LV-04-072a. 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, 6: Employment and 7: Active sports.

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

9.3.12 Residential receptors, which have a high sensitivity to change, are located on the higher ground at Offchurch and Cubbington and as isolated groups of residences adjacent to Welsh Road and interspersed throughout the landscape. Views are typically across agricultural land and include vegetation bordering: the Grand Union Canal; the River Leam; South Cubbington Wood; local lanes and; ridge lines. Generally, these views are partially filtered by garden vegetation and intervening field boundaries.

9.3.13 Recreational receptors, also with a high sensitivity to change, are located on PRoW throughout the study area, including the Centenary Way, Offchurch Greenway (PRoW W192) and Shakespeare's Avon Way (PRoW W130). Views are typically across agricultural land, extending into the background of the view, with visibility of occasional farm properties and localised vegetated ridge lines.

9.3.14 Viewpoints from people travelling along roads are located on the B4455 Fosse Way and Welsh Road and have a medium sensitivity to change. These views are characterised by roadside hedgerows and vegetation with filtered views of arable farmland.

Future baseline

9.3.15 A summary of the committed developments that are assumed to be mostly built and occupied prior to either the construction or operation of the Proposed Scheme is provided below, along with the consequential effect on the character of LCAs and nature of views. Developments which will introduce new visual receptors which may be significantly affected are also described. These developments are shown in Volume 5: Cross Topic Map Book, Maps CT-13-044 to CT-13-046.

Construction (2017)

9.3.16 The Thwaites works flood alleviation schemes, which will introduce an attenuation area to the south and north of Mill Lane, Cubbington. However, due to the small scale of the proposed re-profiling and earthworks, the sensitivity of this area will be unchanged for the assessment of effects during construction.

Operation (year 1 – 2026)

9.3.17 No committed developments have been identified for the area that will materially alter the baseline conditions for 2026. The Thwaites flood alleviation schemes would not alter the sensitivity of this area and this therefore there will be no cumulative effects.

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 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. 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 third quarter of 2017 and the first quarter of 2022. The Fosse Way main compound will be in place for approximately five years. Satellite compounds will be in place for between approximately one and two years. The civil engineering works at most individual sites along the route in this CFA will occur for a period of between approximately three months and one year, with the Offchurch cutting taking approximately two years. Effects during other phases of works are likely to be lesser due to less construction equipment being required at the time and a reduced intensity of construction activity.

9.4.2 The construction works that have been taken into account in determining the effects on landscape and visual receptors include:

- localised hedgerow and tree removal from the fields, construction plant crossing the haul roads, the general earthworks and modification of the landform and the presence of construction compounds;
- construction of Longhole viaduct;
- realignment of the B4455 Fosse Way, including an overbridge and the construction of a roundabout at the junction with Welsh Road;
- vegetation removal from along Welsh Road, the realignment of the road to link with the B4455 Fosse Way and the construction of an infiltration basin adjacent these two roads;
- part closure of Long Itchington Road and the construction of a cycle path between this road and the Offchurch Greenway (PRoW W192); vegetation removal from the Offchurch Greenway (PRoW W192) and the construction of the Offchurch Greenway overbridge;
- presence of the material transfer stockpile area and the workers accommodation at the B4455 Fosse Way main compound;
- realignment of Hunningham Road, including vegetation removal and construction of the Hunningham Road overbridge;
- vegetation removal from Ash Beds;
- the construction of Offchurch auto-transformer station and balancing pond with road access;
- construction of the River Leam viaduct and approach embankments;
- removal of woodland at South Cubbington Wood, the construction of Cubbington retaining wall and construction of Mill Lane overbridge; and
- realignment of the B4453 Rugby Road and Coventry Road, including vegetation removal and the construction of overbridges.

Avoidance and mitigation measures

9.4.3 Measures that have been incorporated into the draft CoCP to avoid or reduce landscape and visual effects during construction include (see Volume 5: Appendix CT-003-000/1):

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

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

Assessment of temporary impacts and effects

9.4.5 The most apparent changes to landscape character and viewpoints during construction will relate to the temporary presence of construction plant and the removal of existing landscape elements, such as trees, hedges and agricultural land. Changes will be most notable along the route at the Grand Union Canal, the B4455 Fosse Way, Offchurch Greenway (PRoW W192), the River Leam and South Cubbington Wood. The height of the construction plant and viaducts and the 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

9.4.6 The following section describes the likely significant effects on LCAs during construction. All LCAs within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-017, Part 4.

Leamington Plateau Fringe LCA

9.4.7 Within this LCA construction activity will be located from adjacent to Welsh Road to the east of Offchurch and will principally include extensive excavations (to depths of 19m) and embankment formation. There will be partial removal of vegetation from Burnt Firs woodland, Offchurch Greenway (PRoW W192) and Ash Beds. Welsh Road, the B4455 Fosse Way and Hunningham Road will be locally realigned with overbridges constructed on the latter two roads. Long Itchington Road will be part closed and a new cycle way constructed to link this road with the Offchurch Greenway (PRoW W192). Activities will also include the construction of the River Leam viaduct and Offchurch auto-transformer station and the presence of the material transfer stockpile area and the workers accommodation at the B4455 Fosse Way main

compound. There will also be temporary loss of agricultural land and disruption of field use.

9.4.8 The gently undulating landform character will be locally affected by the earthworks and excavation across the fields. There will be a partial loss to the key characteristic areas of vegetation along roads, PRoW, the River Leam and within the fields. The construction plant on the haul roads crossing the fields and the presence of the construction compounds will be at variance to the agricultural character of open fields. The scale and extent of construction activity will reduce the tranquillity locally. Therefore, the magnitude of change is considered to be 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.

Bubbenhall Plateau Farmlands LCA

9.4.10 Within this LCA construction activity will be located to the east of Offchurch across to the immediate north of Coventry Road and will include the excavation and construction of retained cutting and embankment formation within the fields, the partial removal of ancient woodland from South Cubbington Wood and hedgerows within the fields. The construction activity will also include the realignment of the B4453 Rugby Road and Coventry Road with construction of overbridges along them. There will also be a number of construction compounds and construction plant crossing the fields and on the haul roads.

9.4.11 The removal of ancient woodland at South Cubbington Wood is a partial loss to a key characteristic of the setting of the LCA. The scale and extent of the construction activity will reduce the tranquillity locally. Therefore, the magnitude of change is considered to be medium.

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

Stoneleigh Parklands LCA

9.4.13 With the exception of construction plant on the A445 Leicester Lane, all of the construction activity will be located within the adjoining CFA18 (Stoneleigh, Kenilworth and Burton Green). There will be a removal of key characteristic ancient woodland, changes to the landform and presence of construction compounds within the fields. The scale and extent of construction activity will reduce the tranquillity locally. Therefore, the magnitude of change is considered to be medium.

9.4.14 The medium magnitude of change assessed alongside the medium sensitivity of the character area, within CFA18, will result in a moderate adverse effect.

Visual assessment

9.4.15 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 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-001-017, Part 4.

9.4.16 The number identifies the viewpoint locations, which are shown in Volume 2, CFA17 Map Book, Maps LV-03-069b to LV-03-072a. In each case, the middle number (xxx.X.xxx) identifies the type of receptor that is present in the area – 2: Residential, 3: Recreational 4: Transport, 6: Employment and 7: Active sports.

9.4.17 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 247.3.001: View north-east from Ridgeway Lane

9.4.18 The construction of the Longhole viaduct and vegetation clearance adjacent to the Grand Union Canal will be visible in the foreground. The formation of embankments (up to 9.5m in height and extending up to 850m in length), construction plant and vehicles crossing the haul roads will also be visible in the foreground and middle ground. Given the proximity of the viewpoint to the construction activities and the substantial nature of changes compared to the existing canal view; and also their being within the direct field of view, the magnitude of change is considered to be high.

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

Viewpoint 248.4.002: View west from the Welsh Road

9.4.20 Construction activity will be visible in the foreground and middle ground although partially filtered by intervening vegetation alongside the Grand Union Canal. Elements within the foreground will be material transfer stockpile area 3 and construction plant crossing the haul roads in the fields. The activity in the middle ground will be the upper sections of cranes constructing Longhole viaduct and the formation of the approach embankment. Compared to existing views of the canal and open fields this activity is a substantial change, partially filtered by intervening vegetation. Therefore, the magnitude of change is medium.

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

Viewpoints 249.3.001: View east from PRoW (footpath) W125 and 249.2.003: View north-east from Bunkers Hill Cottages

9.4.22 Construction activity will be visible in the foreground and middle ground although partially filtered by intervening hedgerows and vegetation along the Welsh Road. The construction plant on Welsh Road, the realignment of this road and the construction of the overbridge, the 2.4m high fencing surrounding Welsh Road underbridge satellite compound will all be visible in the foreground. The removal of vegetation along the Grand Union Canal, the cranes constructing Longhole viaduct and the formation of the approach embankments to it, will be visible in the middle ground. This activity, compared to existing views of fields, is considered to represent

substantial change that will be partially filtered by intervening vegetation. Therefore, the magnitude of change is medium.

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

9.4.24 At night, the lighting of Welsh Road underbridge satellite compound is considered to be non-significant. This is reported in Appendix LV-001-017 Part 4.

Viewpoints 249.4.002: View north-east from the Welsh Road and 249.4.009: View east from the Welsh Road

9.4.25 The construction of the Welsh Road realignment and the Welsh Road underbridge will be visible in the foreground. The cranes constructing Longhole viaduct and the approach embankments (up to approximately 9.5m high), across the fields will be visible in the middle ground. These elements will represent a substantial change compared to existing views of fields which are open in character. Therefore, the magnitude of change is considered to be high.

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

Viewpoints, 249.2.010: View east from Welsh Road Farm and 249.2.011: View east from Bunkers Hill Farm residences

9.4.27 The realignment of Welsh Road across the fields and the 2.4m construction fencing bordering the Welsh Road underbridge satellite compound will be visible in the foreground. The embankment formation to Longhole viaduct will be visible in the foreground and middle ground. This will include views of the vegetation removal along the Grand Union Canal, the cranes constructing the viaduct and construction plant within the fields. These activities will result in major alterations to existing views of the open agricultural landscape and the vegetation along the Grand Union Canal. Therefore, the magnitude of change is considered to be high.

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

9.4.29 At night, for receptor 249.2.010, the continuous lighting of Welsh Road underbridge satellite compound will be visible in the foreground in conjunction with lighting from vehicles on the Welsh Road. Therefore the magnitude of change is medium, giving rise to a moderate adverse effect. For receptor 249.2.011 the lighting from this construction compound will be largely screened by 249.2.010 and is considered to be non-significant. This is reported in Appendix LV-001-017 Part 4.

Viewpoint 250.3.002: View south-west from Ridgeway Lane

9.4.30 The construction plant crossing Ridgeway Lane and the works to upgrade it will be visible in the foreground. The formation of the embankment approaching Longhole viaduct, the construction of the balancing pond and access track within the adjacent fields and the upper sections of cranes constructing Longhole viaduct and the Welsh Road underbridge will be visible in the middle ground. These activities will represent substantial changes compared to existing views and will be within the direct frame of view. Therefore, the magnitude of change is considered to be high.

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

Viewpoint 251.2.001: Views north-east and south-west from Springhill Cottages

9.4.32 Construction plant on the haul roads and the excavation within the fields will be visible in the middle ground to the north-east. To the south-west the realignments of the B4455 Fosse Way and Welsh Road across the fields, including the construction of the new roundabout and infiltration basin will be visible in the foreground. As these activities are located within views either side of the receptor, the overall close proximity and change compared to views of fields which are open in character is a substantial change. Therefore, the magnitude of change is considered to be high.

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

Viewpoints 251.2.002: View north from residences located between Offchurch Lane and Offchurch Greenway (W192) and 252.3.006: View south-west from Footpath W192

9.4.34 Vegetation clearance from alongside the Offchurch Greenway (W192) and the construction of the temporary culvert or bridge and the Offchurch Greenway overbridge will be visible in the foreground. The hedgerow and tree removal from the fields, the excavation and construction plant on the haul roads will be visible in the middle ground. Compared to the existing views of the open fields and vegetation this activity will be a substantial change in close proximity. Therefore, the magnitude of change is considered to be high.

9.4.35 The high magnitude of change assessed alongside the high sensitivity of these receptors will result in a major adverse effect.

Viewpoint 251.2.004: View north-east from Fosseway Cottage

9.4.36 The removal of hedgerows, the realignments of the B4455 Fosse Way and Welsh Road, including the construction of the infiltration basin in the fields will be visible in the middle ground. The removal of the roadside vegetation will result in the visibility of vehicles on these roads. This, in conjunction with the construction activity within the fields is considered to be a partial alteration to the view. Therefore, the magnitude of change is considered to be medium.

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

Viewpoint 251.2.007: View north-east from Brickyard Cottages

9.4.38 The realignment of the Welsh Road will be visible in the foreground. The construction plant crossing the fields and the partial removal of vegetation from Burnt Firs woodland will be visible in the middle ground although partially filtered by the vegetation along the Welsh Road. While the realignment works are in close proximity to the receptor, they are a small extent. Therefore, the magnitude of change is medium.

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

Viewpoint 251.2.008: View north from The Bridge residences

9.4.40 The removal of hedgerows and trees, excavation and formation of raised earthworks within the fields and cranes constructing the Hunningham Road overbridge and construction compounds will be visible in the middle ground, from this elevated viewpoint. The cranes constructing the River Leam viaduct and vegetation clearance from South Cubbington Wood will be visible in the background. These activities will introduce new vertical features that are incongruous with the existing views and remove key characteristic vegetation of hedgerows, trees and ancient woodland within the view. Therefore, the magnitude of change is 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 lighting of the construction compounds is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 252.2.001: View south-west from Burnt Heath Farm

9.4.43 The construction plant excavating within the fields, the backfilling and draining of Burnt Firs reservoir and removal of the majority of Burnt Firs woodland will be visible in the middle ground. This will be a major alteration to key characteristics of fields and woodland. Therefore, the magnitude of change is considered to be high.

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

Viewpoint 253.2.001: View north and east from Valley Fields

9.4.45 Construction plant on the haul roads crossing the fields and the formation of earthworks will be visible in the foreground and middle ground to the east. Hunningham Road overbridge satellite compound, realignment to this road and overbridge construction, along with that of a balancing pond and access road and the Offchurch auto-transformer station will be visible in the foreground. The removal of vegetation from Ash Beds will be visible in the middle ground, although partially filtered by intervening vegetation. These elements are considered to represent substantial changes in close proximity to the receptor. Therefore the magnitude of change is considered to be high. The view of the Proposed Scheme from this location during construction is illustrated on the photomontage shown in Figure LV-01-197 (Volume 2: CFA17 Map Book).

