

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA15 | Greatworth to Lower Boddington

November 2013

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Department
for Transport

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Structure of the HS2 Phase One Environmental Statement

The Environmental Statement (ES) documentation comprises:

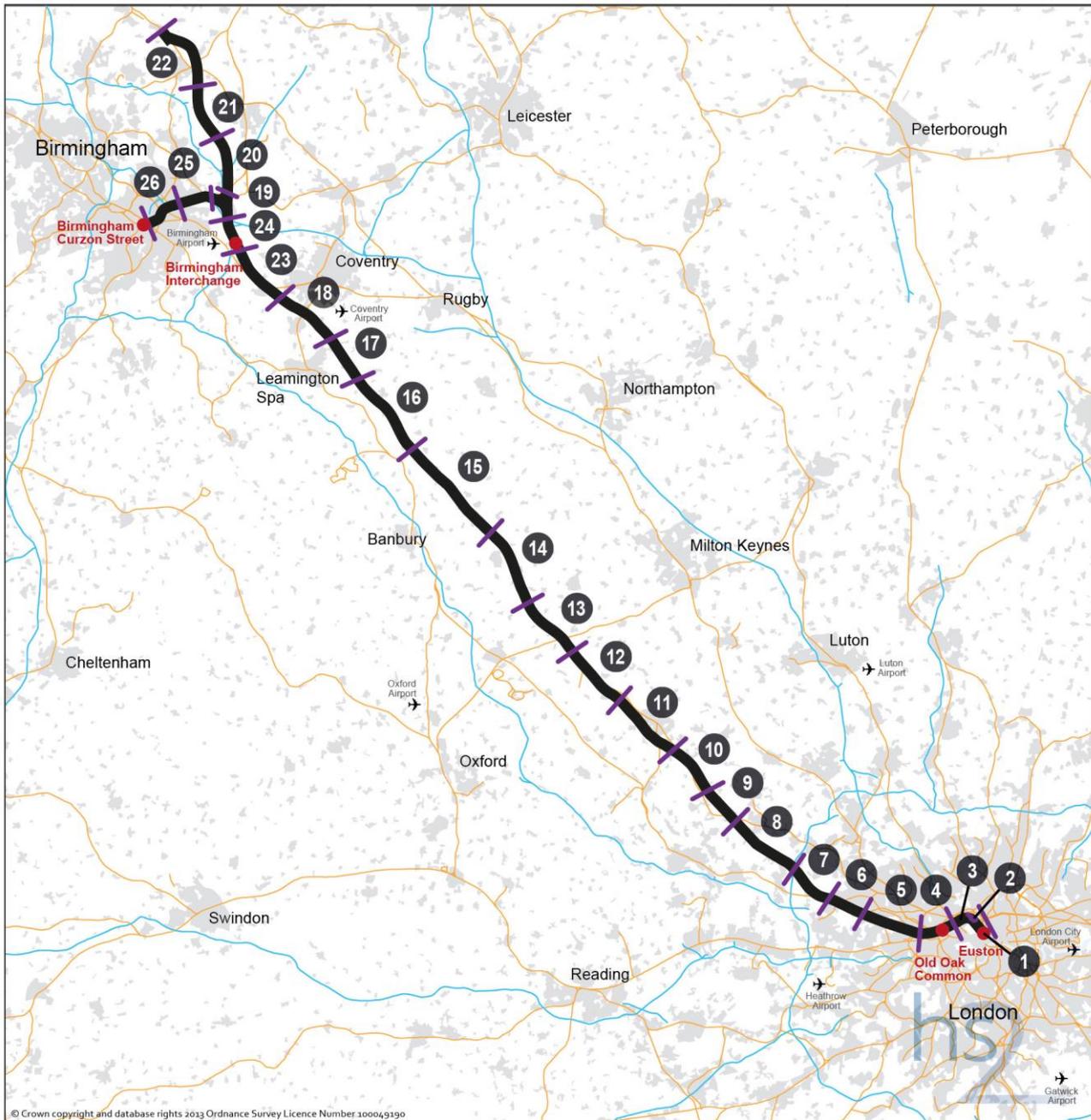
- Non-technical summary (NTS) – which provides a summary in non-technical language of the Proposed Scheme, the likely significant environmental effects of the Proposed Scheme, both beneficial and adverse, and the means to avoid or reduce the adverse effects;
- Volume 1: Introduction to the ES and the 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 local alternatives and the likely significant environmental effects in each area;
- Volume 3: Route-wide effects – provides an assessment of the effects of the Proposed Scheme where it is not practicable to describe them within the CFA descriptions in Volume 2;
- Volume 4: Off-route effects – provides an assessment of the off-route effects of the Proposed Scheme;
- Volume 5: Appendices and map books – contains supporting environmental information and associated map books; and
- Glossary of terms and list of abbreviations – contains terms and abbreviations, including units of measurement, used throughout the ES documentation.

1 Introduction

1.1 Introduction to HS2

- 1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester, South Yorkshire and the East Midlands will be served by high speed trains running at speeds of up to 360kph (225mph).
- 1.1.2 HS2 is proposed to be built in two phases. Phase One, the subject of this ES, will involve the construction of a new railway line of approximately 230km (143 miles) between London and Birmingham. Construction will begin in 2017 and the line will become operational by 2026; with a connection to the West Coast Main Line (WCML) near Lichfield and to the existing HS1 railway line in London.
- 1.1.3 During Phase One beyond the dedicated high speed track, high speed trains will connect with and run on the existing WCML to serve passengers beyond the HS2 network to destinations in the north. A connection to HS1 will also allow some services to access that high speed line through east London and Kent and connect with mainland Europe via the Channel Tunnel.
- 1.1.4 Phase Two will involve the construction of lines from Birmingham to Leeds and Manchester; with construction commencing approximately 2023, and planned to be operational by 2033.
- 1.1.5 Section 4 of Volume 1 describes the anticipated operational characteristics of HS2, including the anticipated frequency of train services. As Volume 1 shows, the frequency of trains is expected to increase over time and to increase further upon opening of Phase Two. In assessing the environmental effects of the Proposed Scheme the anticipated Phase 2 operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Greatworth to Lower Boddington area (CFA15), see Section 2.4.
- 1.1.6 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish its final report on recommended options for maintaining the country's status as an international aviation hub.
- 1.1.7 For consultation and environmental assessment purposes, the proposed Phase One route has been divided into 26 community forum areas (CFA), as shown in Figure 1. This has enabled wider public engagement on the Proposed Scheme design and on the likely adverse and beneficial effects.

Figure 1: HS2 Phase One route and community forum areas



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Community forum areas		
1 Euston - Station and Approach	14 Newton Purcell to Brackley	● HS2 station
2 Camden Town and HS1 Link	15 Greatworth to Lower Boddington	▬ Proposed Phase One route
3 Primrose Hill to Kilburn (Camden)	16 Ladbroke and Southam	- - - CFA boundary
4 Kilburn (Brent) to Old Oak Common	17 Offchurch and Cubbington	— Existing railways
5 Northolt Corridor	18 Stoneleigh, Kenilworth and Burton Green	— Motorways
6 South Ruislip to Ickenham	19 Coleshill Junction	✈ Airports
7 Colne Valley	20 Curdworth to Middleton	
8 The Chalfonts and Amersham	21 Drayton Bassett, Hints and Weeford	
9 Central Chilterns	22 Whittington to Handsacre	
10 Dunsmore, Wendover and Halton	23 Balsall Common and Hampton-in-Arden	
11 Stoke Mandeville and Aylesbury	24 Birmingham Interchange and Chelmsley Wood	
12 Waddesdon and Quainton	25 Castle Bromwich and Bromford	
13 Calvert, Steeple Claydon, Twyford and Chetwode	26 Washwood Heath to Curzon Street	





1.2 Purpose of this report

- 1.2.1 This report presents the likely significant environmental effects of the construction and operation of the Proposed Scheme on the environment within CFA15 (Greatworth to Lower Boddington). 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 CFA15.

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 6 of the

SMR Addendum also include additional information about climate change adaptation and resilience.

- 1.3.5 The maps relevant to Greatworth to Lower Boddington are provided in a separate corresponding document entitled Volume 2: CFA15 Map Book, which should be read in conjunction with this report.
- 1.3.6 The Proposed Scheme described in this report is that shown on the Map Series CT-05 (construction) (Volume 2, CFA15 Map Book) and CT-06 (operation) (Volume 2, CFA15 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

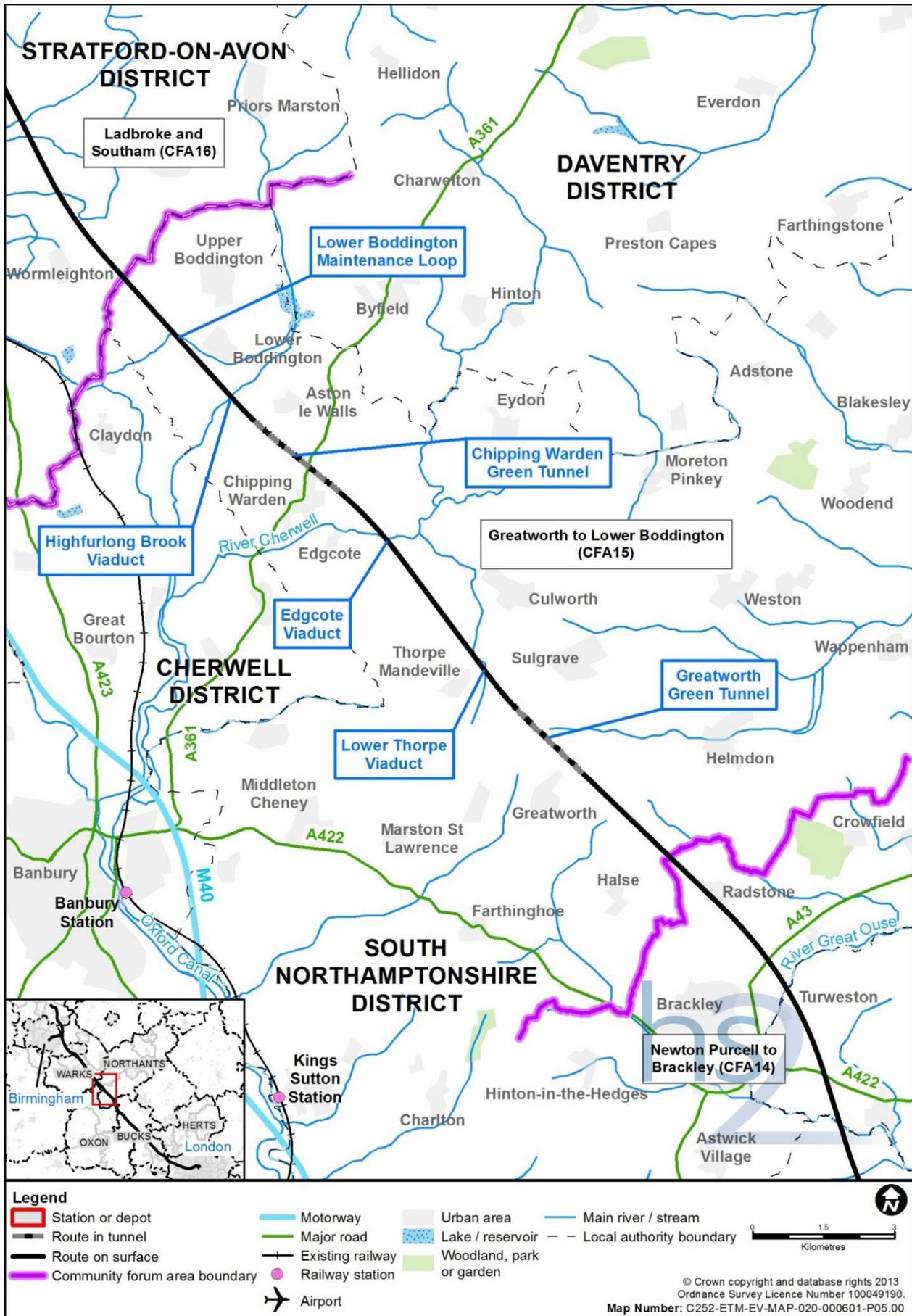
2.1 Overview of the area

- 2.1.1 The Greatworth to Lower Boddington CFA covers approximately 17km of the Proposed Scheme in the district of South Northamptonshire. It extends from south-east of Halse Copse South, near Radstone, in the south to the Northamptonshire and Warwickshire county boundary in the north.
- 2.1.2 The area includes the district council wards of Greatworth, Marston St Lawrence, Thorpe Mandeville, Culworth, Chipping Warden and Edgcote, Aston le Walls and Boddington. It extends from the boundary between Radstone and Greatworth parishes to the intersection of Boddington and Wormleighton parishes in the north-west.
- 2.1.3 Newton Purcell to Brackley (CFA14) lies to the south and Ladbroke and Southam (CFA16) lies to the north, as shown in Figure 2. Throughout the area, HS2 will run broadly parallel with the M1 and the M40, which, at their nearest points are approximately 21km to the east and 7km to the west of the route, respectively. Other main transport routes include the A361 Byfield Road, which crosses north-south through the northern section of the area, linking the M40 at Banbury to Daventry via Chipping Warden, where it crosses the Proposed Scheme.
- 2.1.4 In addition, Welsh Road/Banbury Road runs alongside, and to the east of, the Proposed Scheme from Culworth northwards. The B4525 runs adjacent to the Proposed Scheme from Thorpe Mandeville southwards, crossing it at Greatworth.
- 2.1.5 There are five long distance footpaths that cross the route in the area. The area is also crossed by numerous local access roads and public rights of way (PRoW), which provide important links between the scattered rural dwellings and villages throughout the area.