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

9.4.47 At night, the continuous lighting of Hunningham Road overbridge satellite compound will be in the foreground to the north. While this will be viewed in context of lighting from vehicles on the Hunningham Road, the proximity to the receptor will result in a high magnitude of change, giving rise to a major adverse effect.

Viewpoint 253.2.002: View east from Manor Farm and Manor Farm Cottages

9.4.48 The realignment of Hunningham Road including, construction of the drainage pond and access track, the Offchurch auto-transformer station and the construction of the Hunningham Road overbridge will be visible in the middle ground. This activity will remove hedgerows from the fields, require and along the Hunningham Road require regrading of the landform. The views will also include the Hunningham Road overbridge satellite compound. This activity will be a substantial change which will be partially filtered by the intervening vegetation. Therefore, the magnitude of change is considered to be medium.

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

9.4.50 At night, lighting of Hunningham Road overbridge satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoints 253.2.003: View north from residences on Village Street, Offchurch and 254.2.001: View south from Fields Farm Cottages and The Chalet and 254.3.002: View south-west from Footpath W128 and 254.2.003: View south-west from The Hill

9.4.51 Construction activity will be visible in the middle ground although partially filtered by intervening vegetation. Activity within the view will be localised vegetation removal from field vegetation and along the Offchurch Greenway (W192), cranes constructing the Offchurch Greenway and Hunningham Road overbridges, construction compounds and construction plant crossing the haul roads. Views will also include the excavation and forming of raised earthworks within the fields. This activity is considered to be a substantial change compared to existing views of open fields and across a predominantly agricultural landscape with the partial loss of key vegetation within the view. This change will be partially filtered by intervening vegetation. Therefore, the magnitude of change is considered to be medium.

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

9.4.53 At night, views from residential receptors, of the satellite compounds are considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 255.2.002: View east from Ham Farm and Ham Farm Cottage

9.4.54 The construction plant crossing the fields and the upper sections of cranes constructing the River Leam viaduct will be visible in the middle ground. The construction plant will be partially filtered by intervening vegetation within the fields and adjacent the River Leam. Therefore the magnitude of change is considered to be medium.

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

Viewpoint 256.2.001: View south-west from Fields Farm

9.4.56 The regrading of the landform, vegetation removal from the fields and construction plant crossing between Hunningham Road and the River Leam will be visible in the

foreground. The cranes constructing Footpath 129y overbridge will be visible in the middle ground. This activity will be a major alteration to the key characteristics of vegetation and undulating landform in close proximity to the visual receptor. Therefore, the magnitude of change is considered to be high.

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

Viewpoint 257.2.003: View north-east from Lower Grange

9.4.58 The construction of the new access track with vegetation removal from the fields and construction plant crossing the fields will be visible in the foreground. The River Leam viaduct and the embankment formation will be visible in the fields in the middle ground. This activity will represent substantial changes in close proximity to the receptor and therefore the magnitude of change is considered to be high.

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

Viewpoint 257.2.005: View south-east from residences adjacent The Grange and Mill Lane

9.4.60 Construction activity will be visible in the middle ground although partially filtered by intervening hedgerows and trees within the fields. Elements within this view will be the partial removal of woodland from South Cubbington Wood, cranes constructing the Shakespeare's Avon Way footbridge and the B4453 Rugby Road overbridge. The view will also include the Cubbington retaining wall satellite compound and the construction plant on the haul roads crossing the fields. This activity will be a substantial change compared to views of fields and a partial loss of woodland. This change will be partially filtered by intervening vegetation. Therefore, the magnitude of change is considered to be medium.

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

9.4.62 At night, lighting of the Cubbington retaining wall satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoints 258.3.001: View south-west from Footpath W129t and 258.3.007: View west from Footpath W130

9.4.63 Construction activity will be visible in middle ground and background although partially filtered by intervening hedgerows and trees within the fields. Activity within the middle ground will be the embankment formation of the River Leam viaduct. The partial removal of woodland from South Cubbington Wood, the upper sections of cranes constructing the Mill Lane and Shakespeare's Avon Way overbridge will be visible in the background. This activity will be a substantial change due to the loss of woodland and activity within fields which are open in character. The substantial change will be partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

Viewpoints 259.3.004: View north-east from Footpath W130 and Cubbington Church of England Primary School and Play Area and 259.2.006: View east from residences in Cubbington

9.4.65 Construction activity will be visible in the middle ground although partially filtered by intervening hedgerows and trees. Activity within the view will be construction plant crossing the haul roads either side of the B4453 Rugby Road, the realignment of this road and construction of the overbridge. The Cubbington retaining wall satellite compound will also be visible. This activity will result in a substantial change to views of open fields although partially filtered by intervening vegetation. Therefore, the magnitude of change is considered to be medium.

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

9.4.67 At night, the view from receptor 259.2.006 of lighting at the Cubbington retaining wall satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017 Part 4.

Viewpoint 259.2.005: View north-east from residences in Cubbington

9.4.68 The realignment of the B4453 Rugby Road and the cranes constructing its overbridge and that of the Shakespeare's Avon Way will be visible in the middle ground. Views will also include the construction plant crossing the haul routes, Cubbington retaining wall satellite compound and removal of vegetation from South Cubbington Wood. These activities will be new features, compared to views of open fields which will be highly visible and incongruous with the existing view. Therefore, the magnitude of change is considered to be high.

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

9.4.70 At night, the view of the Cubbington retaining wall satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 259.2.008: View north from residences in Cubbington adjacent the B4453 Rugby Road

9.4.71 Construction activity will be visible in the middle ground although partially filtered by intervening vegetation. The activity within the view will include the cranes constructing the A445 Leicester Lane overbridge and material transfer stockpile area 5 (CFA17 Volume 2 Map Book, Map CT-05-093a F3). These activities will be a substantial change compared to existing views of open fields. This change is will be partially filtered by intervening vegetation. Therefore the magnitude of change is considered to be medium.

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

Viewpoints 259.3.009: View south-east from Footpath W130b and 260.3.004: View south from Footpath W130b

9.4.73 Recreational users will be realigned from their baseline location to the B4453 Rugby Road. This new location is considered suitable to assess the receptor location in construction as the landscape elements within the view will be similar.

9.4.74 The realignment of the B4453 Rugby Road and constructing the overbridge, excavation within the fields and Cubbington retaining wall satellite compound will be visible in the foreground and middle ground. These activities will result in a substantial change to the view in close proximity to the receptors. Therefore the magnitude of change is considered to be high.

9.4.75 The high magnitude of change assessed alongside the high sensitivity of these receptors will result in a major adverse effect.

Viewpoint 261.2.003: View east from Oakdene including Oakdene Day Nursery

9.4.76 Construction activity will visible in the foreground and middle ground, although partially filtered by intervening garden vegetation and built form. The activity within the foreground will be the construction plant crossing the Coventry Road and work associated with its realignment and overbridge. Coventry Road overbridge satellite compound and construction plant on the haul routes will be visible in the middle ground. This activity will be a partial alteration to key characteristics of the view. Therefore, the magnitude of change is considered to be medium.

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

9.4.78 At night, the view of Coventry Road overbridge satellite compound is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017 Part 4.

Cumulative effects

9.4.79 Section 2.1 and Appendix CT-004-000/1 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 LCAs and viewpoints is described below. The developments are shown on Volume 5: Cross Topic Map Book, Maps CT-13-044 to CT-13-046.

9.4.80 There are no committed developments which are assumed to be under construction at the same time as the Proposed Scheme, and therefore, there are no consequential cumulative effects on LCAs and viewpoints.

Other mitigation measures

9.4.81 To further reduce the significant effects described above, consideration of where planting can be established early in the construction programme will be given during the detail design stage. This may include consideration of early planting in ecological mitigation sites which will 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

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

9.5 Permanent effects arising during operation

9.5.1 The specific elements of the Proposed Scheme which may give rise to permanent significant effects on landscape and visual receptors include:

- modifications to the agricultural landform with new embankments and cuttings, overhead line equipment, high speed trains, noise fence barriers, the Offchurch auto-transformer station and boundary fencing;
- new balancing ponds within the fields, including associated access roads and upgrading of Ridgeway Lane;
- realignments, including overbridges, of the Welsh Road, B4455 Fosse Way, Hunningham Road, B4453 Rugby Road, Coventry Road and the part closure of Long Itchington Road;
- Longhole and the River Leam viaducts including approach embankments;
- realignment of PRoW, including new overbridges at the Offchurch Greenway, Mill Lane and the Shakespeare's Avon Way; and
- retained cutting though South Cubbington Wood.

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 in 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 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 is provided where reasonably practicable;

- planting, including native broad-leaved woodland, shrub and hedgerows, will be implemented 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:

- the shaping of the realignment of the Welsh Road between Ridgeway Lane and the B4455 Fosse Way to integrate it into the character of the surrounding landscape;
- substantial areas of woodland planting in the Welsh Road area, including advance planting to the north of Welsh Road, to aid in integrating the earthworks and more readily screen the Proposed Scheme;
- Offchurch Greenway overbridge and Mill Lane overbridge to have hedges on both sides to enable landscape connectivity;
- establishment of woodland edge management zones along the Offchurch Greenway and at South Cubbington Wood to enable retention of existing vegetation where possible and a more integrated transition between the Proposed Scheme and retained vegetation;
- substantial areas of woodland planting in the Leam Valley and Cubbington Wood areas, including advance planting to the south of the retained cut at South Cubbington Wood, to aid integration aid more readily screen the Proposed Scheme;
- 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.

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 of approximately 10m high with associated infrastructure; the introduction of noise fence barriers that will create a linear feature; permanent severance of land; the introduction of overhead line electrification; 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 LCAs during year 1, year 15 and year 60 of operation. Non-significant effects on LCA are presented in Volume 5: Appendix LV-001-017, Part 4.

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

Ufton Vale Farmlands LCA

9.5.8 The Proposed Scheme will cross a small section of this LCA via Longhole viaduct and on embankment across the fields, to the realigned Welsh Road. Landscape effects of the Proposed Scheme will include:

- the introduction of a new major infrastructure including a 140m long viaduct, up to 10m above the Grand Union Canal, with approach embankments and in close proximity to Longhole Bridge. Compared to the existing canal crossings, these viaduct and embankments are at variance due to their greater scale and mass and will be a partial alteration to the character of the canal in this location;
- an engineered embankment reducing from 10m high slopes crossing the fields which will be at variance to the existing generally flat landform;
- the realigned Welsh Road, which is considered to reflect the existing road character;
- an upgraded length of Ridgeway Lane and realignments with an access road to a new balancing pond. These elements are considered to generally reflect the existing character of Ridgeway Lane and agricultural land use in the area; and
- extensive new planting on the approach embankment to Longhole viaduct, adjacent Ridgeway Lane and the Grand Union Canal.

9.5.9 There will be a reduction in tranquillity of the character area due to the introduction of high speed trains within an area with relatively little infrastructure and characterised by agricultural land use.

9.5.10 Therefore, due to the partial variance to the generally flat landform and loss to the key characteristic vegetation, the magnitude of change is considered to be medium in year 1 of operation.

9.5.11 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.

9.5.12 By year 15 of operation, new planting adjacent the Grand Union Canal, the realigned Welsh Road and along the Longhole viaduct approach embankment will have

established. This will aid in reducing the mass of the embankment and replicating the key characteristic roadside and canal side vegetation.

9.5.13 However, the high speed trains, the scale and mass of Longhole viaduct and height of the approach embankment will remain at variance to the landform and existing canal crossings. Therefore the magnitude of change will remain as medium in year 15 of operation.

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

9.5.15 By year 60 of operation the planting will have matured to largely reflect the character of the existing vegetation and reduce the mass and scale of Longhole viaduct and the approach embankments. This will reduce the effects to be non-significant. These are reported in Volume 5: Appendix LV-001-017 Part 4.

Leamington Plateau Fringe LCA

9.5.16 The Proposed Scheme will cross the LCA from the Welsh Road to the north of the River Leam. The Proposed Scheme will be mainly in cutting and on embankment prior to crossing the River Leam viaduct. There will be realignments to the main roads within the area, with associated overbridges. Additional new features will include the Offchurch auto-transformer station. Landscape effects of the Proposed Scheme will include:

- the introduction of new major infrastructure which will cross an agricultural landscape. The route will mainly be in cutting, to localised depths of approximately 19m and include raised earthworks and false cuttings. These earthworks will be at partial variance in their scale and form to the existing gently undulating landform;
- the realignment of, and overbridges for, Welsh Road, the B4455 Fosse Way (including lighting at the roundabout) and Hunningham Lane;
- part closure of Long Itchington Road;
- reduction in vegetation from Burnt Firs woodland, Ash Beds and the reduction in hedgerow and vegetation along the Offchurch Greenway (PRoW W192). This is a partial loss to the key elements of vegetation within the area; and
- the Offchurch auto-transformer station which will introduce new built form and mass at variance with the rural landscape.

9.5.17 There will be a reduction in tranquillity of the character area due to the introduction of high speed trains within an agricultural area.

9.5.18 Therefore, due to a partial variance to the existing landform and loss to the key characteristic vegetation, the magnitude of change is considered to be medium in year 1 of operation.

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 the new planting on the earthworks and within the fields will have established. This will aid in reducing the massing effect of the earthworks. It will also help to integrate the realigned roads into the landscape and will replicate the existing vegetated roadside character. The new planting will also reflect the character of pockets of woodland and generally localised vegetation coverage within the LCA. However, the high speed trains, the River Leam viaduct and Offchurch auto-transformer station will remain at variance with the landscape character. Therefore, the magnitude of change will remain as medium in year 15.

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

9.5.22 By year 60 of operation the new planting on the earthworks and within the fields will have matured. Although this will further reduce the massing effect of the earthworks, the River Leam viaduct and the Offchurch auto-transformer station, the continued presence of the high speed trains and the linearity of the route across a broad and gently undulating valley will remain at variance with the landform and agricultural land use. Therefore, the magnitude of change will remain at medium in year 60.

9.5.23 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 60 of operation.

Bubbenhall Plateau Farmlands LCA

9.5.24 The Proposed Scheme will cross the area from the fields south of South Cubbington Wood to the immediate north of the Coventry Road. The Proposed Scheme will be mainly in cutting, including for retained cutting through South Cubbington Wood and the north of the B4453 Rugby Road. Landscape effects of the Proposed Scheme will include:

- the introduction of new major infrastructure which will cross a predominantly agricultural landscape in cutting;
- the partial loss of vegetation from South Cubbington Wood (ancient woodland), hedgerows and road side vegetation;
- the realignment of the B4453 Rugby Road and Coventry Road, including new overbridges approximately 6m above existing ground levels. Although these will be prominent elements they will largely be characteristic of the existing road infrastructure; and
- realignment of several PRoW including new footbridges which will introduce new built form within the agricultural landscape, and a partial alteration to the existing character.

9.5.25 There will be a reduction in tranquillity of the character area due to the introduction of high speed trains within an area characterised by agricultural land use but with some existing infrastructure.

9.5.26 Therefore due to the partial loss of key vegetation and change to the landform, the magnitude of change is considered to be medium in year 1 of operation.

9.5.27 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.

9.5.28 By year 15 of operation the new planting adjacent to the B4453 Rugby Road and Coventry Road will have established; and the replacement hedgerows here will have partially established. This will aid in reducing the massing effect of the overbridges and will reflect the character of the roadside vegetation. However, the presence of the high speed trains within a mainly agricultural landscape together with the partial loss of ancient woodland will remain at variance with the existing character. Therefore the magnitude of change will remain at medium in year 15.

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

9.5.30 By year 60 of operation the new planting adjacent the B4453 Rugby Road and Coventry Road and within the fields will have matured. This will reflect the existing landscape character. However, the presence of the high speed trains will remain at variance with the existing character. Therefore, the magnitude of change will remain at medium in year 60.

9.5.31 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 60 of operation.

Stoneleigh Parklands LCA

9.5.32 The Proposed Scheme will cross this LCA (mainly located in the adjacent CFA18, Stoneleigh, Kenilworth and Burton Green). In CFA18 the character of the LCA will be partially altered by the removal of ancient woodland, the reduction in separation between Kenilworth and Coventry, a reduction in tranquillity and the introduction of new infrastructure. Therefore the magnitude of change is considered to be medium in year 1 of operation and the effect as moderate adverse.

9.5.33 By years 15 and 60 and due to the continued presence of the infrastructure, loss of ancient woodland and reduction in the separation between Kenilworth and Coventry, the magnitude of change will remain medium and the effects moderate adverse.

Visual assessment

9.5.34 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-001-017, Part 4.

9.5.35 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.

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

9.5.37 The number identifies the viewpoint locations which are shown in Volume 2, CFA17 Map Book, MapsLV-04-069b to LV-04-072a. 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.

9.5.38 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.

9.5.39 The view of the Proposed Scheme from viewpoint 248.4.002 (illustrated in the photomontage shown in Figure LV-01-112 (Volume 2, CFA17 Map Book)) will not be significantly affected due to the intervening vegetation largely filtering views of the Proposed Scheme. The view of the Proposed Scheme from viewpoint 249.2.003 (illustrated in the photomontage shown in Figure LV-01-113 (Volume 2, CFA17 Map Book)) will not be significantly affected due to the Proposed Scheme being largely characteristic of the existing view. The view of the Proposed Scheme from viewpoint 259.3.004 (illustrated in the photomontage shown in Figure LV-01-115 (Volume 2, CFA17 Map Book)) will not be significantly affected due to the Proposed Scheme being located within the very minor extent of the view.

Viewpoint 247.3.001: View north-east from Ridgeway Lane

9.5.40 Longhole viaduct, noise fence barriers, trains and overhead line equipment will be visible within the foreground. The approach embankment will be visible within the middle ground crossing the fields. This will cause a substantial change in close proximity to the receptor compared with existing open views of the Grand Union Canal and of canalside vegetation and fields. Therefore, the magnitude of change is considered to be high.

9.5.41 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.

9.5.42 In summer of year 1 of operation, the close proximity of the Proposed Scheme and direct view will remain, therefore the magnitude of change is considered to remain high meaning the overall effect will be unchanged.

9.5.43 By year 15 the new planting adjacent to the Grand Union Canal and on the approach embankments to Longhole viaduct will have established. This will integrate these elements within existing views of the fields. However, Longhole viaduct, the noise fence barriers and trains will remain within the direct field of view and at close range. Therefore, the magnitude of change is considered to remain high, meaning the overall effect will be unchanged as major adverse.

9.5.44 By year 60 the planting adjacent to the Grand Union Canal will have matured and largely filter views of the approach embankment. It will also reduce the extent of Longhole viaduct within the view. Therefore, the magnitude of change is considered to be medium.

9.5.45 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 60 of operation.

Viewpoint 249.3.001: View east from Footpath W125

9.5.46 The approach embankment to Longhole viaduct (up to 9.5m high), Welsh Road underbridge, overhead line equipment and trains will be visible in the middle ground. These features will be highly visible and incongruous with the open fields and generally flat landform. This will result in a marked deterioration in the existing view. Therefore, the magnitude of change is considered to be high.

9.5.47 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.

9.5.48 In summer of year 1 of operation, the view is considered to remain as per winter due to the elevated location of the receptor and open character of the fields in the foreground. Therefore, the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.49 By year 15 the planting in the fields either side of Welsh Road will have established. This will partially filter views of the earthworks, although views of the Welsh Road underbridge will remain open. Therefore, the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.50 By year 60, the planting either side of Welsh Road will have matured sufficiently to help filter views and reduce the massing effect of the Welsh Road underbridge. Therefore, the magnitude of change is considered to be medium.

9.5.51 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 60 of operation.

Viewpoints 249.4.002: View east from the Welsh Road and 249.4.009: View east from the Welsh Road and 249.2.010: View east from Welsh Road Farm

9.5.52 The 850m long embankment, Welsh Road underbridge and adjacent new planting, overhead line equipment and trains, will be visible in the foreground. These elements are considered to represent substantial change compared to existing fields of open fields and a generally flat landform. The views will be in close proximity to the receptors. Therefore, the magnitude of change is considered to be high.

9.5.53 The high magnitudes of change assessed alongside the high sensitivity of these the receptors will result in major adverse effects in the winter of year 1 of operation.

9.5.54 In summer of year 1 of operation, the view will remain as per winter due to the open character along the Welsh Road, the scale of the embankments and the close proximity of the Proposed Scheme within the view. Therefore, the magnitude of change is considered to remain high, meaning the overall effect will be unchanged.

9.5.55 By year 15 the planting adjacent Welsh Road underbridge will have established, however not sufficiently to partially filter views of the Proposed Scheme. Therefore, the magnitudes of change are considered to remain high, meaning the overall effects will be unchanged.

9.5.56 By year 60, the planting adjacent Welsh Road will have matured. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017 Part 4.

Viewpoint 249.2.011: View east from Bunkers Hill Farm residences

9.5.57 Welsh Road underbridge, overhead line equipment, trains and the approach embankments to Longhole viaduct will be visible in the middle ground. These elements are considered to represent a marked deterioration in the existing view compared to open fields and a generally flat landform. Therefore, the magnitude of change is considered to be high.

9.5.58 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.

9.5.59 In summer of year 1 of operation, field boundaries and trees within the foreground are likely to partially filter views of the Proposed Scheme. Therefore, the magnitude of change is considered to be medium.

9.5.60 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.

9.5.61 By year 15 the planting adjacent Welsh Road and the embankment approach to Longhole viaduct will have established. However the scale of the embankments and views of Welsh Road underbridge will remain. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.62 By year 60, the planting adjacent to the Proposed Scheme will have matured to aid in largely filtering views. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 250.3.002: View south-west from junction of Ridgeway Lane and Welsh Road

9.5.63 The upgraded Ridgeway Lane will be visible in the foreground. The embankments, overhead line equipment and trains will be visible in the middle ground crossing the fields beyond Welsh Road. These elements will be highly visible and a substantial change compared to a generally flat agricultural landscape of fields. Therefore, the magnitude of change is considered to be high.

9.5.64 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.

9.5.65 In summer of year 1 of operation, the open character of Welsh Road and proximity to Ridgeway Lane will retain open views of the elements in the foreground. The extent of the elements in the middle ground will be reduced by vegetation along Welsh Road. However, some open views will remain of the Proposed Scheme. Therefore, the magnitude of change is considered to remain high, meaning the overall effect will remain unchanged.

9.5.66 By year 15, the planting adjacent Welsh Road and Ridgeway Lane will have established and partially filtering views. Therefore, the magnitude of change is considered to be medium.

9.5.67 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.

9.5.68 By year 60, the planting adjacent the Proposed Scheme will have matured and largely filter views. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 251.2.001: View north-east and south-west from Springhill Cottages

9.5.69 To the north-east the reduced Burnt Firs woodland, new boundary fencing and planting will be visible in the middle ground. This will be a partial alteration to existing views of fields and woodland. To the south-west, views will be of the realigned B4453 Fosse Way (by approximately 60m), including a new roundabout with tall lighting columns. These elements will be visible in the foreground and are considered to be new features that are largely characteristic of the existing views. Therefore, the magnitude of change is considered to be medium due to the partial change to views to the north-east.

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

9.5.71 In summer of year 1 of operation, the views in both orientations are considered to remain as per winter due to the proximity of the elements and the openness of the area. Therefore, the magnitude of change is considered to remain medium, meaning the overall effect will remain unchanged.

9.5.72 At night, the new lighting is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

9.5.73 By year 15 and beyond to year 60 of operation, roadside planting and that along the boundary fence line will have matured. This will reduce the effect to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 251.2.002: View north from residences located between Offchurch Lane and Offchurch Greenway

9.5.74 The new planting in the fields between the receptors and the extent of cutting will be visible in the foreground. These views will be partially filtered by existing boundary vegetation. Therefore, the magnitude of change is considered to be 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 of year 1 of operation.

9.5.76 In summer of year 1 of operation (and years 15 and 60), the view is considered to be largely filtered by boundary vegetation. This will reduce the effect to being non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 251.2.004: View north-east from Fosseway Cottage

9.5.77 The realigned B4455 Fosse Way and Welsh Road will be visible in the middle ground. This will include views of tall lighting columns at the new roundabout. As existing views towards the road are largely filtered by hedgerows, the removal of these will result in more open views of vehicles and is therefore a partial alteration to existing views. Therefore, the magnitude of change is considered to be medium.

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

9.5.79 In summer of year 1 of operation the view is considered to remain as per winter due to the absence of intervening vegetation. Therefore, the magnitude of change is considered to remain medium, meaning the overall effect will remain unchanged.

9.5.80 By year 15 and beyond to year 60 of operation, hedgerow planting will have established and matured, integrating with existing character and largely filtering views of the vehicles. This will reduce the effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

9.5.81 At night new lighting is considered to be non-significant. This is reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 251.2.008: View north from The Bridge residences

9.5.82 The overhead line equipment, trains and reduction of ancient woodland at South Cubbington Wood will be visible in the middle ground and background. These elements are considered to represent features that will be continuously highly visible and represent a substantial change compared to an agricultural landscape with a limited presence of infrastructure. The main variance with the existing character is the linearity of the Proposed Scheme across a gently undulating landform. Therefore, the magnitude of change is high.

9.5.83 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.

9.5.84 In summer of year 1 of operation the retained vegetation within the middle ground is considered to partially filter views of the Proposed Scheme, with the exception of South Cubbington Wood. Therefore, the magnitude of change is considered to be medium.

9.5.85 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.

9.5.86 By year 15 and beyond to year 60 the planting within the middle ground will have established and matured; however, views of the retained cut through South Cubbington Wood will remain. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

Viewpoint 252.2.001: View south-west from Burnt Heath Farm

9.5.87 The reduction in vegetation from Burnt Firs woodland and new boundary fencing and planting parallel to the cutting will be visible in the middle ground. These elements are considered to represent a partial alteration and loss to the existing view of fields and woodland. Therefore, the magnitude of change is medium.

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

9.5.89 In summer of year 1 of operation the view is considered to remain the same due to the open views from the receptor. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will remain the same.

9.5.90 By year 15 planting established adjacent to the cutting will have matured, providing additional screening to elements of the Proposed Scheme. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 252.3.006: View south-west from Footpath W192

9.5.91 The track, trains, overhead line equipment and the extent of cutting will be visible in the foreground due to the receptors elevated location and proximity to the Proposed Scheme. These elements are considered to represent substantial change. Therefore, the magnitude of change is considered to be high.

9.5.92 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.

9.5.93 In summer of year 1 of operation the view is considered to remain as per winter due to the proximity of the Proposed Scheme. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will remain the same.

9.5.94 By year 15 and beyond to year 60 of operation, the planting established on the boundaries of the Proposed Scheme will have matured. However open views along the track and track bed will remain from this elevated location. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will remain the same.

Viewpoint 253.2.001: View north and east from Valley Fields

9.5.95 Within the foreground of the view to the north will be the realigned D2246 Hunningham Road and new overbridge, the access track to the balancing pond and the Offchurch express feeder auto-transformer station. Within the middle ground of the view to the east will be the raised earthworks, boundary fencing and new planting. The combination of new elements within the view to the north and east will result in a substantial change in the view, due to the variance with the open character of fields, the loss of key characteristic vegetation and the contrast with the undulating landform. Additionally, the elevation of Hunningham Road overbridge will result in more open views of vehicles. Therefore the magnitude of change is high. 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.

9.5.96 In summer of year 1 of operation, open views will remain to the north of the realigned Hunningham Road, overbridge and Offchurch express feeder auto-transformer station. Therefore the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.97 The view of the Proposed Scheme during operation year 1 is illustrated on the photomontage shown in Figure LV-01-114. (This photomontage is representative of views east from this location.)

9.5.98 By year 15, the open views to the north of the realigned Hunningham Road, overbridge and Offchurch express feeder auto-transformer station, will remain as a partial alteration to the existing agricultural and road character. With regards views to the east, the planting on the raised earthworks will have established and aid in reducing the mass and variance compared to the existing undulating landform, therefore the magnitude of change is considered to be medium. The view to the east,

of the Proposed Scheme during operation year 15 is illustrated on the photomontage shown in Figure LV-01-246. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

9.5.99 By year 60, new planting along the raised earthworks and surrounding the Offchurch auto-transformer station will have matured and largely filter views. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 253.2.003: View north from residences on Village Street, Offchurch

9.5.100 The upper sections of overhead line equipment and earthworks will be visible in the middle ground crossing the fields. These elements are considered to represent substantial change compared to views of fields and agricultural land use. The view will be partially filtered by garden vegetation located in the foreground. Therefore, the magnitude of change is considered to be medium.

9.5.101 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.

9.5.102 In summer of year 1 of operation (and years 15 and 60), the garden vegetation will largely filter views towards the Proposed Scheme. This will reduce the effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 255.2.002: View east from Ham Farm and Ham Farm Cottages

9.5.103 The upper sections of overhead line equipment, trains and boundary fencing will be visible in the middle ground. This is considered to be a substantial change compared to views of existing fields. The view will be partially filtered by middle ground vegetation. Therefore, the magnitude of change is considered to be medium.