Settlement, land use and topography

- 2.1.6 The Greatworth to Lower Boddington area is predominantly rural in character, with agriculture being the main land use. The agricultural land is interspersed with small villages and a scattering of isolated dwellings and farmsteads (see Map Series CT-10 (Volume 2, CFA15 Map Book)).
- 2.1.7 Ground levels rise from the southern boundary of the area towards the village of Greatworth, which lies just to the west of the line of HS2, before descending at Thorpe Mandeville to cross the floodplain of the River Cherwell, approximately 800m east of the settlement of Edgcote.
- 2.1.8 North of the River Cherwell, the land rises towards Chipping Warden before descending over a ridge at Aston le Walls into the floodplain of the Highfurlong Brook. North of the Highfurlong Brook the land is flat, with higher land towards the east around the villages of Lower and Upper Boddington, which lie approximately 500m and 1.2km away from the line of HS2, respectively.

Figure 2: Area context map



Key transport infrastructure

- 2.1.9 Throughout the area, HS2 will run broadly parallel with the M1 and the M40, which, at their nearest points are approximately 21km to the east and 7km to the west of the route, respectively. Other main transport routes include the A361 Byfield Road, which crosses north-south through the northern section of the area, linking the M40 at Banbury to Daventry via Chipping Warden, where it crosses the Proposed Scheme.
- 2.1.10 In addition, Welsh Road/Banbury Road runs alongside, and to the east of, the Proposed Scheme from Culworth northwards. The B4525 runs adjacent to the Proposed Scheme from Thorpe Mandeville southwards, crossing it at Greatworth.
- 2.1.11 There are five long distance footpaths that cross the route in the area. The area is also crossed by numerous local access roads and public rights of way (PRoW), which provide important links between the scattered rural dwellings and villages throughout the area.

Socio-economic profile

- 2.1.12 To provide a socio-economic context for the area, data for the following demographic character areas (DCA) are used: Greatworth; Thorpe Mandeville; Culworth; Aston le Walls; Lower and Upper Boddington; and Edgcote and Chipping Warden¹. In total, the population of the DCA is approximately 3,100 highlighting the low population density and rural nature of the area. The area's labour market outperforms England's as a whole; unemployment at 3.0% is significantly lower than the national level of 7.4%, while 72.9% of the population aged 16-74 is economically active compared to the national figure of 69.9%². There are approximately 1,200 people who work within the area³.

Notable community facilities

- 2.1.13 There are a number of community facilities in the villages of Greatworth and Chipping Warden, with a small number of facilities in the villages of Thorpe Mandeville, Sulgrave, Culworth, Aston le Walls and Lower Boddington. The town of Banbury lies approximately 8km to the west of HS2, and contains a larger range of shops, services and community facilities.
- 2.1.14 Greatworth has a primary school, sports and social club, two churches, a recreation ground, a public house called The Inn and a village store and post office. Chipping Warden includes Chipping Warden Primary School, a village hall and recreation ground off Culworth Road, the Wesleyan Chapel, a church, allotments and two public houses – The Griffin and the Rose and Crown.
- 2.1.15 In Thorpe Mandeville there is Church of St John the Baptist and a public house called The Three Conies. In Sulgrave there is the Church of St James the Less, and The Star Inn public house. St Mary's Church and Culworth Church of England Primary School are located in Culworth. The village of Aston le Walls has a primary school, St Mary's Catholic Primary School and two churches – St Leonard's Church and the Parish of

¹A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).

²Data are taken from the Office for National Statistics (ONS), Population Census 2011.

³Data are taken from the ONS Business Register and Employment Survey 2011.

The Sacred Heart & Our Lady. The only major community facility in Lower Boddington is a public house called The Carpenters Arms.

Recreation, leisure and open space

- 2.1.16 The Greatworth to Lower Boddington area is predominantly rural, with large areas of open space and woodland, and a small number of recreation grounds in surrounding towns and villages. Calves Close Spinney (woodland) contains derelict buildings, some of which are associated with the nearby former Royal Air Force World War II airfield.
- 2.1.17 Glyn Davies Nature Reserve (part of Fox Covert) is managed by the Banbury Ornithological Society. It is accessible to the approximately 120 members of the society throughout the year for bird watching and to record other wildlife, such as butterflies or bats.
- 2.1.18 There are several long-distance trails that run through the area. A number of these connect the surrounding settlements. The Macmillan Way, the Battlefields Walk and Battlefields Trail, the Millennium Way and the Jurassic Way are long-distance walking routes promoted by South Northamptonshire District Council.

Policy and planning context

Planning framework

- 2.1.19 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.
- 2.1.20 The following local policies have been considered and referred to where appropriate to the assessment:
- Northamptonshire County Council Minerals and Waste Core Strategy DPD (MWCS)⁴;
 - Northamptonshire County Council Control and Management of Development DPD⁵;
 - West Northamptonshire Joint Planning Unit⁶ Joint Core Strategy (JCS) Significant Proposed Changes (2012)⁷;
 - South Northamptonshire District Council Local Plan Saved Policies (2007)⁸;
 - Cherwell District Council Local Plan Saved Policies (2007)⁹;

⁴ Northamptonshire County Council (2010), *Minerals and Waste Core Strategy Development Plan Document*.

⁵ Northamptonshire County Council (2011), *Control and Management of Development DPD*.

⁶ Councillors from Daventry District Council, Northampton Borough Council, South Northamptonshire Council and Northamptonshire County Council.

⁷ West Northamptonshire Joint Planning Unit (2012), *Proposed Changes to the West Northamptonshire Joint Core Strategy Pre-Submission – Schedule 1: Significant Proposed Changes*.

⁸ South Northamptonshire District Council (1997), *Adopted Local Plan, Saved Policies*.

⁹ Cherwell District Council (1996), *Adopted Local Plan, Saved Policies*.

- Cherwell District Council Non-Statutory Cherwell Local Plan (2011)¹⁰;
- Cherwell District Council Proposed Submission Local Plan (2012)¹¹;
- Cherwell District Council Proposed Submission Focused Consultation (2013)¹²; and
- Daventry District Council Local Plan Saved Policies (2007)¹³.

2.1.21 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 Joint Core Strategy of the West Northamptonshire Joint Planning Unit (which encompasses South Northamptonshire Council), submitted to the Secretary of State for examination in December 2012¹⁴. It should be noted that the JCS is currently undergoing examination. Additional work is now being undertaken by the Joint Planning Unit, and hearings on the JCS are expected to resume in December 2013.

2.1.22 There are a number of key planning designations in the area, which include conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens and ancient woodland. These are shown on Maps CT-13-035 to CT-13-041 (Volume 5, Cross Topic Appendix 1 Map Book).

Committed development

2.1.23 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown on Map Series CT-035 to CT-13-041 (Volume 5, Cross Topic Appendix 1 Map Book) and listed in Volume 5: Appendix CT-004-000. Except where noted otherwise in Appendix CT-004-000, it has been assumed that these developments will have been completed by 2017. These are termed 'committed developments' and have been taken into account for the purpose of assessing the likely significant environmental effects of the Proposed Scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic. The following development is relevant to several topic assessments in this area: photovoltaic park, East of Banbury Lane, Culworth Grounds Farm, Thorpe Mandeville, Banbury, OX17 2HW (ref: S/2011/0314/MAF).

2.1.24 However, where a committed development lies wholly or partly within the land required for the Proposed Scheme, it is assumed that the development will not be commenced or completed in its proposed form. Such developments are noted in Volume 5: Appendix CT-004-000/2.

2.1.25 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

¹⁰ Cherwell District Council (2011), *Non-Statutory Cherwell Local Plan*.

¹¹ Cherwell District Council (2012), *Proposed Submission Cherwell Local Plan*.

¹² Cherwell District Council (2013), *Proposed Submission Cherwell Local Plan, Focused Consultation*.

¹³ Daventry District Council (2010), *Saved Policies from the Daventry District Local Plan (June 1997) saved 28 September 2007*, Daventry District Council.

¹⁴ West Northamptonshire Joint Planning Unit (2012), *Joint Core Strategy*.

CT-004-000 and are not included in the assessment. The progress of these proposals is being monitored by HS2 Ltd.

2.2 Description of the Proposed Scheme

2.2.1 The following section describes the main features of the Proposed Scheme in the Greatworth to Lower Boddington area, including the main environmental mitigation measures. Further generic information on typical permanent features is provided in Volume 1, Section 5. Similarly, a general description of the approach to mitigation is set out in Volume 1, Section 9.

2.2.2 The Proposed Scheme will require some land on a permanent basis, key features of which are illustrated in the CT-06 Maps Series (Volume 2, CFA15 Map Book). Land that will also be required, but only on a temporary basis for construction, is set out in Section 2.3.

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

2.2.4 Since the draft ES was published the following changes have been introduced to permanent features of the Proposed Scheme:

- the stopping up of Culworth Road on either side of the Proposed Scheme, with a brideway constructed to provide a right of way to the north of Culworth Road over Chipping Warden green tunnel;
- the replacement of Cedars Farm accommodation underbridge with an access track to the property from Claydon Road (also known as Boddington Road);
- rationalisation of the number, shape and size of the land drainage and balancing ponds required throughout the area; and
- the addition of further landscape mitigation planting and habitat creation areas, in particular at Halse Copse South.

Overview

2.2.5 The Proposed Scheme through the Greatworth to Lower Boddington area will be approximately 17km in length, commencing to the south-east of Halse Copse South near Radstone. The route will then proceed north in a tunnel, passing just east of Greatworth, and will emerge from tunnel to pass over Lower Thorpe on a viaduct.

2.2.6 It will continue north in cuttings and on embankments before passing west of Trafford Bridge (east of Edgcote) on a viaduct. It will then enter into a tunnel to pass east of Chipping Warden, emerging west of Aston le Walls where it will cross over the Highfurlong Brook on a viaduct before passing to the west of Lower Boddington in cuttings and on embankments.

2.2.7 To the north-west of Lower Boddington the route will run in a cutting, in which a maintenance loop also commences before both the route and the maintenance loop continue out of the Greatworth to Lower Boddington area (CFA15) at the

administrative boundary between Northamptonshire and Warwickshire County Councils.

Greatworth south cutting

2.2.8 The Proposed Scheme will enter the Greatworth to Lower Boddington area on a low embankment just south-east of Halse Copse South. It will then pass into a cutting approximately 2.1km in length and up to 10m deep, before continuing onto another low embankment and shallow cutting to the east of Greatworth, north of the dismantled railway that is just to the west of Greatworth Hall.

2.2.9 Key permanent features of this section, which is approximately 2.6km long, will include (see Maps CT-06-068 to CT-06-070, Volume 2, CFA15 Map Book):

- a replacement floodplain storage area to the west of the Proposed Scheme near Halse Copse South, excavated to approximately 1m below existing ground level and re-graded¹⁵;
- landscape earthworks on the western side of the Proposed Scheme running along the edge of the cutting to the dismantled railway. Intermittent planting along the crest of the earthwork and reinstatement of hedgerows will integrate the cutting into the landscape and provide visual screening;
- a land drainage area to the west of the Proposed Scheme near Halse Copse South;
- an overbridge, approximately 10m above existing ground level, adjacent to Halse Copse South to provide an online replacement of Footpath AN22 and farm access;
- landscape earthworks on the eastern side of the Proposed Scheme from just north of Halse Copse South to the dismantled railway. Intermittent planting along the crest of the earthwork and reinstatement of hedgerows will integrate the cutting into the landscape and provide visual screening;
- an area of woodland between Halse Copse South and Halse Copse North to compensate for the loss of ancient woodland at Halse Copse South and to provide a habitat link between the two areas of woodland. An area of grassland habitat will also be provided between the woodland and the route providing a receptor site for species including great crested newts and reptiles;
- an overbridge, approximately 2m above existing ground level, south of Halse Copse North to provide an offline replacement of footpaths AN19 and AN28, Bridleway AN37 and to maintain an existing farm access;
- three land drainage areas to the east of the Proposed Scheme near Greatworth reservoir;

¹⁵ All flood compensation areas will be re-graded to tie back into existing ground level and returned to agriculture, wherever the farming practices are compatible with the land use.

- a culvert under the Proposed Scheme, including access track for maintenance, between Greatworth Hall and Greatworth reservoir;
- an overbridge, approximately 1m above existing ground level, between Halse Copse North and Greatworth Hall to provide an online replacement of Bridleway AN14 and to maintain an existing farm access;
- an area of dispersed trees planted between Greatworth Hall and the Proposed Scheme to break up the line of sight onto the Proposed Scheme from the property;
- noise fence barriers approximately 300m in length and 3m high along the western side of the Proposed Scheme between Greatworth Hall and Greatworth;
- a land drainage area to the east and a balancing pond for railway drainage and associated access track to the west of the Proposed Scheme, south of the dismantled railway;
- a replacement floodplain storage area to the west of the Proposed Scheme near the dismantled railway, which will be excavated and re-graded to approximately 1m below existing ground level;
- a land drainage area, east of the Proposed Scheme to the north-east of the dismantled railway;
- landscape earthworks on both sides of the Proposed Scheme to the north of the dismantled railway to provide visual screening to the east and sound screening to the west. Hedgerow and tree planting will integrate the cutting into the landscape and provide additional visual screening; and
- Greatworth auto-transformer station¹⁶ and associated access track located on the western side of the Proposed Scheme.

2.2.10 Construction of this section will be managed from the Radstone Road overbridge satellite compound and the Greatworth green tunnel satellite compound (see Section 2.3).

Greatworth green tunnel

2.2.11 To the east of Greatworth the route will continue into the Greatworth green tunnel from which it will emerge just west of Sulgrave Road. Key features of this section, which is approximately 2.1km long, will include (see Maps CT-06-070 to CT-06-071 (Volume 2, CFA15 Map Book)):

- Greatworth green tunnel south portal east of Helmdon Road, including portal buildings to the south of the Proposed Scheme with an associated access track;

¹⁶ HS2 trains will draw power from overhead line equipment, requiring feeder stations and connections to the 400kV National Grid network. In addition to feeder stations, smaller auto-transformer stations will be required at more frequent intervals. There will be no feeder stations within the local area, but three auto-transformer stations will be required.

- reinstatement of Helmdon Road over Greatworth green tunnel and the permanent diversion of Footpath AN13;
- earthworks to integrate the green tunnel and Helmdon Road into the surrounding landscape;
- reinstatement of the access to Greatworth Park and Footpath AN4 over the green tunnel;
- reinstatement of Footpath AN40, the B4525, Welsh Road and Footpath AN39 over Greatworth green tunnel;
- reinstatement of hedgerows along the length of the green tunnel;
- reinstatement of Sulgrave Road over Greatworth green tunnel; and
- Greatworth green tunnel north portal located west of Sulgrave Road, including portal buildings to the south of the Proposed Scheme with an associated access track. Earthworks and woodland planting will be provided to screen the portal and cutting and to integrate the new infrastructure into the surrounding landscape.

2.2.12 Construction of this section will be managed from the Greatworth green tunnel satellite compound and the Greatworth green tunnel (north portal) satellite compound, see Section 2.3.

Thorpe Mandeville cutting

2.2.13 The route will continue into Thorpe Mandeville cutting which is approximately 750m long and up to 16m deep, beginning west of Sulgrave Road and extending to the west of Banbury Road. Key features of this section, which is approximately 750m long, will include (see Maps CT-06-071 to CT-06-072 (Volume 2, CFA15 Map Book)):

- a low height retaining wall, required to maintain the stability of the slopes in the area, positioned at the top of the cutting on the eastern side of the Proposed Scheme, between the start of the Thorpe Mandeville cutting and the Banbury Road overbridge;
- landscape planting on both sides of the Thorpe Mandeville cutting to integrate it into the landscape;
- a land drainage area located to the north of the Proposed Scheme, with an associated access track;
- grassland habitat created adjacent to the east side of Thorpe Mandeville cutting to mitigate the loss of a potential Local Wildlife Site (pLWS);
- realignment of Footpath BB3 to run parallel to the cutting just south of Banbury Road;
- diversion of Banbury Road on an overbridge, at existing ground level; and
- noise fence barriers approximately 3m high and 70m long on the west side of the Proposed Scheme, from north of Banbury Road to the end of the cutting.

- 2.2.14 Construction of this section will be managed from the Thorpe Mandeville cutting satellite compound, see Section 2.3.

Lower Thorpe viaduct and adjacent earthworks

- 2.2.15 This section of route comprises a series of short embankments, viaducts and cuttings and extends from just north of Banbury Road to east of Bridleway AGg near Lower Thorpe. It comprises an embankment approximately 350m long and up to 9m high; a viaduct approximately 200m long and up to 9m high; an embankment 100m long and up to 7m high; a cutting approximately 50m long and up to 7m deep; an embankment approximately 440m long and up to 7m high; and a cutting approximately 660m long and up to 26m deep.

- 2.2.16 Key features of this section, which is approximately 1.8km long, will include (see Maps CT-06-072 to CT-06-073, Volume 2, CFA 15 Map Book):

- an embankment approximately 350m long and up to 9m high to the east of Thorpe Mandeville;
- noise fence barriers will extend for approximately 780m along the west side of the Proposed Scheme from the start of the embankment to approximately 240m north of Banbury Lane at Lower Thorpe, including across the Lower Thorpe viaduct. The barrier will be up to 3m high, except across the viaduct where the 1.4m high protection barrier will be modified to also act as an absorptive noise fence barrier;
- landscape planting to the west and east of the Proposed Scheme to provide visual screening;
- a replacement floodplain storage area at the edge of the boating lake at Lower Thorpe to the east of the Proposed Scheme, excavated and re-graded to approximately 2m below existing ground level. The areas in and around the edges of the boating lake itself will be protected to prevent any loss of ecological habitat or water capacity;
- a replacement floodplain storage area to the west of the Proposed Scheme, north-east of the sewage works excavated and re-graded to approximately 1m below existing ground level;
- a balancing pond for railway drainage and associated access track located to the west of the Proposed Scheme, just south of Lower Thorpe;
- landscape planting immediately adjacent to the route to the west of Lower Thorpe and on the edge of Thorpe Mandeville to provide visual screening for the residents;
- Lower Thorpe viaduct to carry the Proposed Scheme over Lower Thorpe and Banbury Lane. The viaduct will be 7-9m above ground level and will have a 1.4m high protection barrier adjacent to the tracks on each side. The protection barrier will be modified along the west side to also act as an absorptive noise fence barrier;

- a replacement floodplain storage area to the west of the Proposed Scheme, excavated and re-graded to approximately 1m below existing ground level;
- a series of embankments up to 7m high and cutting up to 2m deep, approximately 600m long, south of a dismantled railway that crosses the route north-west of Lower Thorpe;
- a balancing pond for railway drainage and associated access track located between the dismantled railway and Banbury Lane on the eastern side of the Proposed Scheme;
- an ecological mitigation area, including pond and grassland creation, for great crested newts and reptiles on the west side of the Proposed Scheme between the Culworth Grounds accommodation overbridge and the dismantled railway;
- landscape planting on the east side of the Proposed Scheme either side of the dismantled railway to screen views from Culworth;
- Culworth Grounds accommodation overbridge will be approximately 12m above existing ground level and will provide an offline farm access to replace the existing access just north of the dismantled railway. The approaches to the overbridge will be planted to integrate the structure into the landscape;
- a cutting approximately 660m long and up to 26m deep north of the dismantled railway; and
- a low height retaining wall, required to limit the extents of the cutting, positioned at the base of the cutting on the eastern side of the Proposed Scheme running the length of the cutting. Landscape planting will be provided along both sides of the cutting to integrate the structure into the surrounding landform.

2.2.17 Construction of this section will be managed from the Lower Thorpe viaduct satellite compound, see Section 2.3.

Edgcote viaduct and adjacent earthworks

2.2.18 The route will continue into the Edgcote viaduct and adjacent earthworks area which comprises a series of embankments and cuttings and a viaduct. This section of the Proposed Scheme extends from east of Bridleway AG9 near Lower Thorpe to west of Culworth Road. It comprises an embankment approximately 900m long and up to 5m high; a cutting approximately 250m long and up to 4m deep; an embankment approximately 400m long and up to 5m high; a viaduct approximately 600m long and up to 9m high; an embankment 150m long and up to 8m high; and a cutting approximately 900m long and up to 6m deep.

2.2.19 Key features of this section, which is approximately 3.2km long, will include (see Maps CT-06-073 to CT-06-075 (Volume 2, CFA15 Map Book)):

- an embankment approximately 900m long and up to 5m high from Bridleway AG9 to Bridleway AG10;

- an overbridge north-west of Lower Thorpe, approximately 10m above existing ground level, providing an online replacement of Bridleway AG9. The approaches to the overbridge will be planted to integrate the structure into the landscape;
- areas of landscape planting to the east and west of the Proposed Scheme to provide visual screening;
- a balancing pond for railway drainage and associated access track between the dismantled railway and Wardington Road to the west of the Proposed Scheme;
- Danes Moor auto-transformer station and associated access track approximately 700m south of Wardington Road on the east side of the Proposed Scheme;
- realignment of Bridleway AG10 across the overbridge south of Wardington Road, approximately 5m above existing ground level, which will also provide access to railway drainage ponds and farm access. The areas around the overbridge will be planted to integrate the structure into the landscape;
- a shallow cutting approximately 250m long and up to 4m deep, east of Danesmoor Spinney;
- an embankment approximately 400m long and up to 5m high south of Wardington Road;
- a balancing pond for railway drainage and associated access track south of Wardington Road on the west of the Proposed Scheme;
- a viaduct at Edgcote approximately 600m long and up to 9m above ground level, carrying the Proposed Scheme over Wardington Road and the River Cherwell. The viaduct will have a 1.4m high protection barrier adjacent to the tracks on both sides;
- two replacement floodplain storage areas to the west of the Proposed Scheme, excavated and re-graded to approximately 1m below existing ground level;
- scattered planting to the north of Edgcote viaduct to soften visual and setting impacts on the Grade II listed Trafford Bridge;
- blocks of woodland planting provided to the south of Edgcote viaduct to screen views from the Grade I listed Edgcote House and grounds;
- wetland (fen and marsh) and grassland habitat created around Edgcote viaduct to mitigate losses from Trafford Bridge Marsh Local Wildlife Site and provide habitat connectivity;
- a balancing pond for railway drainage and associated access track approximately 300m north of Wardington Road to the east of the Proposed Scheme;

- realignment of Footpath AE5 north of the River Cherwell to pass under the western end of the viaduct;
- a replacement floodplain storage area to the east of the Proposed Scheme, excavated and re-graded to approximately 1m below existing ground level;
- an embankment approximately 150m long and up to 8m high east of Edgcote House;
- a cutting approximately 900m long and up to 6m deep from south of Blackgrounds Farm to Culworth Road;
- revised access on the western side of the Proposed Scheme to Blackgrounds Farm from Culworth Road to the north;
- a land drainage area to the south of Culworth Road and the east of the Proposed Scheme;
- planting to the east of the Proposed Scheme and north of Culworth Road providing visual screening for residential properties; and
- stopping up of Culworth Road on either side of the Proposed Scheme, with a bridleway constructed to provide a right of way to the north of Culworth Road over Chipping Warden green tunnel.

2.2.20 Construction of this section will be managed from the Culworth cutting satellite compound and Danes Moor auto-transformer station satellite compound, see Section 2.3.

Chipping Warden green tunnel

2.2.21 The route will continue into the green tunnel at Chipping Warden, emerging again to the east of Highfurlong Brook. Key features of this section, which is approximately 2.5km long, will include (see Maps CT-06-075 to CT-06-076 (Volume 2, CFA15 Map Book)):

- landscape earthworks and planting to integrate the Chipping Warden green tunnel south portal into the landscape and provide visual screening for users of the realigned PRow;
- Chipping Warden green tunnel south portal west of Culworth Road, including portal buildings to the south of the Proposed Scheme and an associated access track;
- reinstatement of Footpaths AE20 and AE12 over Chipping Warden green tunnel incorporating a new bridleway to maintain connectivity along Culworth Road for pedestrians, cyclists and equestrians;
- reinstatement of Footpath AE21 over Chipping Warden green tunnel;
- reinstatement of the A361 Byfield Road, Footpath AE17 and disused airfield circular access track, Appletree Lane and Footpath AA8, over Chipping Warden green tunnel;

- reinstatement of hedgerows along the length of the green tunnel;
- Chipping Warden green tunnel north portal, east of Highfurlong Brook including portal buildings to the north of the Proposed Scheme and an associated access track from Appletree Lane;
- planting and landscape earthworks to integrate the Chipping Warden green tunnel north portal into the landscape and to provide visual screening for residents of Aston le Walls and other scattered properties. Planting will also provide an ecological corridor for bats and other species across the Proposed Scheme to replace the section of a dismantled railway that is severed by the Proposed Scheme to the west of Aston le Walls; and
- two ecological mitigation areas, including pond and grassland creation, for great crested newts and reptiles either side of the Proposed Scheme adjacent to the dismantled railway.

2.2.22 Construction of this section will be managed from the Chipping Warden green tunnel main compound, the Chipping Warden green tunnel south portal satellite compound and the Chipping Warden tunnel north portal satellite compound, see Section 2.3.

Highfurlong Brook viaduct and adjacent earthworks

2.2.23 The Proposed Scheme will continue into the Highfurlong Brook viaduct and adjacent earthworks section, which comprises a series of embankments and cuttings and a stretch of viaduct over the Highfurlong Brook. This section of the Proposed Scheme extends from south of Highfurlong Brook to south of Claydon Road (also known as Hill Road). It comprises an embankment approximately 600m long and up to 9m high; a viaduct approximately 150m long and up to 9m high; an embankment approximately 500m long and up to 7m high.

2.2.24 Key features of this section, which is approximately 1.2km long, will include (see Map CT-06-077 (Volume 2, CFA15 Map Book)):

- noise fence barriers will extend for approximately 800m along the east side of the Proposed Scheme from the tunnel portal to approximately 100m north of Highfurlong Brook. The barrier will be up to 3m high, except across the viaduct where the approximately 1.4m high protection barrier will be modified to also act as an absorptive noise fence barrier;
- an embankment approximately 600m long and 9m high west of Aston le Walls, with landscape planting on both sides;
- Chipping Warden mid-point auto-transformer station located approximately 300m south of Highfurlong Brook on the east side of the Proposed Scheme, with associated access track;
- a land drainage area south of Highfurlong Brook to the west of the Proposed Scheme, and a balancing pond for railway drainage and associated access track south of Highfurlong Brook to the east of the Proposed Scheme;

- Highfurlong Brook viaduct approximately 150m long to carry the Proposed Scheme over Highfurlong Brook. The viaduct will be up to 9m above ground level and will have a 1.4m high protection barrier adjacent to the tracks on each side. The protection barrier will be modified along the east side to also act as an absorptive noise fence barrier;
- an embankment approximately 500m long and up to 7m high, from north of Highfurlong Brook to south of Claydon Road (also known as Hill Road);
- a replacement floodplain storage area to the east of the Proposed Scheme, which will be excavated and re-graded to approximately 1m below existing ground level;
- a balancing pond for railway drainage and associated access track north of Highfurlong Brook to the west of the Proposed Scheme;
- a land drainage area north of Highfurlong Brook to the east of the Proposed Scheme;
- landscape earthworks to the east of the Proposed Scheme from north of Highfurlong Brook, extending to the north of Claydon Road (also known as Hill Road) to integrate the cutting/embankment into the landscape and provide sound mitigation for properties to the east, with hedgerows along the crest of the earthwork; and
- landscape earthworks on the west side of the Proposed Scheme from north of the Highfurlong Brook, extending to the north of Claydon Road (also known as Hill Road) to integrate the cutting/embankment into the landscape and provide visual screening.

2.2.25 Construction of this section will be managed from the Claydon Road overbridge satellite compound and the Chipping Warden tunnel north portal satellite compound, see Section 2.3.

Lower Boddington cutting and embankment and Boddington cutting

2.2.26 The Proposed Scheme will continue past Lower Boddington in cutting or on embankment. This section of the Proposed Scheme extends from south of Claydon Road (also known as Hill Road) to the Northamptonshire County boundary near Stoneton Lane. It comprises a cutting approximately 600m long and up to 3m deep; an embankment approximately 1.2km long and up to 5m high; and a cutting approximately 1km long and up to 12m deep in this area and which continues for a further 1.2km in the Ladbroke and Southam area (CFA16).