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

9.5.105 In summer of year 1 of operation (and years 15 and 60), intervening vegetation will largely filter views towards the Proposed Scheme. This will reduce the effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 256.2.001: View south-west from Fields Farm

9.5.106 The Hunningham Road overbridge, overhead line equipment, trains and new planting will be visible in the foreground and middle ground. These are considered to represent substantial change compared to views of fields crossed by hedgerows and trees. Therefore, the magnitude of change is high.

9.5.107 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.

9.5.108 In summer of year 1 of operation, the view is considered to remain as per winter due to the proximity of the Proposed Scheme and the open views due to the slightly elevated location of the receptor. Therefore, the magnitude will remain high, meaning the overall effects will remain the same.

9.5.109 By year 15 the planting will have established, however not sufficiently to partially filter views of the Hunningham Road overbridge and overhead line equipment from the elevated location. Therefore, the magnitude of change is considered to remain high, meaning the overall effects will be unchanged as major adverse.

9.5.110 By year 60 the planting will have matured to partially filter views of this substantial change. Therefore, the magnitude of change will reduce to medium. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 60 of operation.

Viewpoint 257.2.003: View north-east from Lower Grange

9.5.111 The upgraded access track will be visible in the foreground. This is considered to largely reflect the character of existing views. The overhead line equipment, River Leam viaduct and trains will be visible in the middle ground, although partially filtered by intervening vegetation. Therefore, the magnitude of change is considered to be medium.

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

9.5.113 In summer the view is considered to remain as per winter. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.114 By year 15 the planting will have established, however views of the River Leam viaduct will remain open. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.115 By year 60 planting within the Proposed Scheme will have matured and in conjunction with existing field vegetation largely filter views. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoints 258.3.001: View south-west from Footpath W129t and 258.3.007: View west from Footpath W129d

9.5.116 The upper sections of overhead line equipment and trains and the retained cut at South Cubbington Wood will be visible in the middle ground, although partially filtered by intervening vegetation. This is a substantial change due to the reduction in woodland and the introduction of new infrastructure crossing the agricultural landscape. Therefore, the magnitude of change is medium.

9.5.117 The medium magnitude of change assessed alongside the high sensitivity of these receptors will result in moderate adverse effects in winter of year 1 of operation.

9.5.118 In summer, part of the view will be further filtered by intervening vegetation; however the divide in South Cubbington Wood will remain evident due to its elevated location in relation to the receptor. Therefore the magnitude of change will remain medium, meaning the overall effects will be unchanged.

9.5.119 By year 15 the planting will have established; however views of the divide in South Cubbington Wood will remain within the field of view. Therefore, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged as moderate adverse.

9.5.120 By year 60 planting within the Proposed Scheme will have matured and in conjunction with the existing vegetation largely filter views. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 259.2.005: View north-east from residences in Cubbington and 259.2.008: View north from residences in Cubbington adjacent the B4453 Rugby Road

9.5.121 The B4453 Rugby Road and Coventry Road overbridges will be visible in the middle ground and partially filtered by intervening vegetation. Due to the increased elevation of these two roads, by approximately 6m in height, vehicles will be more visible but this change is still considered to be largely characteristic of the existing view. Therefore, the magnitude of change is considered to be medium.

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

9.5.123 In summer of year 1 of operation (and years 15 and 60), vegetation within the foreground is likely to further screen views towards the Proposed Scheme. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Viewpoint 259.3.009: View south-east from Footpath W130b and 260.3.004: View south from Footpath W130b

9.5.124 Implementation of the Proposed Scheme will result in these receptors being realigned to the B4453 Rugby Road overbridge. The proximity of this location and the landscape elements within the view compared to the baseline are considered similar. The track, trains and overhead line equipment will be visible in the foreground. This is considered to be a substantial change compared to existing views of fields. Therefore the magnitude of change is considered to be high The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in major adverse effects in winter of year 1 of operation.

9.5.125 In summer the view is considered to remain as per winter due to the open character and close proximity. Therefore, the magnitude of change is considered to remain medium meaning the overall effects will remain unchanged.

9.5.126 By year 15 and year 60 the view is considered to remain as per winter due to the open character and close proximity. Therefore, the magnitude of change is considered to remain medium meaning the overall effects will remain unchanged as major adverse.

Viewpoint 261.2.003: View east from Oakdene including Oakdene Day Nursery

9.5.127 The realigned Coventry Road will be visible in the foreground. The Coventry Road overbridge and the approach embankments will be visible in the middle ground. While this road will be higher within the field of view, by approximately 6m, it is considered to be largely characteristic of the existing view. The views of the Proposed Scheme will also be partially filtered by intervening vegetation or buildings. Therefore, the magnitude of change is considered to be medium.

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

9.5.129 In summer of year 1 of operation (and years 15 and 60), the filtering by intervening vegetation will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-017, Part 4.

Cumulative effects

9.5.130 Section 2.1 and Appendix CT-004-001 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The consequential cumulative effect of these committed developments on LCAs and viewpoints is described below. The developments are shown in Volume 5: Cross Topic Map Book, Maps CT-13-044 to CT-13-046.

9.5.131 There are no known developments that are assumed to be in operation at the same time as the Proposed Scheme, and therefore, there are no consequential cumulative effects on LCA and viewpoints.

Other mitigation measures

9.5.132 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 will 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

9.5.133 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 character of the Leamington Plateau Fringe LCA due to the earthworks being at variance to the gently undulating landform, the scale and built form of the River Leam viaduct and Offchurch auto-transformer station and the presence of major infrastructure within a predominantly rural area:

- adverse effects on the character of the Bubbenhall Plateau Farmlands LCA due to the extent of the loss of ancient woodland from South Cubbington Wood;
- adverse effect on the character of the Stoneleigh Parklands LCA due to the loss of ancient woodland and introduction of major infrastructure in the adjacent CFA18 (Stoneleigh, Kenilworth and Burton Green) which reduces the separation between Kenilworth and Coventry (the majority of this LCA is located within the adjacent CFA18);

- adverse effects on views from residences at Welsh Road Farm (249.2.010), Bunkers Hill residences (249.2.011), The Bridge (251.2.008), Valley Fields (253.2.001), Lower Grange (257.2.003) and Fields Farm (256.2.001) due to their proximity and elevated locations which will retain open views across and Proposed Scheme;
- adverse effects on recreational users of Ridgeway Lane (247.3.001 and 250.3.002), PRoW (Footpath) W125 (249.3.001), PRoW (Footpath) W192 (252.3.006), PRoW (Footpath) W129t (258.3.001), PRoW (Footpath) W129d (258.3.007) and PRoW (Footpath) W130b (259.3.009 and 260.3.004) due to their proximity and direct views of the Proposed Scheme, which will be at variance with existing views of the agricultural landscape; and
- adverse effects on transport users of Welsh Road (249.4.002 and 249.4.009), due to their close proximity and open views of the raised earthworks and high speed trains crossing the agricultural landscape.

9.5.134 Effects on viewpoints 249.4.002; 249.4.009; 249.2.010; 249.2.001; 250.3.002; 251.2.001; 251.2.002; 252.2.001; 253.2.001; 257.2.003; 258.3.001; 258.3.003; and 258.3.007 will not be significant by year 60 of operation due to the planting reaching full maturity.

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 within 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 relevance in terms of socio-economics, in relation to potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

10.1.5 The operation of the Proposed Scheme will have relevance in terms of socio-economics, in relation to the potential employment opportunities created by new business opportunities.

10.2 Scope, assumptions and limitations

10.2.1 The assessment scope, key assumptions and limitations for the socio-economics assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

10.2.2 There have been no variations to the socio-economic assessment methodology arising from engagement with stakeholders and community organisations.

10.3 Environmental baseline

Existing baseline

Study area description

10.3.1 Section 2 of this report provides a general overview of the Offchurch and Cubbington 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, and labour market within the area[45].

10.3.2 The Offchurch and Cubbington area lies wholly within the area covered by WDC.

10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)[46] to provide a profile of local communities. Volume 5: Appendix SE-002-102 shows the location of the DCA. The area contains Cubbington DCA which contains the village of Cubbington, the north-eastern edge of Leamington Spa and the area to the south of Cubbington[47].

Business and labour market

10.3.4 In terms of business activity, in 2012, Warwick District had a larger proportion of professional, scientific and technical services businesses (19%) than the West Midlands regional average (12%) and the English average (14%). Similarly at 8% information and communication account for a greater proportion of businesses in Warwick District than the wider region at 5%[48]. This is shown in Figure 6[49].

10.3.5 Approximately 81,000 people worked in Warwick District, while 600 people were employed in Cubbington DCA[50].

10.3.6 According to the ONS Business Register and Employment Survey 2011, the sector with the highest proportion of employment in Warwick District was health, though at 11% this makes up a smaller proportion of employment than the West Midlands average (14%) and the England average (12%). The professional, scientific and technical sector made up 10% of the district employment, higher than for the West Midlands (6%) and England (8%). A further key sector for employment is education (10%) which makes up the same proportion of the labour force as for the West Midlands and England (both 10%). This is shown in Figure 7. Key sectors for Cubbington DCA include production (26%), education (18%) and health (16%)[51].

[45] Further information on the socio-economics baseline, with regard to business and labour market profile, within the area is contained in the Volume 5: Appendix SE-001-000.
[46] DCAs have been determined through an understanding of local context and aim to be aligned as closely as possible to groups of lower super output areas (LSOAs).
[47] A DCA was not defined for the area of Offchurch due to a lack of population concentration in the area.
[48] Office for National Statistics (ONS) (2012), *UK Business: Activity, Size and Location 2011*, ONS, London. Please note 2011 data has been used to provide an appropriate comparison with 2011 Census data.
[49] The figure presents the proportion of businesses within each business sector in the district but not the proportion of employment by sector.
[50] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London. Please note 2011 data has been presented to provide an appropriate comparison with 2011 Census data.
[51] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.

Figure 6: Business sector composition in Warwick District and West Midlands[52]

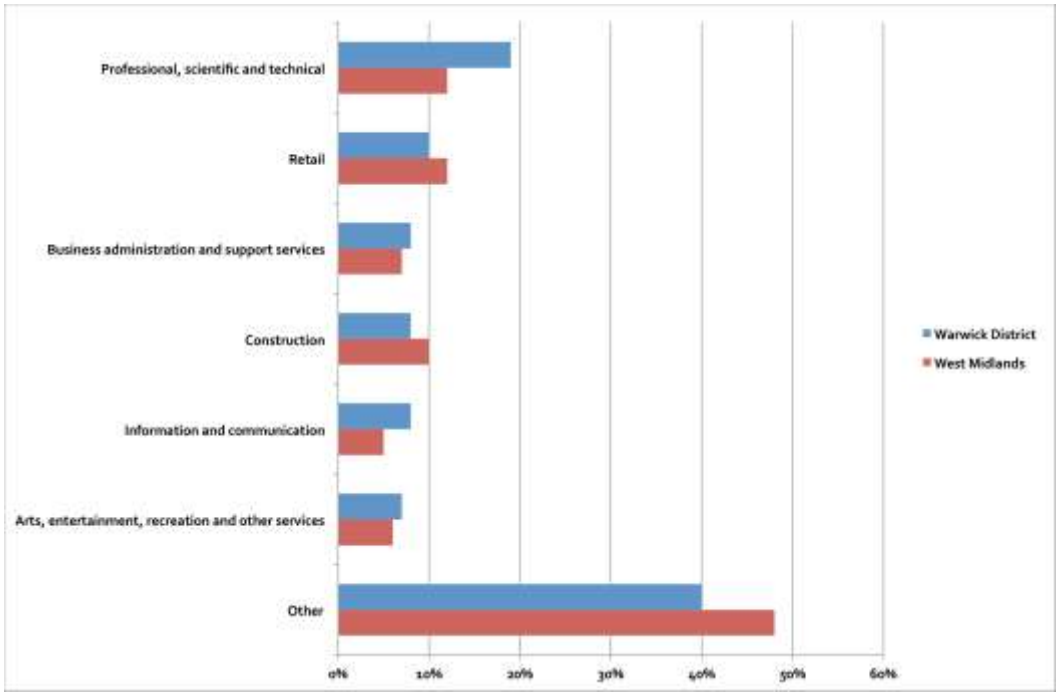
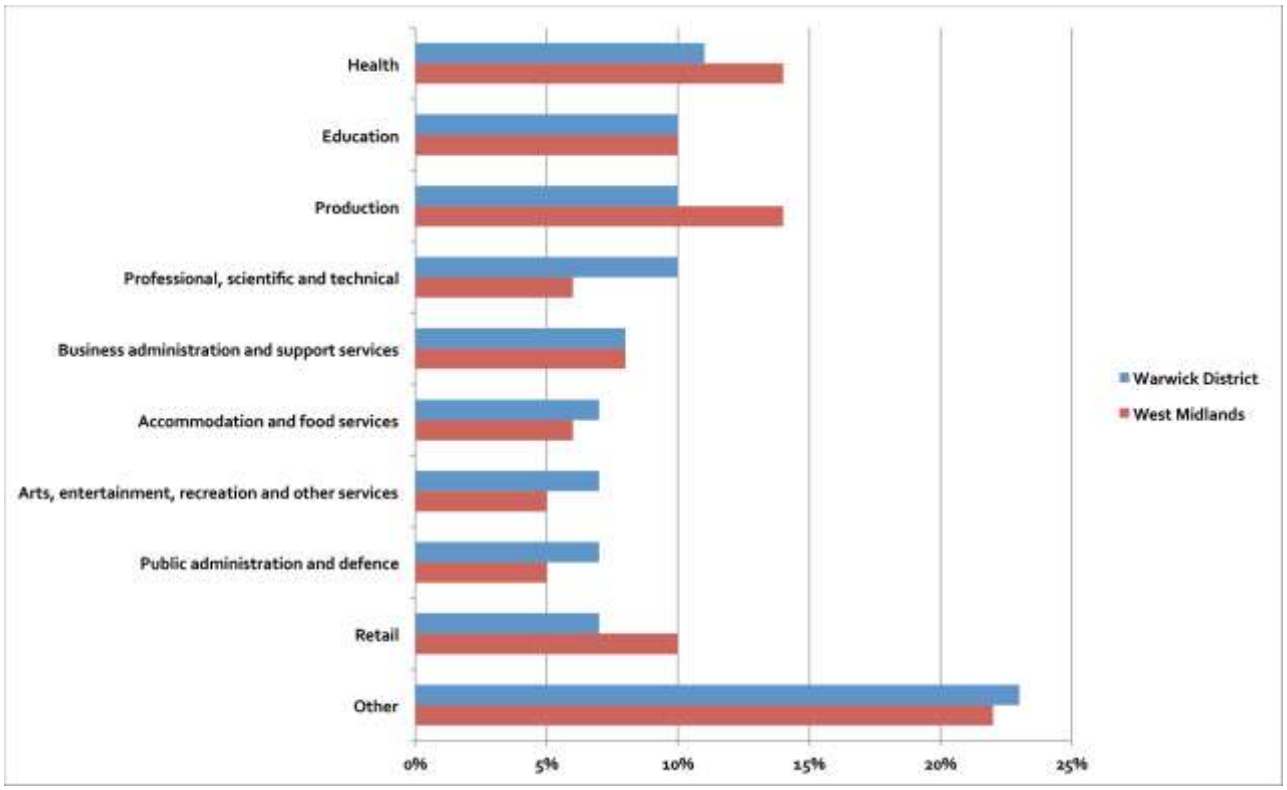


Figure 7: Employment by industrial sector in Warwick District and West Midlands[53]



10.3.7 According to the 2011 Census[54], the employment rate[55] within the district was 68% (70,000 people), which was higher than that recorded for both the West Midlands

[52] 'Other' includes motor trades; finance and insurance; property; public administration and defence; and education and health sectors.
[53] 'Other' includes agriculture, forestry & fishing; mining, quarrying & utilities; motor trades; wholesale; transport & storage; Information & communication and financial & insurance.