2.2.27 Key features of this section, which is approximately 2.8km long, will include (see Maps CT-06-077 to CT-06-079 (Volume 2, CFA15 Map Book)):

- an inverted siphon located adjacent to Claydon Road (also known as Hill Road) to maintain watercourse connectivity;
- Claydon Road overbridge, approximately 8m above existing ground level, to provide an online replacement of Claydon Road (also known as Hill Road)

incorporating the diverted footpaths AC1 and AC2. Tree planting on the approaches of the overbridge will integrate the structure into the wider landscape;

- a cutting approximately 600m long and 3m deep;
- a balancing pond for highway drainage located to the west of the Proposed Scheme and south of Claydon Road (also known as Hill Road);
- land drainage areas either side of Claydon Road (also known as Hill Road) to the east of the Proposed Scheme;
- landscape earthworks on both sides of the Proposed Scheme from Claydon Road (also known as Hill Road) west of Lower Boddington to Cedars Farm, to integrate the route into the landscape, and to provide visual screening to the west and sound mitigation to the east, with hedgerows on the crest of the earthworks;
- a replacement floodplain storage area to the east of the Proposed Scheme, excavated and re-graded to approximately 1m below existing ground level;
- landscape earthworks and tree planting on both sides of the Proposed Scheme from north of Cedars Farm to Claydon Road (also known as Boddington Road), to integrate the cutting/embankment into the landscape and provide visual screening;
- a land drainage area to the west of the Proposed Scheme, near Cedars House Farm;
- two replacement floodplain storage areas to the east of the Proposed Scheme, excavated and re-graded to approximately 1m below existing ground level;
- a land drainage area between Claydon Road (also known as Boddington Road) and the sewage works on the east of the Proposed Scheme;
- Lower Boddington package sub-station and associated access track located between Claydon Road (also known as Boddington Road) and Cedars Farm;
- realignment of Claydon Road (also known as Boddington Road), west of its current position, to the north of the Proposed Scheme to connect to Banbury Road. Access tracks to the adjacent railway maintenance loop will be provided at Claydon Road (also known as Boddington Road) to the east and west of the Proposed Scheme;
- maintenance loops located west of Claydon Road (also known as Boddington Road) extending into the Ladbroke and Southam area (CFA16). An access track will be provided along either side of the maintenance loops;
- an overbridge, approximately 2m above existing ground level, providing an offline replacement for Banbury Road between Claydon Road (also known as Boddington Road) and Stoneton Lane; and

- diversion of Stoneton Lane alongside the Proposed Scheme to the east to connect into Banbury Road.

2.2.28 Construction of this section will be managed from the Banbury Road green overbridge satellite compound, see Section 2.3.

2.2.29 The route will then continue into the Ladbroke and Southam area (CFA16) 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 Greatworth to Lower Boddington 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 Maps Series CT-05 (Volume 2, CFA15 Map Book). Following construction works, land required temporarily will be prepared for its eventual end use, which will include being returned to its pre-construction use wherever appropriate.

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

Overview of the construction process

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

- advance works including: site investigations further to those already undertaken; preliminary mitigation works; preliminary enabling works;
- civil engineering works including: establishment of construction compounds; site preparation and enabling works; main earthworks and structure works; site restoration; and removal of construction compounds;
- railway installation works including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; and removal of construction compounds; and

- system testing and commissioning.

2.3.6 General provisions relating to the construction process are set out in more detail in Volume 1, Section 6.3, including:

- the approach to environmental management during construction and the role of the Code of Construction Practice;
- working hours;
- management of construction traffic; and
- handling of construction materials.

Advance works

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

- further site investigations and surveys for proposed construction compounds;
- further 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 railway will require engineering works along the entire length of the route, and within land adjacent to the route. This will comprise two broad types of engineering work:

- civil engineering works, such as earthworks and erection of bridges and viaducts; and/or
- The railway systems installation works will include track, overhead line equipment, communications equipment and traction power supply. The installation of track in open areas will comprise the laying of ballast and/or slab tracks, rail and sleepers.

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

2.3.10 In the Greatworth to Lower Boddington area there will be one main compound and six civil engineering satellite compounds and six railway installation satellite compounds (of which two will continue to use compounds previously established for the civil engineering works).

2.3.11 Figure 3 shows the management relationship for civil engineering works compounds and Figure 4 for the railway installation works. Details about individual compounds are provided in subsequent sections of this report.

General overview of construction compounds

2.3.12 Main compounds will be used for core project management staff (i.e. engineering, planning and construction delivery), and commercial and administrative staff. These management teams will directly manage some works and/or coordinate satellite compounds, which will manage other works. In general, main compounds will contain:

- space for the storage of bulk materials (aggregates, structural steel and steel reinforcement);
- space for the receipt, storage and loading/unloading of excavated material either onto or off the site;
- an area for the fabrication of temporary works equipment and finished goods;
- fuel storage;
- plant and equipment storage; and
- office space for management staff, limited car parking for staff and site operatives, and welfare facilities.

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

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

- roadheads require an additional area of land adjacent to the compound for the storage and loading and unloading of bulk earthworks materials which are moved to and from the site on public highways; and
- living accommodation for the construction workforce.

2.3.15 In addition, areas adjacent to some compounds will be used for the storage of topsoil stripped as part of the works prior to it being used when the land is reinstated to its former use.

2.3.16 Further information on the function of compounds, including general provisions for their operation, including security fencing, lighting, utilities supply, site drainage, codes of worker behaviour are set out in Volume 1, Section 6.3, and the draft CoCP, Section 5.6.

Construction traffic routes

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

Figure 3: Schematic of construction compounds for civil engineering works

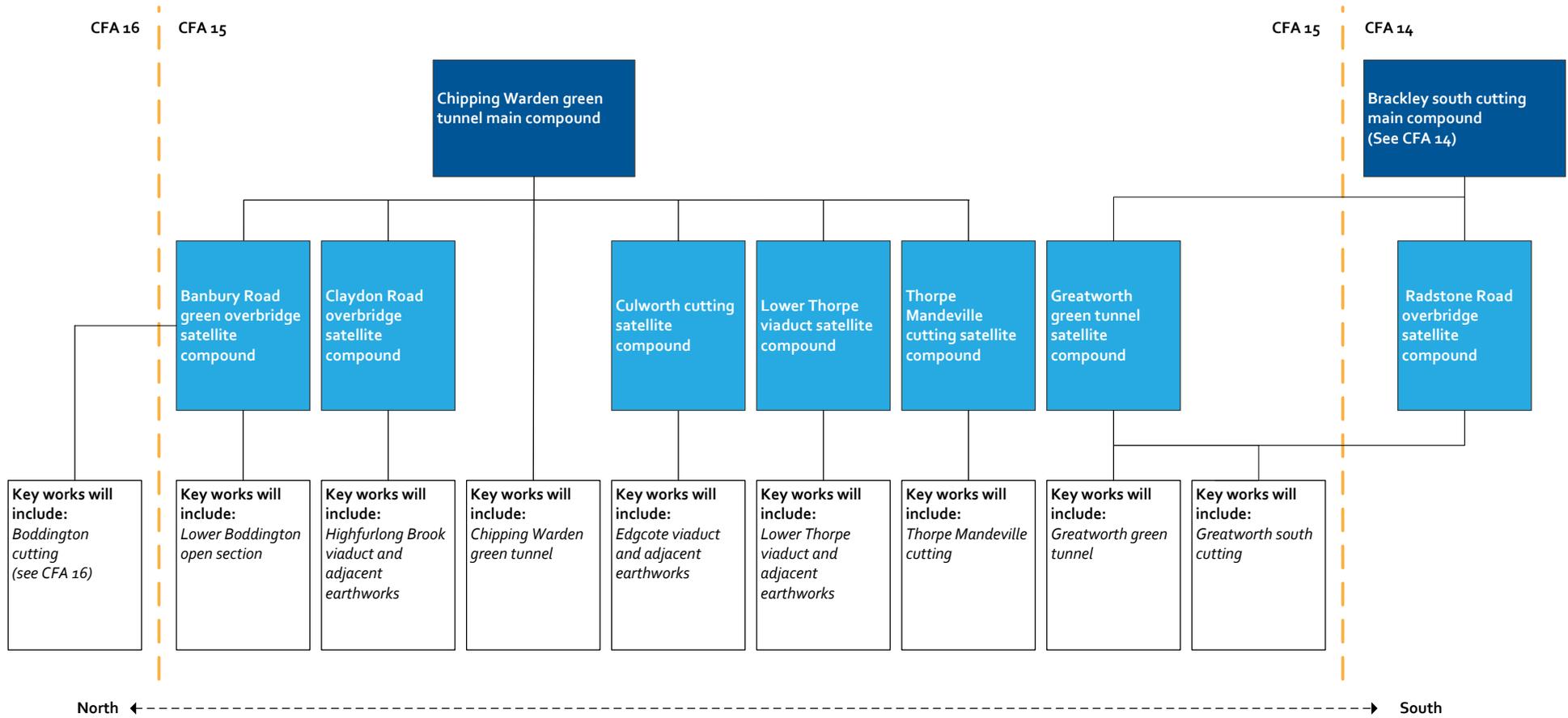
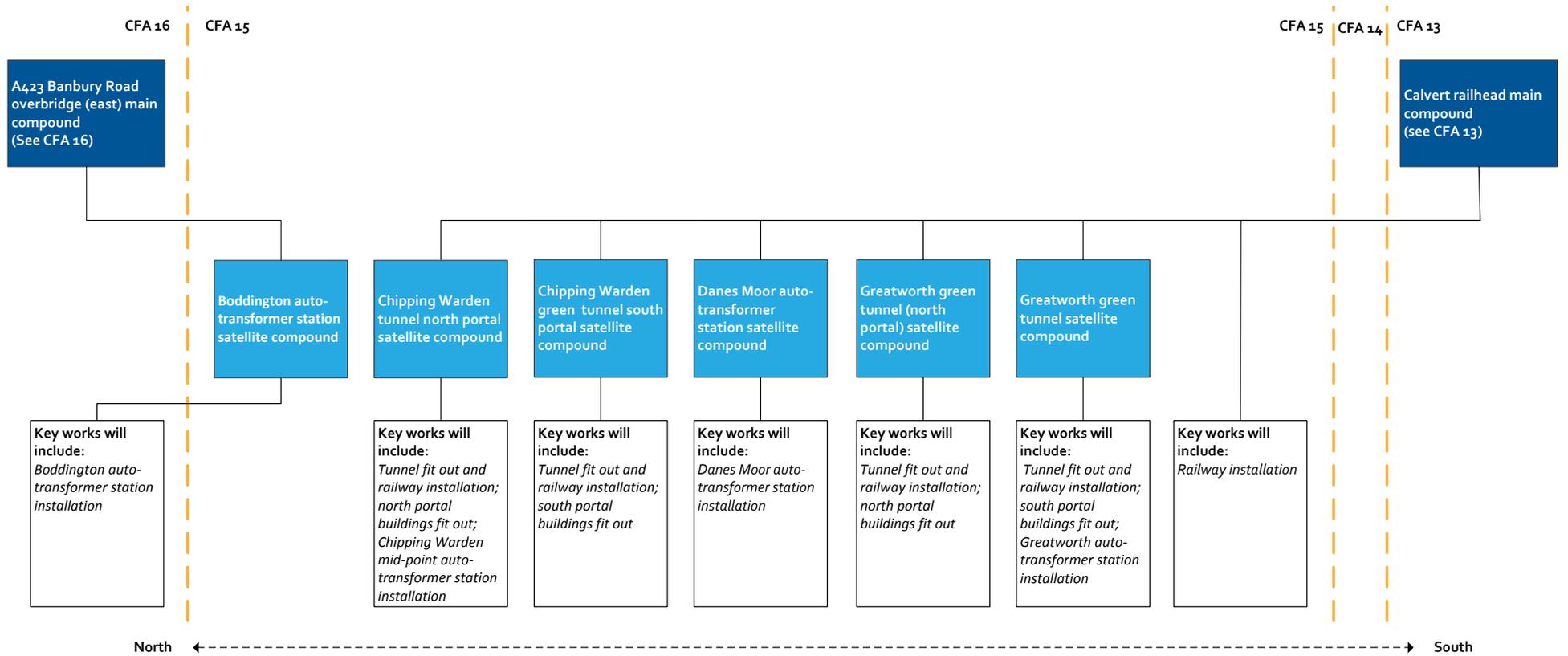


Figure 4: Schematic of construction compounds for railway installation works



Calvert railhead main compound

- 2.3.19 This compound is located in the Calvert, Steeple Claydon, Twyford and Chetwode area (see CFA13). However it will provide support to all rail installation works in this area and five satellite compounds, as illustrated in Figure 4, which themselves provide directly for the construction of the Proposed Scheme in this area.
- 2.3.20 The railway systems installation works will include track, overhead line equipment, communications equipment and traction power supply. The installation of track in open areas will be of standard ballast or slab track configuration. The track installation through green tunnels in this area will also comprise standard ballast or slab track construction.
- 2.3.21 Works in this local area will take approximately one year and three months to complete, commencing in 2022.
- 2.3.22 The track will be laid in a northerly direction away from the Calvert railhead main compound. Before the railway systems installation can commence, adequate civil engineering work will need to be completed to allow a continuous track laying sequence.
- 2.3.23 The railway systems installation has its own mobile welfare facilities for the site staff.

Brackley south cutting main compound

- 2.3.24 Whilst this compound is located within the Newton Purcell to Brackley area (CFA14), it will provide support to two satellite compounds, as illustrated in Figure 3, which themselves will manage the construction of the Proposed Scheme between Radstone and Greatworth within this area. See Newton Purcell to Brackley report (CFA14) for more information about this compound.

Radstone Road overbridge satellite compound

- 2.3.25 This compound (which will be managed from Brackley south cutting main compound) is located within the Newton Purcell to Brackley area, but will provide directly for civil engineering works within this area. See the Newton Purcell to Brackley report (CFA14) for more information about this compound.
- 2.3.26 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - culverts and drainage;
 - PRoW overbridges;
 - cuttings, embankments and landscape earthworks;
 - permanent fencing;
 - rail systems installation; and
 - landscaping and planting.