(62%) and England (65%). The employment rate for Cubbington DCA was also 68%. In 2011 the unemployment rate in Warwick District was 5% compared to 9% in the West Midlands and 7% in England. The unemployment rate for Cubbington DCA was 4%[56].

10.3.8 According to the 2011 Census, 38% of Warwick District residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 23% in West Midlands and 27% in England, while 16% of residents had no qualifications which was lower than that recorded both for the West Midlands (27%) and England (22%). In Cubbington DCA 31% of residents were qualified to NVQ4 and above while 23% had no qualifications.

10.3.9 Cubbington DCA is characterised by a focus of employment in the manufacturing sector. Employment and unemployment levels are similar to those at a district level.

Future baseline

Construction (2017)

10.3.10 Volume 5: Appendix CT-004-000/1 provides details of the developments which are assumed to have been implemented by 2017. No material increase in employment due to development is anticipated in the area by 2017. The existing composition and numbers of employers, employees and economic sectors in the area is likely to change over time in ways that cannot be accurately forecast.

Operation (2026)

10.3.11 Volume 5: Appendix CT-004-000/2 provides details of the developments which are assumed to have been implemented by 2026. There are no committed developments in this area which are expected to accommodate material additional 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 CoCP includes a range of provisions that will help mitigate socio-economic effects associated with construction within this local area, including:

- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (draft CoCP, Section 5);
- reducing nuisance through sensitive layout of construction sites (draft CoCP, Section 5);

[54] ONS (2012), *Census 2011*, ONS, London.
[55] The proportion of working age (16-74 years) of residents in the district that are employed. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.
[56] Unemployment figures have been rounded to the nearest whole number. DCA unemployment rates are presented for each DCA in this chapter while in Section 2 they are shown in aggregate.

- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (draft CoCP, Section 13);
- contractors being required to monitor and manage flood risk and other extreme weather events which may affect socioeconomic resources during construction (draft CoCP, Sections 5 and 16); and
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP, Section 14).

Assessment of impacts and effects

Temporary effects during construction

Change in business amenity value

10.4.3 No non-agricultural businesses[57] have been identified within the area that are expected to experience significant amenity effects as a result of the Proposed Scheme.

Isolation

10.4.4 No non-agricultural businesses have been identified within the area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

10.4.5 There are plans to locate one temporary main construction compound in the area off Fosse Way and a further seven temporary compounds to support construction activity. The use of these sites could result in the creation of up to 800 person years of construction employment opportunities[58], or approximately 80 full-time equivalent jobs[59], which, depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been assessed as part of the route wide assessment (see Volume 3).

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).

[57] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.
[58] 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.
[59] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

Permanent effects from construction

Businesses

10.4.9 Businesses directly affected, i.e. those that lie within land which will be used for the construction of the Proposed Scheme, are reported in groups where possible to form defined resources, based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses/resources are clustered together.

10.4.10 No significant direct effects on non-agricultural employment[60] have been identified within the area. The Proposed Scheme is not anticipated to result in the displacement or possible loss of jobs within this area.

Cumulative effects

10.4.11 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.12 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are dealt with as part of the route-wide assessment (Volume 3).

Other mitigation measures

10.4.13 The assessment has concluded that there are no significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.

10.4.14 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the line of route in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that fuels further economic growth across the UK.

Summary of likely significant residual effects

10.4.15 No residual significant socio-economic effects are likely to arise during construction of the Proposed Scheme within this area.

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.

[60] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.

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 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).

Cumulative effects

10.5.7 No committed developments have been identified that are considered to interact with the Proposed Scheme.

Other mitigation measures

10.5.8 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

10.5.9 No residual significant socio-economic effects are likely to arise during operation of the Proposed Scheme in this area.

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 Offchurch and Cubbington 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[61]; 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'[62].

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 Offchurch and Cubbington is available in the relevant appendices in Volume 5:

[61] '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.

[62] Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity (further information is provided in Volume 5: Appendix SV-001-000).

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-017);
- sound, noise and vibration construction assessment (Appendix SV-003-017);
- sound, noise and vibration operation assessment (Appendix SV-004-017); and
- Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5, Sound, noise and vibration Map book).

11.2 Environmental baseline

Existing baseline

11.2.1 The existing baseline sound environment for this area is consistent with it being a predominantly rural area containing a number of small communities, isolated residences and farms. Agriculture is the principal land use with both livestock and arable farms throughout.

11.2.2 The significant sound sources that traverse the area are the B4455 Fosse Way in the south and the B4453 Rugby Road in the north which provide connections between Leamington Spa and the Coventry and Rugby urban areas. Welsh Road is the main north-south route through the study area, connecting Southam to Cubbington via Offchurch. Away from these main sources, the sound environment comprises local road traffic, agricultural activities, and natural sound sources.

11.2.3 The village of Cubbington, in the north of the study area, is the largest settlement and extends to within 500m of the Proposed Scheme. Within the village, baseline sound sources are mixed. In the inner residential area, the sound environment is characterised by transportation sources, both distant (from B4453 Rugby Road and Coventry Road) and local road traffic, as well as the occasional passage of aircraft overhead. Close to the B4453 Rugby Road, road traffic dominates the sound environment during both day (daytime sound levels of around 60dB[63]) and night-time periods (45 to 50dB[64]) while at properties located on the eastern edge of the village, facing onto Church Lane, New Street and Mill Lane, the environment is characterised by natural sound sources with only sporadic local road traffic. At these properties, daytime sound levels are typically 50dB to 55dB. During the night-time the same sources generally contribute, but sound levels reduce to typically around 40dB to 45dB.

11.2.4 At the rear facade of properties located on the south eastern edge of Cubbington, adjacent to the agricultural farmland, existing baseline sound levels are subjectively low (substantially lower than 50dB daytime and/or 40dB night-time). The acoustic environment is characterised by little appreciable manmade sound.

11.2.5 The village of Offchurch is located in a rural area north of the B4455 Fosse Way and Welsh Road which passes through the village. Close to these main transportation routes, road traffic is the dominant sound source and levels are constant during both

[63] Quoted dB values at residential areas refer to the 16-hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.
[64] Night-time sound levels refer to the 8-hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr}$.

the daytime (typically 50 dB to 55 dB) and night-time periods (typically 45dB to 50dB). In areas away from the main roads, the sound environment is characterised by natural sound and sporadic distant aircraft.

11.2.6 In the agricultural areas between Offchurch and the southern limits of the study area, ambient sound levels (typically 45 dB to 50 dB during the day) are dominated by natural sources, with contributions from distant road traffic on the B4455 Fosse Way.

11.2.7 In the agricultural area between Cubbington and Offchurch and away from main roads, the sound environment is characterised by little appreciable man-made sound. Sound levels here are relatively low during both daytime (40dB to 45dB) and night (35dB to 40dB).

11.2.8 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-017.

11.2.9 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[65]. 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

11.2.10 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth. 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[66], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

11.2.11 The assessment of noise from construction activities assumes a baseline year of 2017 which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline (2012/13) and the future baseline year of 2017. The assessment of noise from construction traffic assumes a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak. Further information can be found in the Traffic and Transport assessment in Section 12.

Operation (2026)

11.2.12 The assessment is based upon the predicted change in sound levels that result from the Proposed Scheme. The assessment initially considered a worst case (that will overestimate the change in levels) by assuming that sound levels will not change from the existing baseline year of 2012/2013. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2026 to coincide

[65] Further information is available in Volume 5: Appendix SV-001-000, the SMR and its Addendum.
[66] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

with the proposed start of passenger services. The future baseline is for the sound environment that will exist in 2026 without the Proposed Scheme.

11.3 Effects arising during construction

Local assumptions and limitations

Local assumptions

11.3.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3 of this report.

11.3.2 Although it is anticipated that there may be some short periods of night-time working during road possession periods, it is expected that the noise effects will be limited in duration and hence are not considered to be significant. The management and control processes in the draft CoCP will reduce any adverse noise effects.

Local limitations

11.3.3 In this area, there are a number of locations where the land or property owners did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient information has been obtained to undertake the assessment. Further information is provided in Volume 5: Appendix SV-002-017.

Avoidance and mitigation measures

11.3.4 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP which are:

- Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA) will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings[67]; 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

[67] Warning signals that consist of bursts of noise.

construction noise and vibration including confirmation of noise insulation/temporary re-housing provision;

- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and
- contractors will be required to comply with the terms of the CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.5 In addition to this mitigation, taller screening as described in the draft CoCP[68] has been assumed along the edge of the construction site boundary adjacent to the residential communities and non-residential receptors at: Welsh Road to the eastern edge of Offchurch; eastern Cubbington; the eastern quadrant of the B4455 Fosse Way and Welsh Road crossroads; the edge of the southbound carriageway of Hunningham Road; the eastern edge of the proposed River Leam Embankment; both sides of the B4453 Rugby Road to the north east of Cubbington; the edge of the northbound carriageway of Coventry Road near Weston Wood.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.3.6 The mitigation measures will reduce noise inside all dwellings such that it does not reach a level where it will significantly affect[69] residents.

Residential receptors: direct effects – communities

11.3.7 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

11.3.8 In locations with lower existing sound levels[70], construction noise effects are likely to be caused by changes to noise levels outside dwellings. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life. However, 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 adverse effects identified are considered to be not significant.

Residential receptors: indirect effects

11.3.9 Any adverse noise effects on residential receptors from construction traffic are considered to be not significant when assessed on a community basis and taking account of local context.

[68] 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.
[69] Information is provided in the emerging National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk, – refer to the table for the noise exposure hierarchy.
[70] Further information is provided in Volume 5: Appendix SV-001-000.

Non-residential receptors: direct effects

11.3.10 Significant construction noise or vibration effects have been identified on a worst case basis on:

- Metcalfe Timber Ltd, Rugby Road (CSV17-No1). A significant noise effect has been identified during the daytime with noise levels rising at times to around 80dB[71] during the construction of the B4453 Rugby Road realignment and the Cubbington retaining wall.

Non-residential receptors: indirect effects

11.3.11 Significant noise effects on non-residential receptors arising from construction traffic are unlikely to occur in this area.

Cumulative effects from the Proposed Scheme and other committed development

11.3.12 This assessment has considered the potential cumulative construction noise effects of the proposed scheme and other committed developments. In this area, no committed developments are anticipated to 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 or vibration effects.

Summary of likely residual significant effects

11.3.13 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it will significantly affect residents.

11.3.14 The measures also reduce the effect of outdoor construction noise on the acoustic character around the local residential communities such that any adverse effects are not considered to be significant.

11.3.15 Construction traffic is unlikely to cause significant noise effects on adjacent residential and non-residential receptors.

11.3.16 On a worst case basis, noise from specific construction activities has been identified as resulting in significant residual temporary effects on a commercial property (Metcalfe Timber Ltd) located on Rugby Road, Cubbington.

11.3.17 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.

[71] Equivalent continuous sound level at the facade, L_{pAeq}, 07:00-19:00.

11.4 Effects arising during operation

Local assumptions and limitations

Local assumptions – service pattern

11.4.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based on the highest likely train flows, including the Phase Two services. Trains are expected to be 400m long during peak hours and a mix of 200m and 400m long trains at other times.

11.4.2 The expected passenger service frequency for both Phase One, and Phase One with Phase Two services are described in Volume 1[72]. As a reasonable worst case, this assessment is based upon the service pattern for Monday to Saturday including Phase Two services. Passenger services will start at or after 05:00 from the terminal stations and in this area will progressively increase to the number of trains per hour in each direction on the main lines set out in Table 16. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 16.

Table 16: Train flows and speeds

Description of line	Time period for peak daytime flows	Number of trains per hour in each direction with Phase Two services (Phase One only trains per hour in each direction is set out in brackets)	Speed
Main line between London and the north	07:00-21:00 hours	18 (14)	330kph for timetabled trains (assumed 90% of services), and 360kph for 10% of services

Avoidance and mitigation measures

11.4.3 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities. These avoidance measures have protected many communities from likely significant noise or vibration effects.

Airborne noise

11.4.4 HS2 trains will be quieter than the relevant current European Union specifications. This will include reduction of aerodynamic noise from the pantograph that otherwise will 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 operating on the new track. Further information is provided in Volume 5: Appendix SV-001-000.

11.4.5 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise 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.

[72] The change in noise and vibration effects between the different passenger services is assessed in Volume 1.

11.4.6 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.

11.4.7 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.

11.4.8 Noise effects are reduced in other locations along the line by landscape earthworks provided to avoid or reduce significant visual effects and engineering structures such as cuttings and safety fences on viaducts (where noise barriers are not required). The location of these barriers is shown on Volume 5: Map Book – Sound, noise and vibration, Map Series SV-05.

11.4.9 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements (for further information please see Volume 5: Appendix SV-001-000).

Ground-borne noise and vibration

11.4.10 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.4.11 The mitigation measures will reduce noise inside all dwellings such that it will not reach a level where it will significantly affect residents.

Residential receptors: direct effects – communities

11.4.12 The mitigation measures in this area will avoid airborne noise adverse effects on the majority of receptors, and at the following communities:

- Cubbington;
- Offchurch;
- Weston Under Wetherley; and
- the areas of Leamington Spa closest to the Proposed Scheme.

11.4.13 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2 Map book) shows the long-term 40dB[73] night-time sound level contour from the operation of

[73] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$.

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[74]. In general, below these levels adverse effects are not expected.

11.4.14 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).

11.4.15 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 the change may be considered to be significant when assessed on a community basis[75] taking account of the local context[76]. However, the assessment has not identified any adverse effects that are considered to be significant on a community basis in this area.

Residential receptors: indirect effects

11.4.16 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

Non-residential receptors: direct effects

11.4.17 The assessment of operational noise and vibration indicates that significant direct effects on non-residential receptors are unlikely to occur in this area.

Non-residential receptors: indirect effects

11.4.18 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

Summary of likely significant residual effects

11.4.19 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it will significantly affect[69] residents.

11.4.20 The mitigation measures in this area will avoid noise and vibration adverse effects[69] on the majority of receptors and communities including shared open areas such that residual significant effects are unlikely.

[74] With the train flows described in the assumptions section of this CFA Report, the daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or $_{LpAeq,day}$) from the Proposed Scheme would be approximately 10dB higher than the night-time sound level. The 40dB contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 50dB.
[75] Further information is contained in Volume 1.
[76] Further information is provided in SV-001-000 and SV-004-017.

12 Traffic and transport

12.1 Introduction

12.1.1 This traffic and transport section describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction and operation of the Proposed Scheme through the Offchurch and Cubbington 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 Volume 5: Appendix TR-001-000, Transport Assessment.

12.1.5 Figure 2 shows the location of the key transport infrastructure in this area.

12.1.6 Engagement has been undertaken with the key transport authorities including 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 study area includes the B4455 Fosse Way, the B4453 Rugby Road, Welsh Road, Ridgeway Lane, Coventry Road, Hunningham Road and Long Itchington 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 area have been determined through site visits, specially commissioned transport surveys, and liaison with Warwickshire transport authorities and stakeholders to source information on public transport, highway flows, 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 HA 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 equestrians (non-motorised users). The surveys included PRoW and roads that will cross the route of the Proposed Scheme, and additional PRoW and roads that will be affected by the Proposed Scheme. The Proposed Scheme affects seven PRoW and one E-Road (Ridgeway Lane) within the Offchurch and Cubbington area and crosses all of these. Four of these PRoW were used by less than ten people a day. The route with the greatest usage was W129d with 59 users per day.

12.3.4 There are no strategic roads that pass through the area.

12.3.5 The main local roads affected by the Proposed Scheme will be Welsh Road, which runs through the whole of the area in a south-east to north-west alignment; Ridgeway Lane, which runs in a broadly south-north direction and crosses the Grand Union Canal near Welsh Road; the B4455 Fosse Way, which runs in a south-west to north-east direction starting in Halford in the south and ending at its junction with the A5 in the north; Long Itchington Road, which runs from Radford Semele in the west of Offchurch to the B4455 Fosse Way in the east of Offchurch; Hunningham Road, which runs broadly parallel to the B4455 Fosse Way connecting Offchurch with Hunningham; the B4453 Rugby Road, which runs through Cubbington in the west and ends at its junction with Weston Lane in the east; and Coventry Road, which runs in a broadly south to north direction starting in Cubbington and ending to the east of Stoneleigh.

12.3.6 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.

12.3.7 There are two public bus services, route number 538 and 69, which pass through the Offchurch and Cubbington area. The bus services provide connections to Lillington, Cubbington, Leamington Spa, Princethrope, Hunningham and Offchurch. These services provide a maximum combined service frequency of seven buses per day between Monday and Friday. The local communities served by these bus services include:

- bus route no. 538 – Offchurch and Hunningham; and
- bus route no. 69 – Cubbington and Weston under Wetherley.

12.3.8 There are no existing national or local rail services in the area and consequently these are not considered further in this assessment.

12.3.9 There are two waterways situated within the Offchurch and Cubbington area, the Grand Union Canal and River Leam. Both will intersect with the Proposed Scheme. Only the Grand Union Canal is navigable by boat and is the only waterway considered further. A survey identified usage by four boats per hour.

Future baseline

12.3.10 Future baseline traffic volumes have been calculated by applying growth factors based on TEMPRO for the years of assessment 2021, 2026 and extrapolated to 2041, also 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)

12.3.11 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 10% by 2021 compared to 2012.

Operation (2026)

12.3.12 Future baseline traffic volumes in the peak hours are forecast to grow by around 17% by 2026 compared to 2012.

Operation (2041)

12.3.13 Future baseline traffic volumes in the peak hours are forecast to grow by around 38% by 2041 compared to 2012.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as described in Section 2.3) have been included as part of the engineering design of the Proposed Scheme 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 reasonably 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 minor diversions of traffic onto alternative routes;
- the Proposed Scheme includes permanent realignments of seven PRoW and temporary re-routeing as necessary to reduce loss of amenity;
- road closures will be limited to overnight and/or weekend;
- local highway changes on Fosse Way, to improve operations at the access to the main compound and at the junction with Welsh Road, to improve traffic conditions and accommodate increased flows;
- HGV routeing, as far as reasonably practicable, along the strategic road network and using designated routes for access, as shown in Map TR-03-102 (Volume 5, Map Book, Traffic and Transport); 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) (see Volume 5: Appendix CT-003-000) includes measures that 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 that will require travel plans to be used along with a range of potential measures to mitigate the impacts of traffic and transport movements associated with construction of the Proposed Scheme. As part of this, a construction workforce travel plan will be put into operation with the aim of reducing workforce commuting by private car, especially sole occupancy car travel. This will encourage the use of sustainable modes of transport.

12.4.4 The measures in the 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:

- 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); 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 during construction

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 CFA will be:

- construction vehicle movements to/from the main construction compound and satellite construction compounds;
- road realignments and associated overnight and/or weekend diversions; and
- PRoW diversions.

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 2.3. Construction of the Proposed Scheme. 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 17. 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 17: 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
Satellite	Welsh Road underbridge compound	Welsh Road	2018	1.5	30	40	15-30
Satellite	Longhole viaduct compound (north)	Track/haul route via Welsh Road underbridge compound	-	-	-	Few external movements	
Main	Fosse Way main compound	B4455 Fosse Way	2017	5	23	100-170	30-55
Roadhead	Fosse Way	B4455 Fosse Way	2019	2.5	20	0	200-220
Satellite	Hunningham Road overbridge compound	Hunningham Road	2018	2	13	60-65	35-50
Satellite	River Leam viaduct compound	Track/haul route via Hunningham Road Overbridge compound	-	-	-	Few external movements	
Satellite	Cubbington retaining wall compound	B4453 Rugby Road	2018	2	22	140-190	65-90
Satellite	Coventry Road overbridge compound	Coventry Road	2018	1	12	40	20

12.4.10 Details of construction phasing are provided in Section 2.3. The construction assessment considers the traffic and transport impacts and effects in two peak periods of construction activity based on the proposed phasing of the works. The peak periods have been identified as month 31 to 42 (2018 Quarter 4 to 2019 Quarter 4) when there will be five sites in operation and month 43 to 45 (2019 Quarter4 to 2020 Quarter 1) when there will be four sites in operation. Where impacts are significant in any of these periods they are identified, together with the effects of other significant changes.

12.4.11 It is envisaged that the M40 motorway, the A425 Leamington Road and the B4455 Fosse Way will provide the primary HGV access and egress routes.

12.4.12 There will be overnight and/or weekend closures on Welsh Road, the B4455 Fosse Way, Hunningham Road, the B4453 Rugby Road and Coventry Road. The effect of these measures on traffic flows and delays to vehicle occupants, as a result of the diversions or traffic congestion[77], will not be significant.

12.4.13 Part of Long Itchington Road will be permanently closed and this is considered in Section 12.5, operations effects.

12.4.14 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.

12.4.15 The main compound and Roadhead at B4455 Fosse Way are expected to generate substantial HGV movements that will use B4455 Fosse Way, the B4100 Banbury Road, and A452 to reach the M40. In addition, movement of excavated material from the neighbouring CFA16 will be routed through this area via the A425 Southam Road/Fosse Way junction.

12.4.16 There are generally no locations where increased congestion is expected to be significant within this CFA. While the increase in HGV traffic on the B4455 Fosse Way is substantial, it is not likely to result in significant congestion effects. Between Fosse Way and the M40 access, the road characteristics are such that it is expected the additional traffic can be accommodated without significant congestion effects.

12.4.17 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[78] for non-motorised users, making it more difficult to cross the roads in the following locations:

- B4455 Fosse Way, between A425 Southam Road and approximately 180m north-east of Long Itchington Road (moderate adverse effect due to increase in HGV traffic);

[77] 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.

[78] In the context of this Traffic and Transport section, severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels or a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

- B4455 Fosse Way, between A425 Southam Road and B4100 Banbury Road (major adverse effect due to increase in HGV traffic as set out in the report for CFA16);
- A425 Southam Road between B4455 Fosse Way and the River Itchen road bridge (major adverse effect due to increase in HGV traffic as set out in the report for CFA 16).
- B4100 Banbury Road from B4455 Fosse Way to A452 (major adverse effect due to increase in HGV traffic);
- Welsh Road, south of the B4455 Fosse Way to Ridgeway Lane (moderate adverse effect);
- Welsh Road, north of the B4455 Fosse Way to Hunningham Road (minor adverse effect due to increase in HGV traffic);
- Hunningham Road, between Welsh Road and Fields Farm Cottages access road (major adverse effect due to increase in HGV traffic);
- the B4453 Rugby Road, between Kenilworth Road and approximately 700m to the east of Church Lane (minor adverse effect due to increase in HGV traffic);
- Welsh Road/Long Itchington Road junction (major adverse effect due to increase in HGV traffic);
- Kenilworth Road, between B4453 Rugby Road and A445 Leicester Lane (minor adverse affect); and
- West Hill Road, between A445 Leicester Lane and B4113 Stoneleigh Road (minor adverse effect).

12.4.18 Utility works (including diversions) have been assessed in detail where they are major works and where the traffic and transport impacts from the works separately, or in combination with other works, are greater than other construction activities arising within the area. Minor utilities works are expected to have only localised impacts and be of short duration. No additional significant effects from utilities works are expected.

12.4.19 In order to access the River Leam Viaduct satellite compound the existing access track to Fields Farm and beyond 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.

12.4.20 The effect on accident and safety risks will not be significant. There are no locations where there are existing highway safety issues and where there will be substantial increases in traffic during construction.

12.4.21 It is not expected that the construction of the Proposed Scheme will require any bus route diversions, as road closures will generally occur at night, when bus services will not be operational. There will be no significant effect on bus passenger delays.

12.4.22 Construction of the Proposed Scheme is not expected to result in any loss of pedestrian links to public transport.

12.4.23 There will be increased travel distance for non-motorised users, which will have a minor adverse effect on one PRoW (Footpath W129y). The increase in journey length will be 105m. Permanent PRoW diversions will also be implemented and are reported later in this section.

12.4.24 There will be four minor adverse effects on journey ambience for non-motorised users within the Offchurch and Cubbington area. These are: Ridgeway Lane, where users will have to cross roads utilised by construction traffic, Footpaths W128 and W129y, where construction vehicles will travel alongside the PRoW and the diverted National Cycle Route 41 where this passes the main construction compound.

12.4.25 The effect of the construction of the Proposed Scheme on the Grand Union Canal is not expected to be significant since no stoppage of the waterway is proposed.

Cumulative effects

12.4.26 The assessment includes the cumulative effects of planned development during construction by taking this into account within the background traffic growth.

12.4.27 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in the neighbouring CFA areas. Construction traffic flows of 400 cars/LGV and 280 HGV per day inbound and 380 cars/LGV and 280 HGV outbound as generated from CFA16 (Ladbroke and Southam) and CFA18 (Stoneleigh, Kenilworth and Burton Green) have been included in the assessment for this area.

Permanent effects from construction

12.4.28 Any permanent effects of construction have been considered in the assessments of operation for traffic and transport in Section 12.5. This is because the impacts and effects of the forecast increases in travel demand and the wider impacts and effects of operation need to be considered together.

Other mitigation measures

12.4.29 The implementation of the draft CoCP (Volume 5: Appendix CT-003-000) in combination with the construction workforce travel plan will, to some degree, mitigate the transport related effects during construction of the Proposed Scheme. The reductions in effects arising from the travel plan measures have not been included in the assessment as presented in this section, which will mean that the adverse effects may be over-stated.

12.4.30 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered necessary, based on the outcomes of this assessment.

Summary of likely significant residual effects

12.4.31 The most intensive peak periods of construction will cause increases in traffic that will affect pedestrians, cyclists and equestrians crossing and using the B4455 Fosse Way, between Southam Road and approximately 180m north-east of Long Itchington Road; the B4455 Fosse Way, between Southam Road and B4100 Banbury Road; the A425 Southam Road, between B4455 Fosse Way and the River Itchen road bridge; the B4100 Banbury Road from B4455 Fosse Way north to A452; Welsh Road, south of the

B4455 Fosse Way up to Ridgeway Lane; Welsh Road, north of the B4455 Fosse Way up to Hunningham Lane; Hunningham Road, between Welsh Road and Fields Farm Cottages access road; the B4453 Rugby Road, between Kenilworth Road and approximately 700m to the east of Church Lane; and Welsh Road/Long Itchington Road junction.

12.4.32 One PRoW (W129y) will be temporarily affected and users will be diverted during the construction period with an increased walking distance. Permanent PRoW diversions will be implemented and are reported in Section 12.5.

12.4.33 The journey ambience of Footpaths W128 and W129 and one E-road (Ridgeway Lane) will be temporary affected during the construction of the Proposed Scheme as a result of construction traffic operating alongside the PRoW and the need for Ridgeway Lane users to cross a road utilised by construction traffic. The journey ambience of the diverted National Cycle Route 41 will also be affected where this passes the main construction compound.

12.4.34 The significant adverse effects that result from construction of the Proposed Scheme are shown in Map TR-03-102 (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, 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.

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 of this report).

12.5.3 The operational traffic and transport impacts within this CFA will be:

- permanent realignments or diversions of roads;
- permanent closure of one road;
- permanent realignments or diversions of PRoW; and
- traffic accessing the areas of the Proposed Scheme for maintenance purposes.

12.5.4 Part of Long Itchington Road will be permanently closed from Welsh Road to the B4455 Fosse Way. Traffic will be diverted via the B4455 Fosse Way and Welsh Road. The closure will cause increased journey times for road users due to the 340m increase in distance. Due to the short diversion this will have no significant effect on vehicle occupants.