- 2.3.27 Together with the Greatworth green tunnel satellite compound (see below), this compound will be used to manage construction of the Greatworth south cutting, which will take approximately two years to complete. Volume 1, Section 5 describes a typical cutting, and Volume 1, Section 6.8 describes a typical construction sequence for a cutting.
- 2.3.28 In this area no demolitions, no road diversions and no utilities diversions will be required.
- 2.3.29 Alternative routes for the following five PRoW will be required:
- a temporary alternative route for Footpath AN22, to the south for a period of approximately six to nine months, adding an additional 100m. It will then be permanently reinstated along its existing alignment across the new Footpath AN22 accommodation overbridge¹⁷;
 - Bridleway AN37 remains open during construction. It will then be permanently diverted 100m to the west, across the new offline Bridleway AN37 accommodation overbridge, adding an additional 250m;
 - an alternative temporary route for Footpath AN19, to the north via Footpath AN28 for a period of approximately six to nine months, adding an additional 200m. It will then be permanently reinstated across the new Bridleway AN37 accommodation overbridge along its existing alignment;
 - a temporary alternative route for Footpath AN28 to the south via footpath AN19 for a period of approximately six to nine months, adding an additional 200m. It will then be permanently diverted approximately 250m to the west, across the new Bridleway AN37 accommodation overbridge, adding an additional 400m; and
 - a temporary alternative route for footpath AN14, to the north for a period of approximately six to nine months, adding an additional 100m. It will then be permanent reinstated along its existing alignment across the new Bridleway AN14 accommodation overbridge.
- 2.3.30 Temporary diversion of the private access to Greatworth Field will be required during the construction of Bridleway AN14 accommodation overbridge.
- 2.3.31 Diversion of two watercourses will be required:
- a dry valley¹⁸ adjacent to Halse Copse South, which will require a diversion of approximately 430m to the south; and
 - a dry valley south of Halse Copse North, which will require a diversion of approximately 1.1km to the south.

¹⁷ This overbridge also provides farm access.

¹⁸ A valley formed by water erosion that has no permanent surface stream.

Greatworth green tunnel satellite compound

- 2.3.32 This compound will be used for civil engineering and railway installation works, between Greatworth and Thorpe Mandeville. The compound will:
- be operational for approximately six years and six months, including civil engineering works for approximately four years and six months, commencing during in 2017 and railway installation works for approximately two years and three months, starting in 2021;
 - support approximately 145 workers each day throughout the civil engineering works period; increasing to a maximum of approximately 235 workers each day during the peak period of activity; and support approximately 20 workers each day throughout the rail systems installations works period increasing to a maximum of approximately 40 workers each day during the peak period of activity;
 - not provide worker accommodation;
 - be accessed via A43 and B4525 from the east and via the M40, A422 and B4525 from the west; and
 - be managed from Brackley south cutting main compound for the civil engineering works and from Calvert railhead main compound for the railway systems installation works.
- 2.3.33 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - building demolition;
 - cutting and landscape earthworks;
 - construction of green tunnel;
 - backfill over green tunnel;
 - highway and footpath reinstatement;
 - rail systems installation; and
 - landscaping and planting.
- 2.3.34 The compound will be used to manage construction of the Greatworth green tunnel, which will take approximately five years and nine months to complete. See Volume 1, Section 5.5 for a general description of a green tunnel. The cut and cover construction technique will be adopted in this location, see Volume 1, Section 6.12 for further information.
- 2.3.35 In this area no utilities diversions will be required.
- 2.3.36 Demolitions will be required at two properties:

- commercial property (two buildings occupied by two motorsport engineering businesses: Triple Eight Race Engineering and MP Motor Sport Ltd, part of the former World War II wireless reception and intervention centre) at Greatworth Park; and
- commercial property (one building and one outbuilding at Dean Barn) near Sulgrave Road.

2.3.37 Diversions of three roads will be required:

- temporary closure of Helmdon Road, with alternate route via B4525 Welsh Road for a period of approximately a year and a half, then permanent realignment 50m to the north of its current alignment over the green tunnel;
- a temporary realignment of B4525 Welsh Road for a period of approximately two and a half years, then permanent reinstatement along its existing alignment; and
- a temporary realignment of Sulgrave Road for a period of approximately two and a half years, then permanent reinstatement along its existing alignment.

2.3.38 Alternative routes for seven PRow will be required:

- a temporary alternative route for public footpath AN13, 200m to the east for a period of approximately six to nine months, adding an additional 400m. It will then be permanently diverted 100m to the north via Helmdon Road, adding an additional 200m;
- a temporary alternative route for Footpath AN4, to the north-west via B4525 Welsh Road for a period of approximately one year and six months, adding an additional 300m. It will then be permanently reinstated along its existing alignment;
- a temporary alternative route for Footpath AN40, via the B4525 Welsh Road, for a period of approximately two years, adding an additional 500m. It will then be permanently reinstated along its existing alignment;
- a temporary alternative route for Footpath AN42, via the B4525 Welsh Road, for a period of approximately two years and six months, adding an additional 1.4km. It will then be permanently reinstated along its existing alignment;
- a temporary alternative route for Footpath AN39, via the B4525 Welsh Road, for a period of approximately two years and six months, adding an additional 1700m. It will then be permanently reinstated along its existing alignment;
- a temporary alternative route for Footpath AN6, to the east for a period of approximately two years and six months, adding a negligible distance. It will then be permanently reinstated along its existing alignment; and
- a temporary alternative route for Footpath AY12, via Sulgrave Road for a period of approximately two years and six months, adding a negligible distance. It will then be permanently reinstated along its existing alignment.

- 2.3.39 Temporary diversion of the private access to Greatworth Park will be required during construction of Greatworth green tunnel.
- 2.3.40 Diversion of one watercourse will be required, a dry valley adjacent to Helmdon Road, a diversion of approximately 410m to the south, and with a culvert crossing under the railway.
- 2.3.41 The compound will also be used to manage the following key railway systems installation works in this section of the Proposed Scheme:
- installation of an auto-transformer station at Greatworth green tunnel south portal, which will take approximately one year and three months to complete.
 - fit-out of Greatworth green tunnel south portal buildings; and
 - fit-out of tunnel systems within Greatworth green tunnel.
- 2.3.42 See Volume 1, Section 5.17 for a generic description of power supply and tunnel systems and Volume 1, Section 6.23 for a description of associated construction activities.

Chipping Warden green tunnel main compound

- 2.3.43 This compound will be used for civil engineering works only, between Thorpe Mandeville and Lower Boddington. The compound will:
- be operational for approximately five years and three months, commencing during 2017;
 - support up to approximately 190 workers each day throughout much of the civil engineering works period;
 - provide worker accommodation for between 110 and 165 people for an estimated period of approximately five years;
 - be accessed via the A361 Byfield Road, from the M40 in the west and from the A45 and M1 in the east;
 - provide main compound support to five satellite compounds, as illustrated in Figure 3 for the civil engineering works; and
 - have an associated roadhead for the receipt, storage and transfer of earthworks material route-wide (see Maps CT-05-075 to 076, Volume 2, CFA15 Map Book).
- 2.3.44 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - building demolition;
 - cutting and landscaping earthworks;
 - construction of green tunnel;

- backfill over green tunnel;
- highway and footpath reinstatement;
- rail systems installations; and
- landscaping and planting.

2.3.45 The compound will be used to manage construction of the Chipping Warden green tunnel, which will take approximately four years and three months to complete. See Volume 1, Section 5.5 for a description of a green tunnel. The cut and cover construction technique will be adopted in this location, see Volume 1, Section 6.12 for further information.

2.3.46 In this area no diversions of key utilities will be required.

2.3.47 Demolition will be required at two properties:

- residential property (The Bungalow) and associated commercial buildings at Calves Close; and
- residential property (Stone House plus one outbuilding) on A361 Byfield Road.

2.3.48 Diversion of two roads will be required:

- a temporary realignment of A361 Byfield Road to the north for a period of approximately three years, then permanent reinstatement along its existing alignment; and
- temporary alternative route for Appletree Lane (south of Aston le Walls), via the Appletree Road, Welsh Road and A361 Byfield Road for a period of approximately four years, then permanent reinstatement along its existing alignment.

2.3.49 Alternative routes for the following PRow will be required:

- a temporary alternative route for Footpaths AE12, AE20 and AE21, for a period of approximately three years. A combined alternative route is provided for all three footpaths along the existing AE21 alignment across the Proposed Scheme, adding an additional 100m. They will then be permanently reinstated along their existing alignments;
- a temporary alternative route for Footpath AE16, via the A361 Byfield Road and Footpath AE17 for a period of approximately three years, adding a negligible distance. It will then be permanently reinstated along its existing alignment;
- a temporary alternative route for Footpath AE17, via the A361 Byfield Road for a period of approximately one year and six months, adding an additional 50m. It will then be permanently reinstated along its existing alignment; and
- a temporary alternative route for Footpath AA8, to the south for a period of approximately four years, adding an additional 400m. It will then be permanently reinstated along its existing alignment.

Greatworth green tunnel (north portal) satellite compound

- 2.3.50 This compound will manage railway systems installation works only, from approximately Greatworth to Thorpe Mandeville. The compound will:
- be operational for approximately one year and six months, starting in 2022;
 - support approximately 10 workers each day throughout this period;
 - not provide worker accommodation;
 - be accessed via Sulgrave Road from the M40, A422 and B4525 from the west; and
 - be managed from Calvert railhead main compound (see Figure 3).

- 2.3.51 The railway systems installation works will include:
- fit-out of Greatworth green tunnel north portal buildings; and
 - fit-out of tunnel systems within Greatworth green tunnel.

- 2.3.52 See Volume 1, Section 5 for descriptions of typical tunnel portals (Section 5.6) and railway systems (Section 5.16-5.18), and Section 6 for associated construction activities (Section 6.13 and 6.23-6.25, respectively).

Thorpe Mandeville cutting satellite compound

- 2.3.53 This compound will be used for civil engineering works only, adjacent to Thorpe Mandeville. The compound will:
- be operational for approximately two years, starting in 2017;
 - support approximately 30 workers each day throughout much of this period; increasing to a maximum of approximately 45 workers each day during the peak period of activity;
 - not provide worker accommodation;
 - be accessed via Banbury Road from the M40, A422 and B4525 from the west;
 - have an associated roadhead with access to/from Banbury Road for the receipt, storage and transfer of earthworks material route-wide (see Map CT-05-071, Volume 2, CFA15 Map Book); and
 - be managed from Chipping Warden green tunnel main compound (see Figure 3).

- 2.3.54 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works;
 - highway overbridge;
 - cutting earthworks;

- permanent fencing;
- rail systems installation; and
- landscaping and planting.

2.3.55 The compound will be used to manage construction of the Thorpe Mandeville cutting, which will take approximately two years to complete. See Volume 1, Section 5.2 for a description of a typical cutting, and Volume 1, Section 6.8 for typical construction sequence for a cutting.

2.3.56 In this area no demolitions and no utilities diversions will be required.

2.3.57 The realignment of Banbury Road will be required. It will be temporarily realigned to the south for a period of approximately one year to one year and three months, then permanently realigned 30m to the north over the new overbridge.

2.3.58 Permanent diversion of Footpath BB3, 20m to the north via Banbury Road overbridge, adding a negligible distance.

2.3.59 Diversion of one watercourse will be required: a drain at Costow House, Thorpe Mandeville, diverted for approximately 750m to the north.

Lower Thorpe viaduct satellite compound

2.3.60 This compound will be used for civil engineering works only, adjacent to Lower Thorpe. The compound will:

- be operational for approximately two years, starting in 2017;
- support approximately 110 workers each day throughout much of this period; increasing to a maximum of approximately 190 workers each day during the peak period of activity;
- not provide worker accommodation;
- be accessed via Banbury Lane from the M40, A422 and B4525 and/or the M40, A43 and B4525 from the west; and
- be managed from Chipping Warden green tunnel main compound (see Figure 3).

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

- site clearance and enabling works;
- culverts and drainage;
- cutting and embankment earthworks;
- viaduct;
- private access overbridge;
- permanent fencing;

- rail systems installation; and
- landscaping and planting.

- 2.3.62 The compound will be used to manage construction of the Lower Thorpe viaduct and adjacent earthworks, which will take approximately two years to complete. See Volume 1, Section 5.2 for descriptions of typical embankments and viaducts, and Volume 1, Section 6.8 for typical construction techniques.
- 2.3.63 In this area no diversion of key utilities will be required.
- 2.3.64 Demolitions will be required at two properties:
- residential property (Twin Oaks and two associated outbuildings) at Banbury Lane; and
 - residential property (Lower Thorpe Farmhouse (Grade II listed) and two associated outbuildings) at Banbury Lane.
- 2.3.65 Diversions of two roads will be required:
- temporary closure of Banbury Lane with temporary alternative route via Banbury Road, for a period of approximately one to two months, then permanent reinstatement along its existing alignment; and
 - permanent reinstatement of Culworth Grounds private access, 80m to the south via the new Culworth Grounds accommodation overbridge.
- 2.3.66 A temporary alternative route for Banbury Lane footpath will be required, to the north for a period of approximately one year and six months to two years, adding an additional 600m. It will then be permanently reinstated along its existing alignment.
- 2.3.67 Diversion of one watercourse (a drain) at Manor House, Lower Thorpe, of approximately 40m to the north with a culvert crossing under the railway.

Danes Moor auto-transformer station satellite compound

- 2.3.68 This compound will be used for railway systems installation works only, between approximately Lower Thorpe and Edgcote. The compound will:
- be operational for approximately one year and six months, starting in 2022;
 - support approximately 30 workers each day throughout this period; increasing to a maximum of approximately 40 workers each day during the peak period of activity;
 - not provide worker accommodation;
 - be accessed via Welsh Road from the A361 Byfield Road and the M40; and
 - be managed from Calvert railhead main compound for the railway systems installations works.
- 2.3.69 The key railway system installation required in this section of the Proposed Scheme will be an auto-transformer station at Danes Moor.

2.3.70 See Volume 1, Section 5.17 for descriptions of typical power supply features, including auto-transformer stations, and Section 6.23 for associated construction techniques.

Culworth cutting satellite compound

2.3.71 This compound will be used for civil engineering works, between Lower Thorpe and Chipping Warden. The compound will:

- be operational for approximately two years, starting in 2018;
- support approximately 130 workers each day throughout much of this period; increasing to a maximum of approximately 190 workers each day during the peak period of activity;
- be accessed via Welsh Road from the A361 Byfield Road and the M40; and
- be managed from Chipping Warden green tunnel main compound.

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

- site clearance and enabling works;
- culverts and drainage;
- cutting and embankment earthworks;
- viaduct;
- PRow overbridges;
- permanent fencing;
- rail systems installation; and
- landscaping and planting.

2.3.73 The compound will be used to manage construction of the Edgcote viaduct and associated earthworks, which will take approximately two years to complete. See Volume 1 for descriptions of typical embankments (Section 5.2) and viaducts (Section 5.9), and for associated construction techniques (Sections 6.8 and 6.16, respectively).

2.3.74 In this area no diversion of key utilities will be required.

2.3.75 Demolition will be required at one property: a commercial property (two barns at Blackgrounds Farm) at Culworth Road.

2.3.76 Diversions of two roads will be required:

- temporary closure of Wardington Road with temporary alternative route via A361 Byfield Road, Culworth Road (before it is stopped up) and Welsh Road, for approximately two years, then permanent reinstatement along its existing alignment; and

- stopping up of Culworth Road (Note: Non-motorised user access will be retained via a shared bridleway over the Chipping Warden green tunnel south portal, see Public Footpath AE28).

2.3.77 Alternative routes for four PRoW will be required:

- a temporary alternative route for Bridleway AG9, to the south for approximately six to nine months, adding an additional 50m. It will then be permanently reinstated 20m to the north across the new Bridleway AG9 overbridge, adding a negligible distance;
- a temporary alternative route for public Bridleway AG10, to the north for approximately six to nine months, adding an additional 100m. It will then be permanently reinstated across the new Bridleway AG10 accommodation overbridge, adding an additional 50m;
- a temporary alternative route for Public Footpath AE5, to the north for approximately one year and six months to two years, adding an additional 200m. It will then be permanently reinstated 50m to the south under Edgcote viaduct, adding an additional 200m; and
- Footpath AE28 will remain open during construction. It will then be permanently reinstated along the route of footpath AE20 and AE12 to tie in with Culworth Road bridleway/cycleway.

2.3.78 Temporary diversion of the private access to land at Calves Close Spinney will be required during construction of Chipping Warden green tunnel.

2.3.79 The River Cherwell at Edgcote will need to be diverted at three locations, for approximately 50m, 80m and 130m respectively, all to the north under the Edgcote viaduct.

Chipping Warden green tunnel south portal satellite compound

2.3.80 This compound will be used for railway systems installation works only, between approximately Chipping Warden and Aston le Walls. The compound will:

- be operational for approximately one year and nine months, starting in 2022;
- support approximately 10 workers each day throughout this period; increasing to a maximum of approximately 15 workers each day during the peak period of activity;
- not provide worker accommodation;
- be accessed via Culworth Road from the A361 Byfield Road and the M40 in the west; and
- be managed from Calvert railhead main compound.

2.3.81 Key railway systems installation works in this section of the Proposed Scheme will be:

- fit-out of Chipping Warden green tunnel south portal buildings; and

- fit-out of tunnel systems within Chipping Warden green tunnel.

2.3.82 See Volume 1, Section 5 for descriptions of typical tunnel portals (Section 5.6) and railway systems (Section 5.16-5.18), and Volume 1, Section 6 for associated construction activities (Section 6.13 and 6.23-6.25, respectively).

Chipping Warden tunnel north portal satellite compound

2.3.83 This compound will be used for railway systems installation works only, between approximately Aston le Walls and Lower Boddington. The compound will:

- be operational for approximately two years, starting in 2022;
- support approximately 25 workers each day throughout much of this period; increasing to a maximum of approximately 40 workers each day during the peak period of activity;
- be accessed via Appletree Lane, Welsh Road, A361 Byfield Road and the M40; and
- be managed from Calvert railhead main compound.

2.3.84 Key railway systems installation works in this section of the Proposed Scheme will be:

- mid-point auto-transformer station at Chipping Warden green tunnel north portal;
- fit-out of Chipping Warden green tunnel north portal buildings; and
- fit-out of tunnel systems within Chipping Warden green tunnel.

2.3.85 See Volume 1, Section 5 for descriptions of typical tunnel portals (Section 5.6) and railway systems (Section 5.16-5.18), and Volume 1, Section 6 for associated construction activities (Section 6.13 and 6.23-6.25, respectively).

Claydon Road overbridge satellite compound

2.3.86 This compound will be used for civil engineering works only, between Aston le Walls and Lower Boddington. The compound will:

- be operational for approximately two years and nine months, starting in 2017;
- support approximately 75 workers each day throughout much of this period; increasing to a maximum of approximately 145 workers each day during the peak period of activity;
- not provide worker accommodation;
- be accessed via Claydon Road (also known as Hill Road) from the M40, A361 Byfield Road and Welsh Road/Banbury Road from the east; and
- be managed from Chipping Warden green tunnel main compound.

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

- site clearance and enabling works;
- drainage;
- highway overbridge;
- cutting, embankments and landscape earthworks;
- viaduct;
- permanent fencing;
- rail systems installation; and
- landscaping and planting.

2.3.88 The compound will be used to manage construction of the Highfurlong Brook viaduct and adjacent earthworks, which will take approximately two years and nine months to complete. See Volume 1 for descriptions of typical embankments (Section 5.2) and viaducts (Section 5.9), and for associated construction techniques (Sections 6.8 and 6.16, respectively).

2.3.89 In this area no diversion of key utilities will be required.

2.3.90 Demolition of one building will be required: a commercial property (outbuilding associated with Old House Farm) at Claydon Road (also known as Boddington Road).

2.3.91 Temporary closure of Claydon Road (also known as Hill Road) with a temporary alternative route via Claydon Road (also known as Boddington Road), for a period of approximately one and a half years, then permanent reinstatement along its existing alignment.

2.3.92 Alternative routes for two PRow will be required:

- a temporary alternative route for Footpath AC₂, to the west for a period of approximately one year, adding an additional 500m. It will then be permanently diverted via the access track to Claydon Road overbridge, adding an additional 500m; and
- a temporary alternative route for Footpath AC₁, to the east for a period of approximately one year and six months, adding an additional 200m. It will then be permanently diverted via Claydon Road overbridge, adding a negligible distance.

2.3.93 Diversion of two watercourses will be required:

- a drain at Aston le Walls, which will require a diversion of approximately 1.25km to the north; and
- Highfurlong Brook, which will require a diversion under the Highfurlong Brook viaduct of approximately 45m to the north and then south around the viaduct pier.

Banbury Road green overbridge and Boddington auto-transformer station satellite compound

2.3.94 This compound will be used for civil engineering and railway installation works, between approximately Lower Boddington and Wormleighton. The compound will:

- be operational for approximately five years and nine months, including civil engineering works for approximately four years and three months, starting in 2018, and railway installation works for approximately one and a half years, starting in 2022;
- support approximately 30 workers each day throughout the civil engineering works period; increasing to a maximum of approximately 60 workers each day during the peak period of activity; and support approximately 30 workers each day throughout the rail systems installations works period; increasing to a maximum of approximately 40 workers each day during the peak period of activity;
- not provide worker accommodation;
- be accessed via Banbury Road from Welsh Road, A361 Byfield Road and the M40 from the west and/or via Banbury Road from Welsh Road, A361 Byfield Road, A45 and the M1 from the east; and
- be managed from Chipping Warden green tunnel main compound for the civil engineering works and be managed from the A423 Banbury Road overbridge (east) main compound for the railway installation works (see CFA16).

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

- site clearance and enabling works;
- culvert and drainage;
- highway overbridge;
- private access underbridge;
- cuttings, embankments and landscape earthworks;
- permanent fencing;
- rail systems installation; and
- landscaping and planting.

2.3.96 The compound will be used to manage construction of the Lower Boddington open section, which will take approximately four years and three months to complete (this duration includes works that will be in the Ladbroke and Southam area, (CFA16). See Volume 1 for descriptions of typical rail corridor (Section 5.1), embankments (Section 5.2) and viaducts (Section 5.9), and for associated construction techniques (Sections 6.8 and 6.16, respectively).

- 2.3.97 In this area no alternative routes for PRow or diversions of key utilities will be required.
- 2.3.98 Demolitions will be required at two properties:
- commercial property (Fir Tree Nursery, including three greenhouses and one barn) at Banbury Road; and
 - commercial property (Spella Field, including three farm outbuildings and manége) at Claydon Road (also known as Boddington Road).
- 2.3.99 Diversion of five roads will be required:
- permanent closure of Claydon Road (also known as Boddington Road), with traffic diverted 550m to the north via the realigned Banbury Road;
 - permanent diversion of private access to Three Shires Farm, via the realigned Claydon Road (also known as Boddington Road);
 - permanent diversion of Banbury Road, over more than 1km from Spella House into the Ladbroke and Southam area (CFA16);
 - permanent diversion of Stoneton Lane towards Lower Boddington through Fox Covert along the north side of the Proposed Scheme to join Banbury Road; and
 - permanent new private access route into Cedars Farm, accessed from Claydon Road (also known as Boddington Road) on the west side of the route.
- 2.3.100 Diversion of four watercourses will be required:
- the canal feeder at Fir Tree Nursery, Lower Boddington, which will require a diversion of approximately 200m to the south, with a culvert crossing under the railway;
 - a drain at Fir Tree Nursery, Lower Boddington, which will require a diversion of approximately 280m to the south;
 - a drain at Spella House, Lower Boddington, which will require a diversion of approximately 500m to the north; and
 - an unnamed watercourse at Fox Covert which will require a diversion of approximately 400m to the south with a culvert crossing under the railway.
- 2.3.101 The compound will also be used to manage the railway systems installation works and the installation of the auto-transformer station at Boddington in the Ladbroke and Southam area. See CFA16 for more information about the works associated with this compound.
- 2.3.102 See Volume 1, Section 5 for descriptions of typical railway systems (Section 5.16-5.18), and Volume 1, Section 6 for associated construction activities (Section 6.13 and 6.23-6.25, respectively).

A423 Banbury Road overbridge (east) main compound

- 2.3.103 This compound is located within the Ladbrooke and Southam area (CFA16), but will provide administrative support to one satellite compound in the Greatworth to Lower Boddington area, as illustrated in Figure 4.

Construction waste and material resources

- 2.3.104 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and worker accommodation site waste produced during the construction of the Proposed Scheme in the Greatworth to Lower Boddington area have been prepared and are presented in Volume 5: Appendix WM-001-000.
- 2.3.105 The majority of excavated material generated across the Proposed Scheme will be re-used as engineering fill material or in the environmental mitigation earthworks of the Proposed Scheme, either with or without treatment.
- 2.3.106 Based on the mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Greatworth to Lower Boddington area will be managed with the aim of contributing to the overall balancing of excavated material on a route-wide basis. This overall balance of excavated material is presented in Volume 3, Section 14.
- 2.3.107 The quantity of surplus excavated material originating from the Greatworth to Lower Boddington area that will require off-site disposal to landfill as excavation waste is shown in Table 1. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for re-use within the Proposed Scheme and which will be taken directly from the Greatworth to Lower Boddington area for off-site disposal to either non-hazardous or hazardous landfill. This represents a proportion of the total quantity of surplus excavated material that will require disposal which altogether is reported on a route-wide basis in Volume 3, Section 14.
- 2.3.108 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 performance of similar projects as follows:
- demolition waste: 90%;
 - construction waste: 90%; and
 - worker accommodation site waste: 50%.
- 2.3.109 The quantities of construction, demolition and excavation waste that will require off-site disposal to landfill are shown in Table 1.

Table 1: Estimated construction demolition and excavation waste

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for off-site disposal to landfill (tonnes)
Excavation	16,200,445	0
Demolition	39,218	3,922
Construction	112,604	11,260
Worker accommodation site	213	107
TOTAL	16,352,480	15,289

2.3.110 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

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

Construction programme

2.3.112 A construction programme that illustrates indicative periods for the construction activities described above 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																																				
Brackley south cutting main compound	See CFA 14																																			
Radstone Road overbridge satellite compound	See CFA 14																																			
<i>Greatworth south embankment</i>																																				
<i>Helmdon culvert</i>																																				
Greatworth green tunnel satellite compound																																				
<i>Greatworth south cutting</i>																																				
<i>Public Footpath AN22 accommodation overbridge</i>																																				
<i>Bridleway AN37 accommodation overbridge</i>																																				
<i>Greatworth dry valley drop inlet culvert</i>																																				
<i>Bridleway AN14 accommodation overbridge</i>																																				
<i>Greatworth north embankment</i>																																				
<i>Greatworth Hall culvert</i>																																				
<i>Greatworth north cutting</i>																																				
<i>Greatworth auto-transformer station</i>																																				
<i>Greatworth green tunnel</i>																																				
Chipping Warden green tunnel main compound																																				
<i>Chipping Warden green tunnel</i>																																				
Thorpe Mandeville cutting satellite compound																																				
<i>Thorpe Mandeville cutting</i>																																				
<i>Banbury Road overbridge</i>																																				

2.4 Operation of the Proposed Scheme

Operational specification

- 2.4.1 Volume 1, Section 4.3 describes the envisaged operational characteristics of Phase One of HS2 as a whole and how they may change when Phase Two is also operational.

HS2 services

- 2.4.2 It is anticipated that initially there would be 11 trains per hour each way passing through the Greatworth to Lower Boddington 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 It is anticipated that with Phase One in place the frequency of services could rise to 14 trains per hour each way during peak hours, and that with Phase Two in place the frequency could rise to 18 trains per hour each way during peak hours. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two.
- 2.4.4 In this area, trains will run at speeds up to 360kph (225mph). The trains will be either single 200m long trains or two 200m long trains coupled together, depending on demand and time of day.