12.5.5 There will be localised permanent realignments of five other roads (Welsh Road, the B4455 Fosse Way, Hunningham Road, the B4453 Rugby Road and Coventry Road), with no significant effect.

12.5.6 In 2026 and 2041, traffic flows with the Proposed Scheme are expected to be similar to those forecast without the Proposed Scheme. 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 low and will have no significant effect, including no effects on travel times or non-motorised users.

12.5.7 The effect on accident and safety risk will not be significant as there will be no substantial increases in traffic due to the operation of the Proposed Scheme.

12.5.8 The Proposed Scheme will have no significant effect on the two bus services, bus route numbers 538 and 69, which will intersect with the alignment of the Proposed Scheme. Highway realignments affecting theses services result in changes in journey length of up to 60m.There will be no significant effects on public transport within this area.

12.5.9 Six PRoW and one E-road will be realigned within this area. Of these, two Footpaths (W192 and W129d) and one E-road (Ridgeway Lane) will be realigned by less than 100m and one Footpath (W130) will be reduced in length by approximately 15m. As a result of increased travel distance, the Proposed Scheme will have a minor adverse effect on two Footpaths (W128 and W130b) with increased travel distance of 360m and 200m respectively.

12.5.10 The effects in 2041 will be the same as those in 2026.

Cumulative effects

12.5.11 The assessment includes the cumulative effects of planned development during operation by taking this into account within the background traffic growth.

12.5.12 The assessment also considers in-combination effects, but there are no transport impacts as a result of the Proposed Scheme in neighbouring CFA areas that affect this area.

Other mitigation measures

12.5.13 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on the outcomes of this assessment.

Summary of likely significant residual effects

12.5.14 Two Footpaths (W128 and W130b) will be realigned with significant increases in journey times.

12.5.15 The significant effects that result in this area from operation of the Proposed Scheme in 2026 and 2041 are shown in Map TR-04-102 (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 and future 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 Offchurch and Cubbington area (CFA17) include:

- the River Leam which is a main river that will be crossed by the Proposed Scheme
- the Grand Union Canal, an artificial water course which will be crossed by the Proposed Scheme;
- ordinary watercourses that will be crossed by the Proposed Scheme including two tributaries of the River Leam;
- Burnt Firs reservoir;
- the Bromsgrove Sandstone Formation, located in the north-west of the study area, which is classified as a Principal aquifer;
- a number of Secondary aquifers;
- numerous springs present within the study area; and
- one licensed groundwater abstraction;

13.1.3 Key environmental issues relating to water resources and flood risk include:

- the need to culvert a section of a tributary of the River Leam at Hunningham Road – Ash Beds, as well as potential associated works in floodplains;
- the potential impact of the viaduct crossings over the watercourses in this study area, specifically the River Leam at Lower Grange, a tributary of the River Leam at Longhole Bridge and the Grand Union Canal at Longhole Bridge;
- the realignment of a tributary of the River Leam at Longhole bridge, as a result of the Longhole viaduct;
- the diversion of another tributary of the River Leam at Hunningham Road – Ash Beds, as a result of straightening the watercourse for the Ash Beds culvert;
- Burnt Firs reservoir which will be drained and backfilled;
- the potential impact of changes in 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;
- Water Framework Directive (WFD)[79] compliance assessment; and
- a route-wide Flood Risk Assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within the Offchurch and Cubbington area are also contained in the Volume 5 appendices. These include:

- Appendix WR-002-017: Water Resources Assessment report;
- Appendix WR-003-017: Flood Risk Assessment; and
- Appendix WR-004-010: Offchurch and Cubbington River Modelling Report.

13.1.6 Map Series WR-01 to WR-03, WR-05 and WR-06 showing details referred to in this report and those in Volume 5 are all contained in the Volume 5: Map Book – Water resources.

13.1.7 Discussions have been held with the Environment Agency, Warwickshire County Council (WCoC) as Lead Local Flood Authority (LLFA), the Canal & River Trust (formerly British Waterways) and Warwickshire Wildlife Trust.

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-002-017 and WR-003-017. 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 these distances it is unlikely that direct impacts on 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 was made in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this 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

[79] *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water* policy, European Parliament and European Council, Strasbourg.

scheme, or within the calculated zone of influence, which therefore may be affected by the Proposed Scheme have been detailed in the baseline in this assessment.

13.2.4 A site visit was undertaken in June 2013 with the Environment Agency and WCoC to the area near to the crossing on the River Leam.

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.

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 study area are described in detail in the Volume 5: Appendix WR-003-017.

13.3 Environmental baseline

Existing baseline – surface water resources

Surface water features

13.3.1 All water bodies within this study area, with the exception of the Grand Union Canal (Braunston to Leamington Spa), fall within the Warwickshire Avon catchment that includes the River Leam. This catchment falls within the Severn River Basin District (RBD) as set out within the RBMP[80]. The Grand Union Canal is not assigned to a catchment; however, it is within the Severn RBD.

13.3.2 The current surface water baseline is shown in Volume 5: Map WR-01-028 and all surface water features within the study area are assessed within Volume 5 Appendix WR-002-017. Table 18 includes features potentially affected by the Proposed Scheme.

[80] The Environment Agency (2009), *River Basin Management Plan – Severn River Basin District*.

Table 18: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (map reference[81])	Water course classification[82]	WFD water body name and number and current overall status	WFD status objective (by 2027 as per Severn River Basin Management Plan (RBMP), unless stated)	Receptor value[83]
Tributary of River Leam	Longhole Bridge (SWC-CFA17-001) Map WR-01-028 (H6)	Ordinary watercourse	River Itchen to confluence River Avon (GB109054044140) – Moderate Status	Good Status	Moderate
Grand Union Canal	Longhole bridge (SWC-CFA17-002) Map WR-01-028 (H6)	Artificial water body	Grand Union Canal, Braunston to Leamington Spa (GB70910511) – Good Potential	Good Potential (by 2015)	High
Reservoir	Burnt Firs (SWC-CFA17-003) Map WR-01-028 (F6)	Not applicable	Not applicable	Not applicable	Moderate
Tributary of River Leam	Hunningham Road Ash Beds (SWC-CFA17-004) Map WR-01-028 (E5)	Ordinary watercourse	River Leam – confluence River Itchen to confluence River Avon (GB109054044140) – Moderate Status	Good Status	Moderate
River Leam	Lower Grange (SWC-CFA17-005) Map WR-01-028 (D5)	Main river			High
2 Ponds	Located within the land required for the construction and operation of the Proposed Scheme.	Not applicable	Not applicable	Not applicable	Low
2 Ponds	Located outside of the land required for the construction and operation of the Proposed Scheme but within the zone of influence.	Not applicable	Not applicable	Not applicable	Low

Water Framework Directive status

13.3.3 The overall WFD classification of the Grand Union Canal is good potential and the River Leam is Moderate Status. The WFD objective for both water bodies is Good

[81] Map references taken from Volume 5: Map Book – Water resources, Map WR-01-028.
[82] Water-feature classifications: Section 113 of the Water Resources Act 1991, London, Her Majesty's Stationery Office 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, London, Her Majesty's Stationery Office 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.
[83] For examples of receptor value see Table 43 in the addendum to the SMR (Volume 5 Appendix CT-001-000/2).

Potential and Status respectively. The objective is to achieve this by 2015 for the Grand Union Canal and by 2027 for the River Leam.

13.3.4 The WFD status and objectives of water bodies that are not crossed by the route are shown in Volume 5: Appendix WR-002-017.

Abstractions and permitted discharges

13.3.5 There is one location where surface water is abstracted within 1km of the Proposed Scheme in this study area, according to data from the Environment Agency, (details in Volume 5: Appendix WR-01-017).

13.3.6 Information from Warwick District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

13.3.7 There is potential for further unlicensed abstractions to exist as a licence is not required for abstractions volumes below 20 cubic metres per day.

13.3.8 Envirocheck data indicates that there are 12 current permitted surface water discharges within 1km of the Proposed Scheme in this study area (details in Volume 5: Appendix WR-002-017).

Existing baseline – groundwater resources

Geology and hydrogeology

13.3.9 The location of abstractions and geological formations are shown on Volume 5: Map WR-02-017.

13.3.10 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 19. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 19: Summary of geology and hydrogeology in CFA17

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor Value
Superficial deposits						
Thrussington Member	From Burnt Heath Farm to Furzen Hill Farm and surrounding South Cubbington Woods.	Diamicton, Clay with flints.	Unproductive strata	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Low
Baginton Sand and Gravel	From Burnt Heath Farm to Furzen Hill Farm and surrounding South Cubbington Woods.	Sands and gravel with lenses of silt and clay.	Secondary A 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 status objective (by 2027* as per RBMP)	Receptor Value
Dunsmore Gravel	From Burnt Heath Farm to Furzen Hill Farm and surrounding South Cubbington Woods.	Flinty gravel with lenses of coarse sands.	Secondary A aquifer	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate
Wolston Sand and Gravel Formation	Present immediately to the south of Offchurch Greenway and to the north and south of North and South Cubbington Woods within the CFA.	Clays, sands and gravels.	Secondary A aquifer	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate
Alluvium	Associated with major surface watercourses in this study area.	Clay, silt, sand and gravel.	Secondary A aquifer	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate
Head	To the east of Welsh Road Farm in this CFA.	Comprising poorly sorted and poorly stratified clay, silt, sand and gravel.	Secondary undifferentiated aquifer	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate
Bedrock						
Mercia Mudstone Group	Underlies the majority of the study area within the CFA.	Comprises mudstones, siltstones and sandstone	Secondary B aquifer	Warwickshire Avon – Secondary Mudrocks. (GB40902G990900) Good Status	Good Status	Moderate
Bromsgrove Sandstone Formation	Present at the northernmost edge of the CFA, between Coventry Road and Leicester Lane.	Sandstones and occasional mudstones.	Principal aquifer	Warwickshire Avon – PT Sandstone Warwick/Avon Confined. (GB40901G300700) Poor Status	Good Status	High

Superficial deposits

13.3.11 The superficial geology present above the bedrock is complex and varied. The deposits comprise of an area of head deposits; glacial deposits of the Wolston Sand and Gravel Formation and alluvium associated with watercourses such as the River Leam.

13.3.12 The groundwater vulnerability of these superficial aquifers is generally high with areas of intermediate and low vulnerability.

Bedrock aquifers

13.3.13 The Mercia Mudstone bedrock is composed of mudstones and siltstones and is classified as a Secondary B aquifer.

13.3.14 The Bromsgrove Sandstone Formation, located in the north-west of the study area, is mainly composed of sandstone and conglomerates and is classified as a Principal aquifer.

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 within the Mercia Mudstone Group in the study area is summarised in Table 19 and is largely classified as probably at risk, with overall Good Status.

13.3.18 The small area in the north of the site which is underlain by the Bromsgrove Sandstone Formation is classified as at risk, with overall Poor Status.

13.3.19 The groundwater bodies in the study area are within the Warwickshire-Avon catchment which falls within the Severn River Basin Management District.

13.3.20 The reason for the poor status is given in the RBMP for the Severn River Basin District, which states that: "For groundwater quality, the main reasons for Poor Status are high or rising nitrate concentrations with failures for pesticides and other chemicals. The main reason for poor quantitative status is that abstraction levels – mainly for drinking water – exceed the rate at which aquifers recharge."

Abstractions and permitted discharges

13.3.21 The locations of licensed abstractions within the study area are shown in Volume 5: Appendix WR-002-017, Table 4. The locations are shown on Volume 5: Map WR-02-017.

13.3.22 Environment Agency has indicated that there is one licensed groundwater abstraction within the study area (Volume 5: Map WR-02-17).

13.3.23 No unlicensed potable abstractions have been identified within the study area by Warwick District Council.

13.3.24 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.

13.3.25 A Source Protection Zone 3 (SPZ3) is designated where the Bromsgrove Sandstone Principal bedrock aquifer is present in the north of the study area (Volume 5: Map WR-02-017).

13.3.26 Envirocheck data indicates that there are two current permitted discharges to groundwater within the study area, details of which are presented in Volume 5: Appendix WR-002-017.

Surface water/groundwater interaction

13.3.27 Surface water/groundwater interaction is widespread throughout the study 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-002-017, Table 6.

13.3.28 Ponds which may potentially be affected by the Proposed Scheme are summarised in Table 18 and listed in full in Table 6 of Volume 5: Appendix WR-002-017. These ponds were assumed to be in hydraulic connectivity with groundwater, unless further assessment suggests that the ponds are situated upon low permeability strata, or lined with an impermeable layer.

Water dependent habitats

13.3.29 There are no areas with statutory ecological designations in relation to surface water or groundwater in the study area.

13.3.30 There are a number of potentially water dependent ecological sites within the Offchurch and Cubbington study area which are locally designated. These are detailed in Table 7 of Volume 5: Appendix WR-002-017 and include:

- Ash Beds local wildlife site (LWS);
- River Leam LWS; and
- South Cubbington Woods LWS.

13.3.31 Further information on ecological receptors is given in Section 7.

Existing baseline – flood risk

River flooding

13.3.32 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping[84]. This mapping has been supplemented with the use of hydraulic modelling at all locations where the Proposed Scheme will cross watercourses shown on Ordnance Survey mapping.

13.3.33 At the southern boundary of CFA17, an ordinary watercourse (SWC-CFA17-001), with a catchment area of approximately 4km^2, flows parallel to the Grand Union Canal. The flood modelling carried out for this watercourse indicates that the 1 in 100 (1%) annual probability event floodplain, with an allowance for climate change is 100m wide at the crossing location. The land use within the flood extent near to the route is less vulnerable, being arable agriculture. There are no residential properties within the flood extent near the route.

[84] Environment Agency, What's in your backyard: Risk of Flooding From Rivers and Sea, http://www.environment-agency.gov.uk/homeandleisure/37837.aspx, accessed: 24 September 2013.

13.3.34 The route is on viaduct across the River Leam as it flows between Hunningham and Offchurch. The catchment area of the watercourse draining to the location of the crossing is 315km^2. The modelling indicates that the 1 in 100 (1%) annual probability event floodplain with an allowance for climate change is approximately 170m wide at this location and the land use within the flood extent near to the route is arable agriculture and therefore categorised as less vulnerable (moderate value receptor).

13.3.35 The Environment Agency mapping and Warwickshire PFRA[85] indicates that river flooding from the River Leam has occurred at the location of the Proposed Scheme, however the date of this event was not provided for this assessment. The Warwick SFRA[86] indicates that river flooding has not occurred at the location of the Proposed Scheme; however it does identify incidents of river flooding within 1km of the route in Cubbington and Offchurch although the dates of these events are unknown.