Maintenance

- 2.4.5 Volume 1, Section 4.3 describes the maintenance regime for HS2.
- 2.4.6 The intention is that inspections of the route will take place on a regular basis, at night when the railway is not operating. There would be routine preventative maintenance, including grinding and milling of the rails to keep them in good condition, and more periodic heavy maintenance as necessary.
- 2.4.7 Railway maintenance vehicles would be parked either at the Calvert infrastructure maintenance depot, or in the defined maintenance loops along the route – in this area there will be maintenance loops to the west of Claydon Road (also known as Boddington Road) extending into the Ladbroke and Southam area (CFA16). The maintenance loops could also be used in the case that a passenger train could not continue unassisted to its destination.

Operational waste and material resources

- 2.4.8 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.
- 2.4.9 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.

- 2.4.10 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.
- 2.4.11 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.
- 2.4.12 The quantity of operational waste that will be re-used, recycled and recovered (i.e. diverted from landfill) has been based on landfill diversion performance information from Network Rail and other sources as follows:
- railway station and trains: 60%;
 - rolling stock maintenance: 80%;
 - track maintenance: 85%; and
 - ancillary infrastructure: 60%.
- 2.4.13 On this basis, approximately 251 tonnes of operational waste will be re-used, recycled and recovered during each year of operation of the Proposed Scheme in the Greatworth to Lower Boddington area. Approximately 50 tonnes will require disposal to landfill (see Table 2).

Table 2: Operational waste forecast for the Proposed Scheme

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste for disposal to landfill per annum (tonnes)
Railway station and trains	0	0
Rolling stock maintenance	0	0
Track maintenance	279	41
Ancillary infrastructure	23	9
TOTAL	302	50

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

2.5 Community forum engagement

- 2.5.1 HS2 Ltd’s approach to engagement on the Proposed Scheme is set out in Volume 1, Section 3.
- 2.5.2 The engagement undertaken within this community forum area is summarised below. A series of community forum meetings and discussions with individual landowners,

organisations and action groups were undertaken. Community forum meetings were held on:

- 27 March 2012 at Aston le Walls Village Hall;
- 19 June 2012 at Aston le Walls Village Hall;
- 18 September 2012 at Aston le Walls Village Hall;
- 20 November 2012 at Aston le Walls Village Hall;
- 19 February 2013 at Aston le Walls Village Hall; and
- 19 September 2013 at Aston le Walls 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:

- the effect of noise from trains entering and exiting green tunnels or when travelling on a viaduct, together with queries as to how this noise will be mitigated;
- the impact on Lower Thorpe and effects on the properties in other local communities;
- disruption to local rights of way/bridleway networks that link the surrounding villages and also the schools at Aston le Walls and Chipping Warden;
- impacts on the Edgcote Battlefield site and local ancient woodlands;
- queries and concerns regarding the design cycle and design standards that will be adopted and the mitigation which can be provided;
- effects of construction sites and traffic on local farmland and the road network; and
- effects of permanent structures associated with the route such as power substations and maintenance access points.

2.5.5 In addition to the engagement through the community forums, the draft Environmental Statement and Design Refinement consultations were launched on 16 May 2013 for a period of eight weeks and closed on the 11 July 2013. As part of these consultations, members of local communities and other interested parties were notified, provided with information and invited to engage on issues pertinent to the draft Environmental Statement and the development of the scheme. Details of the local consultation events were provided on HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the Proposed Scheme. In the Greatworth to Lower Boddington area consultations on the draft Environmental Statement and on the Design Refinement were held on 3 June 2013 at Boddington Village Hall.

- 2.5.6 HS2 Ltd staff attended the events, including engineers and environmental specialists, for members of the public to speak to.
- 2.5.7 Responses from the draft 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 in 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 and in Volume 5: Appendix CT-002-000. The main local alternatives considered for the Proposed Scheme within this area are described in this section.
- 2.6.2 Since April 2012, as part of the design development process, a series of local alternatives have been reviewed within workshops attended by engineering, planning and environmental specialists. During these workshops, the likely significant environmental effects of each design option have been reviewed. The purpose of these reviews has been to ensure that the Proposed Scheme draws the appropriate balance between engineering requirements, cost and potential environmental impacts.

Green tunnel at Greatworth

- 2.6.3 The Proposed Scheme includes a green tunnel as the railway passes Greatworth. The depth of the railway through this section has been reduced compared with the January 2012 announced route. A number of alternatives to the Proposed Scheme were considered:
- Option A: January 2012 announced route, a 2.1km long green tunnel up to 26m deep with a very shallow gradient towards the south;
 - Option B: January 2012 announced route with a partial reduction in tunnel depth (up to 6m shallower than Option A);
 - Option C: a reduction in tunnel depth (up to 8m shallower than Option A) with reduced length of green tunnel to the north;
 - Option D: a reduction in tunnel depth (up to 8m shallower than Option A) with removal of the green tunnel; and
 - Option E: the Proposed Scheme, consisting of the January 2012 announced route with a reduction in tunnel depth (up to 8m shallower than Option A) and a full green tunnel.
- 2.6.4 The January 2012 announced route would be complex to build, resulting in a very deep cutting, with the handling of significant volumes of excavated material and a large area of land during construction. As a consequence, it would take a long time and be costly to construct. To reduce these construction impacts, options were considered to explore whether varying the depth and length of the green tunnel could reduce the environmental effects, costs and construction programme. Options were also considered to simplify the drainage arrangements for the tunnel and to increase the

area of land that could be returned to agricultural use following construction. However, some options would also result in an increase in the height of the viaduct to the north of the tunnel and/or increase the volume of excavated material that would need to be removed from the area, with consequential impacts for construction traffic. A number of alternatives to the Proposed Scheme were considered.

- 2.6.5 Option A could return a high proportion of land to agriculture and have less potential for noise and visual effects than Options B, C and D, and not result in a viaduct change. However, it would not provide the necessary drainage gradients and, being the deepest of the options, would have the largest impact in terms of construction footprint and environmental effects, and the longest construction programme. For these reasons, Option A was not adopted.
- 2.6.6 Option B would provide suitable drainage gradients and a small reduction in the depth of the tunnel. Otherwise, the environmental impact of this option would not be materially different to Option A. For these reasons, Option B was not adopted.
- 2.6.7 Option C would provide suitable drainage gradients and could potentially reduce costs and construction duration. However, the shorter section of tunnel and the longer cutting would result in more excavated material to be removed, less agricultural land following construction, and the potential for more noise and visual effects than Options A, B and E. For these reasons Option C was not adopted.
- 2.6.8 Option D would provide suitable drainage gradients and, by removing the green tunnel completely, could potentially reduce costs and construction duration. However, it would result in more excavated material to be removed, less agricultural land following construction, and create a greater potential for noise and visual effects than Options A, B, C and E. For these reasons Option D was not adopted.
- 2.6.9 As a consequence of the shallower tunnel in Option E, the surface sections to the north and south of the tunnel will be higher, which will increase the potential for noise and visual effects, notably for the viaduct at Lower Thorpe. However, along the tunnel section it will provide suitable drainage gradients, and similar noise and visual screening to Option A. It will result in less excavated material, a relatively small construction footprint, and a higher proportion of agricultural land reinstatement following construction than Options C and D. It will also significantly reduce the cost and construction duration compared to Options A and B. On balance, it was considered that the adoption of noise fence barriers, landscape earthworks and planting will mitigate the effects of the higher alignment outside the tunnel and therefore Option E was adopted in the Proposed Scheme.

Green tunnel at Greatworth – extension past Greatworth Hall

- 2.6.10 The Proposed Scheme consists of the January 2012 announced route with a reduced depth of tunnel past Greatworth (as described in 2.6.3 above). As a consequence of the shallower tunnel, the southern approach to the tunnel would consist of a series of cuttings and embankments. The local community and owners of Greatworth Hall requested that the green tunnel be extended southwards to reduce noise and visual impacts on Greatworth Hall. Three options for the green tunnel were considered:

- Option A: the Proposed Scheme, consisting of a green tunnel past Greatworth extending approximately 150m south of Helmdon Road.
- Option B: A 950m extension of the green tunnel on the current vertical alignment to approximately 400m south of Greatworth Hall.
- Option C: A 950m extension of the green tunnel to approximately 400m south of Greatworth Hall on a lowered vertical alignment.

- 2.6.11 Extending the green tunnel would reduce potential noise effects at Greatworth Hall, avoid the need for a new overbridge and allow more land to be returned to agriculture. However, it would also increase the construction footprint, increasing impacts on the disused railway corridor.
- 2.6.12 Option B would result in the tunnel extension being above ground for almost its entire length, requiring significant earthworks to cover and integrate it into the landscape. This would require additional land from Greatworth Hall as well as impacting on views across the valley from the Hall and other local receptors. The gradient within the tunnel would be below that required for drainage within tunnels with an associated increase in the operational safety risks to the railway and increased maintenance requirements.
- 2.6.13 Option C would involve reducing the vertical alignment past Greatworth Hall. This would enable the minimum gradient for drainage of 0.5% to be achieved and allow the existing watercourse (dry valley) to be maintained over the tunnel; however, a sump and pump would be required at the low point of the sag to dispose collected water. This option would also result in a much deeper cutting at the point at which the tunnel emerges requiring land from Halse Copse South, an area of ancient woodland, as well as requiring the relocation of the Greatworth Reservoir. Past Greatworth Hall the increased depth of tunnel would require a significant retained cut during construction.
- 2.6.14 The extended length of tunnel and increased earthworks for Options B and C would increase the construction and operational costs of the Proposed Scheme which could not be justified for the limited environmental benefits that would be gained.
- 2.6.15 For these reasons an extended tunnel was not adopted in the Proposed Scheme.

Enclosed tunnel at Lower Thorpe

- 2.6.16 The Proposed Scheme exits the cutting at Thorpe Mandeville onto approximately 350m of embankment before moving onto an approximately 190m-long viaduct. The January 2012 announced route also included an embankment and viaduct up to 8m high in this location. However, the height of the route has been raised in the Proposed Scheme in order to align with the green tunnel at Greatworth (see above). The local community proposed extending the green tunnel by enclosing the railway northwards of the tunnel with earth bunds, as a way of mitigating potential noise and visual effects.
- 2.6.17 In this location, the route will cross steep, unstable slopes either side of a floodplain. Any earthwork structures would lead to direct loss of floodplain, therefore requiring

large and long culverts and large areas of floodplain mitigation to ensure no increase in flood risk. This could contravene the Water Framework Directive (WFD), and would add to long-term maintenance and associated costs¹⁹. Furthermore, deep cuttings into the hillside would be required to provide the floodplain compensation, which would be visually intrusive and costly. Whilst steeper earthworks slopes could help to reduce the floodplain impact, these would reduce the area of land that could be returned to agriculture and would have a greater visual effect.

2.6.18 For these reasons, a closed tunnel to cross Lower Thorpe has not been adopted in the Proposed Scheme.

Green tunnel at Chipping Warden

2.6.19 The Proposed Scheme will include a green tunnel as the railway passes Chipping Warden and Aston le Walls. The depth of the railway through this section has been reduced compared with the January 2012 announced route. A number of other alternatives were considered:

- Option A: January 2012 announced route (a 2.47km long green tunnel up to 32m deep with a flat vertical alignment);
- Option B: a partial reduction in tunnel depth (up to approximately 8m shallower than Option A);
- Option C: a reduction in tunnel depth (up to 12.5m shallower than Option A) and a reduced length of green tunnel to the north;
- Option D: a reduction in tunnel depth (up to 12.5m shallower than Option A) and a reduced length of green tunnel to the south; and
- Option E: the Proposed Scheme, with a fully raised tunnel depth (up to 12.5m shallower than Option A).

2.6.20 The January 2012 announced route would be complex to build, resulting in a very deep cutting, the handling of significant volumes of excavated material and a large area of land required during construction. As a consequence it would take a long time and be costly to construct. To reduce these construction impacts, options were considered to explore whether varying the depth and length of the green tunnel could reduce the environmental effects, costs and impacts on construction programme. At the same time, options were also considered to simplify the drainage arrangements for the tunnel. However, as noted below, some options would also result in an increase in the height of the viaduct to the north of the tunnel and/or increase the volume of excavated material that would need to be removed from the area, with consequential impacts for construction traffic.

2.6.21 Option A could return a relatively high proportion of land to agriculture, have less potential for noise and visual effects than Options B, C and D, and not result in changes to railway height north and south of the tunnel. However, it would not

¹⁹ 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, (Water Framework Directive) Strasbourg, European Parliament and European Council.

provide the necessary drainage gradients and, being the deepest of the options, would have the largest impact in terms of construction footprint and environmental effects, and the longest construction programme. For these reasons, Option A was not adopted.

- 2.6.22 Option B would provide suitable drainage gradients and a small reduction in the depth of the tunnel. However, it would increase the height of the embankment and viaduct at Highfurlong Brook compared with Option A. Otherwise, the environmental impact of this option would not be materially different to Option A. It would provide a small cost reduction compared to Option A. However, it would have a larger impact in terms of construction footprint and environmental effects, and take longer to construct than Option E. Therefore, Option B was not adopted.
- 2.6.23 Options C and D would provide suitable drainage gradients, and would potentially reduce costs and construction duration. However, the shorter sections of tunnel and the longer cutting would result in more excavated material to be removed, less agricultural land returned following construction, and the potential for more noise and visual effects than Options A, B and E. For these reasons, Options C and D were not adopted.
- 2.6.24 As a consequence of the shallower tunnel under Option E, the surface sections to the north and south of the tunnel will be higher. However, it will provide suitable drainage gradients, and similar noise and visual screening to Option A along the tunnel section. It will result in less excavated material to be removed, a relatively small construction footprint, and a higher proportion of agricultural land reinstatement following construction than Options B, C and D. It will also significantly reduce the cost and construction duration compared to Options A and B. On balance, it was considered that the adoption of noise fence barriers, landscape earthworks and planting will mitigate the effects of the higher alignment outside the tunnel. Therefore Option E was adopted in the Proposed Scheme.