Surface water flooding

13.3.36 The agreed data set for surface water flooding is the Environment Agency's Flood Map for Surface Water (FMfSW), as shown on Volume 5: Maps WR-01-028 and 029.

13.3.37 These maps have been reviewed to form the basis of the assessment of the impact of the Proposed Scheme on the risk of surface water flooding.

13.3.38 The Flood Maps for Surface Water show two rainfall events, the 1 in 30 (3.3%) and the 1 in 200 (0.5%) annual probability events. The areas susceptible to surface water flooding during the 1 in 200 (0.5%) annual probability event are shown on Volume 5: WR-01-028 and 029. The maps show areas currently at risk of surface water flooding and where surface water is generally collected in low points in topography, such as open drainage channel networks associated with the watercourses in the Offchurch and Cubbington area.

13.3.39 Four areas identified to be at risk of surface water flooding are classed to be at a high risk and two locations have been 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 (e.g. low spots where water collects).

13.3.40 Flooding in areas that are associated with watercourses is generally considered to be dominated by river flood risk. Therefore these areas at risk are discussed in further detail in the river flooding sections above.

13.3.41 In this study area there is one location where overland flow paths are evident on the Environment Agency FMfSW. This is in the northern area of this study area near Burnt Firs Reservoir (Volume 5: Map WR-01-028, SWC-CFA17-009).

[85] Warwickshire County Council (2011), *Warwickshire Preliminary Flood Risk Assessment*. Completed by Royal Haskoning on behalf of Warwickshire County Council.
[86] Warwick District Council (2013), *Warwick Level 1 Strategic Flood Risk Assessment. Volume 1* Produced by Mouchel.

13.3.42 The Environment Agency Mapping, Warwick SFRA and the Warwickshire PFRA indicate that there have been no historical incidents of surface water flooding within the study area

Sewer flooding

13.3.43 The agreed datasets for sewer flooding are the Warwick SFRA, and the Warwickshire PFRA. In this study area, Severn Trent Water asset mapping has also been used.

13.3.44 There are two locations where the Proposed Scheme will either cross or be close to the sewer network. These locations are listed in Section 6.5 of the FRA (Volume 5: Appendix WR-003-017). However, owing to the topography of the area, there are no known flow paths from surcharge points to the Proposed Scheme and the Proposed Scheme will not alter the risk of sewer flooding.

13.3.45 Therefore it is concluded that there is a low risk of flooding from the sewer network.

13.3.46 The Environment Agency Mapping, Warwick SFRA and the Warwickshire PFRA indicate that there have been no historical incidents of sewer flooding within the study area.

Artificial water bodies

13.3.47 The agreed data set for reservoir flooding is the Environment Agency reservoir inundation mapping[87] (reservoir flood risk). OS mapping has been used to determine the location of canals within the study area.

13.3.48 Flooding from artificial drainage systems may occur from failure of a retaining structure that impounds water. The following man made features have been identified within the FRA (Volume 5: Appendix WR-003-017) as being a potential source of flood risk:

- the canal system; and
- reservoir failure.

13.3.49 There is one canal which is crossed by the route in this study area. This is the Grand Union Canal (Volume 5: Map WR-01-028, SWC-CFA17-002) which is crossed by the Longhole viaduct at Volume 5: Map WR-01-028). Topographic data indicates that the canal is not raised above surrounding ground level and hence there is no risk of structural breaching when the water level is maintained at the design level. However there is a small embankment which could be overtopped if water levels rise above the design level. Water levels within canals are maintained and therefore it is unlikely that overtopping will occur. The Proposed Scheme will not increase the risk of flooding from this source as no works that will affect the integrity of the canal are proposed. The residual risk from this source of flooding is low.

13.3.50 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 water body that is listed in the Environment Agency reservoir inundation maps where the flood risk may be impacted because of the

[87] Environment Agency, What's in your backyard: Risk of Flooding from Reservoirs, http://www.environment-agency.gov.uk/homeandleisure/37837.aspx, accessed: 24 September 2013.

Proposed Scheme. This is the Draycote Reservoir which will pose a risk within the River Leam floodplain (Volume 5: Map WR-01-028). However, the data provided does not indicate flood depths, flow velocities or the time taken for onset of flooding after a breach takes place.

13.3.51 Draycote Reservoir is located in excess of 10km upstream of the Proposed Scheme and hence it is assumed that the flood water will be at a low velocity when it reaches the Proposed Scheme. Low velocity flood water is likely to cause less damage and pose a lower risk to life. In addition the Environment Agency reservoir inundation maps broadly follow the areas at risk of river flooding in this area.

13.3.52 Due to the strict regulations and high level of maintenance associated with reservoirs, breaching is considered very unlikely and the works associated with the Proposed Scheme will not increase the risk of failure. 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.

13.3.53 Burnt Firs Reservoir is not a designated reservoir, and hence is not included in the Environment Agency reservoir inundation mapping. This water body will be infilled as part of the Proposed Scheme and therefore will not pose a risk either to the Proposed Scheme or elsewhere. Therefore this water body is not considered further in relation to flood risk.

13.3.54 The Environment Agency Mapping, Warwick SFRA and the Warwickshire PFRA indicate that there have been no historical incidents of canal or reservoir flooding either at the location of the route or within 1km of the route.

Groundwater flooding

13.3.55 The agreed data set for groundwater flooding is the Warwickshire Strategic Flood Risk Assessment (SFRA)[88]. The Warwickshire SFRA suggested there are no known major problems with flooding from groundwater within Warwickshire.

Future baseline

13.3.56 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. The potential cumulative effects arising from committed developments in relation to water resources and flood risk have been considered as part of this assessment of the construction and operation of the Proposed Scheme.

13.3.57 All committed developments are required to comply with the NPPF[89], 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.

[88] Halcrow Group Limited (2008), *Warwickshire County Council, Strategic Flood Risk Assessment for Local Development Framework. Level 1 Volume 1. P41.*
[89] Department for Communities and Local Government (2012), *National Planning Policy Framework Technical Guidance*.

13.3.58 WFD future status objectives are set out in Table 18 and Table 19. This potential change in baseline is not considered to result in the effects from the Proposed Scheme changing in significance.

13.3.59 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

13.3.60 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 in this section, these changes are not considered to result in the reported effects from the Proposed Scheme changing in significance.

13.3.61 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.

13.3.62 When considering the influence that climate change may have on the future baseline, against which impacts from the Proposed Scheme on flood risk have been evaluated, the assessment has used the recommended precautionary sensitivity ranges of key parameters, as given in Table 5 in the Technical Guidance to the NPPF. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

13.3.63 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Section 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 presented in Volume 5: Appendix WR-002-017 and WR-003-017.

13.4.3 It is proposed to culvert a section of a tributary of the River Leam at Hunningham Road – Ash Beds (Volume 5: Map WR-01-028, SWC-CFA17-004).

13.4.4 Culvert length will be minimised wherever possible and will be designed with invert levels below the firm bed of the watercourse to negate the impact on flows and sediment transfer. Consideration will be given to providing 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)[90] and Environment Agency guidance and in consultation with the Environment Agency. The mitigation specifically for the ecology of the watercourses is considered in Section 7, Ecology.

13.4.5 The Proposed Scheme will realign a section of a tributary of the River Leam at Longhole Bridge (Volume 5: Map WR-01-028, SWC-CFA17-001) around the proposed embankment for the viaduct at that location as well as a section of a second tributary of the River Leam which will be culverted at Ash Beds (Volume 5: Map WR-01-028, SWC-CFA17-004).

13.4.6 Consideration will be given in the design to the objectives of the WFD as described in the RBMP. 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 the study area surface water discharges are proposed to:

- the Grand Union Canal (Volume 5: Map WR-01-028, SWC-CFA17-002);
- tributaries of the River Leam at Longhole Bridge and at Hunningham Road – Ash Beds (Volume 5: Map WR-01-028, SWC-CFA17-001, SWC-CFA17-004); and
- the River Leam at Lower Grange (Volume 5: Map WR-01-028, SWC-CFA17-005).

13.4.8 Discharges of railway run-off will be predominantly restricted with balancing ponds to emulate the existing environment by reducing run-off to greenfield rates where reasonably practicable.

13.4.9 Realignments of five minor roads (B4453 Rugby Road, Coventry Road, B4455 Fosse Way, Welsh Road and Hunningham Road) are required as part of the Proposed Scheme in the study area. The receiving watercourses for road run-off are as follows:

- the Grand Union Canal (Volume 5: Map WR-01-028, SWC-CFA17-002) to which runoff from Welsh Road outfalls;
- a tributary of the River Leam at Hunningham Road – Ash Beds to which runoff from Hunningham Road outfalls;
- the River Leam at Lower Grange to which it is assumed Rugby Road outfalls; and
- Coventry Road and the B4455 Fosse Way are assumed to drain to ground through appropriate SuDS.

13.4.10 Appropriate sustainable drainage mitigation will be provided for minor roads to address the risks to the receiving surface watercourses (for both flow and water quality) and will be selected using the Design Manual for Roads and Bridges and

[90] CIRIA (2010), *C689 Culvert Design and Operation Guide*.

CIRIA[91] guidance. For the major roads, (identified through the application of the SMR), detailed assessments will be made using the guidance from the Design Manual for Roads and Bridges through the detailed design phase. Initial assessments using the Highways Agency Water Risk Assessment Tool (HAWRAT) are shown in Volume 5, Appendix WR-002-022.

13.4.11 Two viaducts, Longhole viaduct and River Leam viaduct, are located within this area. These avoid the requirement for culverts and, therefore, allow the watercourse to remain within its existing channel.

13.4.12 The alignment has been raised at the southern end of Offchurch cutting by approximately 3m and this has reduced the extent of the zone of influence created through dewatering of the aquifer.

13.4.13 The alignment has been raised in Cubbington retained cutting and Lower Grange cutting which reduces the drawdown which in turn reduces the zone of influence and the extent of impact from the dewatering of these cuttings.

13.4.14 Sustainable drainage systems (SuDS) and infiltration trenches will be implemented to facilitate recharge to the groundwater to help maintain groundwater levels within the Principal and Secondary aquifers and minimise any effects on springs, issues, abstractions and groundwater dependent ecosystems. These SuDS and infiltration trenches will be located in areas where gravity transfer is achievable, having due regard to Environment Agency guidelines[92].

13.4.15 Replacement floodplain storage will be provided to mitigate the impact of the Proposed Scheme on river flood risk. At the watercourse crossings, areas of land have been identified as suitable to provide replacement floodplain storage, therefore reducing the change in flood level.

13.4.16 Where the Proposed Scheme will interrupt surface water flow paths, the proposed drainage will be designed to intercept and manage this water. This will be achieved through collecting water in the proposed drainage and/or balancing pond prior to being discharge to the associated watercourse. This will allow the water to follow similar path to the existing situation.

13.4.17 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 (see Volume 5: Appendix CT-003-000/1). It will provide effective management and control of the impacts during the construction period.

13.4.18 The following measures in the draft CoCP Section 16 will reduce potentially significant adverse 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;

[91] CIRIA (2006), c648 *Control of water pollution from linear construction projects*.
[92] Environment Agency (2013), *Groundwater: Protection: Principles and practice*.

- spill kits will also be provided where appropriate, such as at the 11 worksites and satellite compounds; Offchurch auto-transformer station; and Fosse Way compound 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; and
- appropriate measures such as use of bunds of non-erodible material or silt or sediment fences adjacent to watercourses such as the River Leam.

13.4.19 Measures defined in the CoCP Section 16 will reduce the risk of the works causing an increase in river flood risk through constricting and altering flood flow paths.

13.4.20 Measures defined in the 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.

13.4.21 In accordance with the draft CoCP, Section 16, monitoring will be undertaken in consultation with the Environment Agency prior to, during and after construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed temporary and permanent mitigation measures.

13.4.22 There are two satellite construction compounds within this area that are located in areas at risk from surface water flooding. In addition all these sites have the potential to increase flood risk from this source due to reduced infiltration capacity of the ground. Whilst overland flow routes may be altered by the presence of the construction sites, the measures set out within the draft CoCP Section 16 (requiring construction works proposals to manage all flood risk appropriately), will effectively manage site drainage so that the effects to surface water flooding will be negligible.

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-002-017 and FRA in Volume 5: Appendix WR-003-017.

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 and groundwater resources (see Volume 3: Route-wide Effects Assessment for further information).

Temporary effects during construction

Surface water

13.4.27 The assessment shows that there will be no significant temporary adverse effects on surface water features during the construction period.

13.4.28 As no significant temporary effects on surface water features have been identified in the assessment, no significant adverse effects on abstractions or discharges will arise.

Groundwater

13.4.29 The assessment shows that there will be no likely significant temporary adverse effects on groundwater, on licensed abstractions and permitted discharges, or on surface water/groundwater interaction.

13.4.30 The assessment shows that there will be no likely temporary significant effects on water dependent habitats.

Flood risk

13.4.31 The assessment has identified no significant increase in risks resulting from all sources of flood risk during the construction process and therefore no significant temporary effects will arise.

Cumulative effects

13.4.32 No committed developments have been identified that will result in significant cumulative effects.

Permanent effects from construction

Surface water

13.4.33 The assessment shows that there will be a residual permanent significant effect from the loss of Burnt Firs reservoir (Volume 5: Map WR-01-028, SWC-CFA17-003) which is a winter storage reservoir/surface water abstraction, used for irrigation. This is a moderate value receptor. The reservoir will be drained to an appropriate water feature at a controlled rate and backfilled as it is on the direct line of the route, resulting in a major impact due to loss of the attribute. This results in a large adverse effect which is significant.

13.4.34 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-002-017.

Groundwater

13.4.35 The assessment shows that there will be no likely significant permanent adverse effects on groundwater, on abstractions and permitted discharges or on surface water/groundwater interaction.

13.4.36 The assessment shows there will be no likely permanent significant effects to water dependent habitats.

Flood risk

13.4.37 The assessment shows that there will be no permanent adverse significant effects on flood risk as a result of the Proposed Scheme.

13.4.38 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-003-017.

Cumulative effects

13.4.39 There are no committed developments that have been identified that will result in significant cumulative permanent effects.

Other mitigation measures

13.4.40 No other mitigation measures are envisaged for surface water, groundwater or flooding.

Summary of likely significant residual effects

13.4.41 There will be a large significant residual effect due to the loss of Burnt Firs reservoir, a winter storage reservoir used for irrigation.

13.4.42 The assessment shows that there will be no residual significant effects for groundwater resources and flood risk during the construction period.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 Generic examples of design measures that will reduce potentially significant effects on the quality and flow characteristics of surface watercourses and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1.

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 run-off 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 mitigation measures required for surface water resources, groundwater resources or flood risk.

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