Lowered alignment or extended green tunnel for Boddington

- 2.6.25 The Proposed Scheme includes a green tunnel as it passes Aston le Walls and Chipping Warden. The route will emerge from green tunnel beyond Aston le Walls. It will continue on embankment before crossing the Highfurlong Brook on a viaduct structure south-west of Lower Boddington. It will then continue on embankments and in shallow cuttings.
- 2.6.26 Five alternative options were considered for the vertical alignment of this section of route:
- Option A: January 2012 announced route which includes an embankment approximately 5m above existing ground level and a cutting approximately 1m deep;
 - Option B: lowered alignment past the villages of Lower and Upper Boddington;
 - Option C: lowered alignment and extend the green tunnel past the villages of Lower and Upper Boddington;

- Option D: extended green tunnel past the villages of Lower and Upper Boddington above ground level screened with landscape earthworks; and
- Option E: the Proposed Scheme, with partially raised alignment adjacent to Lower Boddington (approximately 0.5m higher than Option A) screened with raised earthworks.

2.6.27 For each of the above options, the depth of the railway in this area is restricted by the need to achieve sufficient clearance across the floodplain of the Highfurlong Brook.

2.6.28 Option B would have deeper, wider cuttings at each end of the proposed embankment section at Lower Boddington than Option E. This would increase the construction impacts, costs and construction duration. Option B would also require the permanent acquisition of more land than Option E due to the wider and deeper cuttings. For these reasons, Option B has not been adopted in the Proposed Scheme.

2.6.29 Both Options C and D would provide effective mitigation of operational sound, but would involve extensive excavations and the construction of at least one vent shaft due to the increased length of the green tunnel. They would both affect the ecology and land around the Highfurlong Brook, which would have to be diverted, managed during tunnel construction, and then reinstated over the tunnel with wider deeper cuttings needed required on the tunnel approach and increased loss of agricultural land. They would both increase the depth of the railway to the north and south of the tunnel. Overall, both Options C and D would result in higher construction impacts and costs and longer construction duration than other options and would have a higher construction and maintenance cost.

2.6.30 Option E will include raised landscape earthworks, planting, screen bunds and noise fence barriers to provide sound and visual mitigation in this area. This will be more efficient to construct, and will reduce construction phase effects on residential receptors and on the Highfurlong Brook.

2.6.31 For these reasons Option E was adopted in the Proposed Scheme.

Culworth Road

2.6.32 The Proposed Scheme will be in cutting up to 5m deep on the approach to the south portal of the Chipping Warden green tunnel. The cutting will pass through the current alignment of Culworth Road. Two options were investigated for Culworth Road:

- Option A: a diversion of Culworth Road southwards to move it clear of the tunnel portal works and to allow a more perpendicular crossing of the cutting by the realigned highway; and
- Option B: the Proposed Scheme, the permanent closure of Culworth with the provision of a mixed-use non-motorised access around the top of the south portal of the Chipping Warden green tunnel for pedestrian, equestrian and cycle use. Blackgrounds Farm would have a private access via Culworth Road from Chipping Warden.

2.6.33 Culworth Road is currently lightly trafficked and is not used by scheduled local bus services. The closure to through vehicle traffic, and use of the alternative routes via

Welsh Road and A361 Byfield Road, was considered to have minimal effect on overall journey times on the comparatively few vehicle movements. Option B would have the benefit of avoiding the construction and visual effects of an additional overbridge and highway diversion. Option A would require an approximate 900m diversion to the existing highway alignment that would sever existing agricultural fields and create two pockets of land that may have reduced viability for agricultural use. Option B maintains the existing highway alignment up to where it would be intercepted by the cutting and thereby avoids any additional severance of agricultural land beyond that generated by the railway. Access to land on the opposite side of the railway from Blackgrounds Farm will be maintained underneath the viaduct at Edgcote.

2.6.34 For these reasons Option B has been adopted in the Proposed Scheme.

3 Agriculture, forestry and soils

3.1 Introduction

- 3.1.1 This section provides a description of the current baseline for agriculture, forestry and soils and an assessment of the likely impacts and significant effects as a result of the construction and operation of the Proposed Scheme. Consideration is given to the extent and quality of the soil and land resources underpinning the primary land use activities of farming and forestry, and the physical and operational characteristics of enterprises engaged in these activities. Consideration is also given to diversification associated with the primary land uses, and to related land-based enterprises, notably equestrian activities.
- 3.1.2 The quality of agricultural land in England and Wales is assessed according to the Agricultural Land Classification (ALC) system, which classifies agricultural land into five grades from excellent quality Grade 1 land to very poor quality Grade 5 land. Grade 3 is subdivided into Subgrades 3a and 3b. The main issue in the assessment of the impacts on agricultural land is the extent to which land of best and most versatile (BMV) agricultural quality (Grades 1, 2 and 3a) is affected by the Proposed Scheme.
- 3.1.3 Forestry is considered as a land use feature and the impacts have been calculated quantitatively. The qualitative effects on forestry land and woodland are addressed principally in the ecology and landscape and visual assessments (see Sections 7 and 9).
- 3.1.4 Soil attributes, other than for food and biomass production, are identified in this section but the resulting function or service provided is assessed in other sections, notably cultural heritage, ecology and landscape and visual assessment (see Sections 6, 7 and 9).
- 3.1.5 The main issue for farm holdings is the disruption by the Proposed Scheme of the physical structure of agricultural holdings and the operations taking place upon them, during both its construction and operational phases. Key engagement has been undertaken with farmers and landowners affected by the Proposed Scheme to obtain factual information on the scale and nature of the farm and forestry operations and related farm-based uses.
- 3.1.6 Details of published and publicly available information used in the assessment, and the results of surveys undertaken within this study area, are contained in Volume 5: Appendix AG-001-015.

3.2 Scope, assumptions and limitations

- 3.2.1 The assessment scope, key assumptions and limitations for the agriculture, forestry and soils assessment are set out in Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.
- 3.2.2 The study area for the agriculture, forestry and soils assessment covers all of the land that will be required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land,

forestry land and soils; together with farm and rural holdings. The assessments of the impacts on agricultural land quality and forestry land are made with reference to the prevalence of BMV land and forestry in the general locality, taken as a wider 4km corridor centred on 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. There are no assumptions or limitations that are specific to the assessment in this study area.

3.3 Environmental baseline

Existing baseline

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

Soils and land resources

Topography and drainage

- 3.3.2 The main topographical features within the study area are described in detail in the landscape and visual assessment (Section 9) and comprise a series of valleys associated with the Rivers Tove and Cherwell, their associated tributaries, and the Highfurlong Brook. The Oxford Canal is also a significant water body in the area. Altitudes in the area vary from 100m to 180m above Ordnance Datum (AOD).

Geology and soil parent materials

- 3.3.3 The main geological features are described in detail in the land quality assessment (Section 8). The predominant underlying geology mapped by the British Geological Survey (BGS) is that of the Lias Group. This includes the Whitby Mudstone formation which consists of mudstone and siltstone, and which commonly overlies limestone or ironstone. To the south of the route and around Thorpe Mandeville, the underlying geology is of the Great Oolite Group and includes the Taynton Limestone and Horsehay Sand formations, comprising limestone, sandstone and ironstone. The Taynton Limestone formation is overlain by superficial glacial till deposits.
- 3.3.4 The Charmouth Mudstone formation is mapped along the course of the River Cherwell and consists of mudstones and siltstones, overlain by superficial alluvial deposits of clay, silt, sand and gravel.

Description and distribution of soil types

- 3.3.5 The characteristics of the soils are described by the Soil Survey of England and Wales²⁰ and shown on the National Soil Map²¹. The soils are grouped into associations of a range of soil types. They are described in more detail in Volume 5: AG-001-015 and their distribution is shown on Map AG-02-015 (Volume 5, Agriculture, Forestry and Soils Map Book).
- 3.3.6 The Soil Survey of England and Wales indicates the Denchworth association across most of the area. This is typically stoneless, wet and clayey in texture. These soils are poorly drained; they are waterlogged for prolonged periods throughout the year and are most commonly assessed as being of Wetness Class (WC) IV²². The extent of the Denchworth soil is determined by the outcrop of mudstones. In the south soils of the Ragdale association occur where land is undulating and overlies Oolite Group limestone bedrock overlain with clayey alluvium. These soils are usually of WC III or IV. Aberford and Banbury associations are mapped on the slopes of Greatworth and Thorpe Mandeville and comprise respectively fine and coarse loamy, permeable soils of WC I.
- 3.3.7 In contrast, the Fladbury 1, Wickham 2 and Oxpasture soils are associated with the waterways and floodplains of the River Cherwell, the Highfurlong Brook and the Oxford Canal. Fladbury 1 soil marks the immediate channels and floodplains and consequently is wet and clayey in WC IV. As land rises from the floodplain, soils of the Wickham 2 association are present. These are similarly fine loamy or clay textured, but slightly better draining, in WC III or IV. Wickham 2 soils are also mapped in conjunction with the River Tove, to the east of Greatworth. The Oxpasture association is mapped on the gentle and moderate slopes nearing the hilltops. This comprises fine loamy or silty topsoils over clay. These soils mark a transition between the wet alluvial soils and the loamy hilltop soils, and are most commonly assessed as being in WC II or III.

Soil and land use interactions

Agricultural land quality

- 3.3.8 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.
- 3.3.9 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. In this area there are three distinct groups of soil types: the poorly drained soils of the Denchworth association across much of the lowland areas; the well-drained loamy soils of the hills and slopes; and the poorly drained loamy and clayey soils that are mapped in the vicinity of the watercourses.

²⁰ Soil Survey of England and Wales (1984), *Soils and their Use in South East England*.

²¹ Cranfield University (2001), *The National Soil Map of England and Wales 1:250,000 scale*. National Soil Resources Institute, Cranfield University, UK.

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

- 3.3.10 Climate can be a limiting factor to the grading of agricultural land in the area around Greatworth with the combination of moderate annual rainfall (approximately 700mm per annum) and relatively cool temperatures restricting the land locally to no better than Grade 2 (see Volume 5: Appendix AG-001-015. Section 2). The local climate has about 165 Field Capacity Days, which is slightly longer than the average for lowland England and is slightly unfavourable for landwork.
- 3.3.11 Gradients and changing slopes are not limiting to agricultural machinery in this area. Potential flooding is restricted to the floodplains of the River Cherwell and Highfurlong Brook, which pass through much of the area, and the River Tove which occupies areas in the south-east of the area.
- 3.3.12 The principal limiting factors determining agricultural land quality in this study area are soil wetness and soil droughtiness. Overall, under the local climatic conditions, well drained loamy Aberford and Banbury soils are limited to Subgrade 3a by soil droughtiness. The clay loam over clay soils of the Denchworth, Ragdale, Fladbury 1 and Wickham 2 associations are limited to Subgrade 3b on soil workability. Full details are provided in Volume 5: Appendix AG-001-015.
- 3.3.13 Oxpasture soils are likely to be Grade 2 where they are in WC II and have clay loam topsoils, and Subgrade 3a where they have similar topsoils but are in WC III. These soils are also typically slightly droughty for cereals which will limit them to Grade 2 on droughtiness.
- 3.3.14 Department for Environment, Food and Rural Affairs (Defra) mapping²³ shows that there is generally a low likelihood of encountering BMV land in the locality, which makes such land a resource of high sensitivity in this area.

Other soil interactions

- 3.3.15 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 England²⁴ and The Natural Choice: securing the value of nature²⁵, 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.

²³ Defra, (2005), *Likelihood of Best and Most Versatile Agricultural Land*.

²⁴ Defra (2009), *Soil Strategy for England*.

²⁵ Defra (2011), *The Natural Choice: securing the value of nature*.

- 3.3.16 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.
- 3.3.17 The floodplains of the Rivers Tove and Cherwell and the Highfurlong Brook represent the functional flood environment, as set out in (Section 13). Flood Zone mapping shows there to be a significant risk of flooding in this area, with the soils functioning as water stores for flood attenuation, as well as providing a habitat for ecology. Flooding can downgrade agricultural land to Subgrade 3b or Grade 4 depending on its frequency and duration.
- 3.3.18 The presence of soil-borne cultural assets is detailed in Section 6, and appears mainly to be concentrated in the river valleys, specifically within and immediately adjacent to the valley of the River Cherwell.

Land use

Land use description

- 3.3.19 Agricultural land is mainly in arable use, with fields sown with combinable crops. There are, though, significant areas of pasture used to graze cattle, sheep and horses especially in the vicinity of Thorpe Mandeville, the River Cherwell valley and around Lower Boddington. There are also large equestrian units near Culworth and Aston le Walls, and two horticultural units at Greatworth and Lower Boddington.
- 3.3.20 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone (NVZ), which is an area in which nitrate pollution is a potential problem. Statutory land management measures apply which seek to reduce nitrogen losses from agricultural sources to water. Some agricultural land is also subject to management prescriptions associated with the Environmental Stewardship Scheme which seeks either generally (the Entry Level Scheme – ELS) or specifically (the Higher Level Scheme – HLS) to retain and enhance the landscape and biodiversity qualities and features of farmland. Holdings which have land entered into an agri-environment scheme are identified in Table 3.
- 3.3.21 Woodland in this study area is relatively sparse and represents 4% of land cover compared to the national average of 10%. There are large woodland blocks at Halse Copse at the southern end of the study area, the pockets of woodland near Thorpe Mandeville, including at Lower Thorpe, Osierbed Spinney and the other spinneys at Edgcote. There is also a block of woodland at Fox Covert at the northern end of the study area.

Number, type and size of holdings

- 3.3.22 There is a mixture of owner-occupation and tenancies, which range from smallholdings to large farms of over 800ha. The boundaries of the holdings are shown on Maps AG-01-035 to AG-01-041 (Volume 5, Agriculture, Forestry and Soils Map Book) along with the location of the main farm buildings. Field drainage is common throughout the study area, but no farms have been identified that undertake routine field irrigation of crops.

3.3.23 Table 3 sets out the sensitivity of individual holdings to change, which is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, can absorb impacts and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Small (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 Series AG-01 (Volume 5, Agriculture, Forestry and Soils Map Book) and Volume 5: Appendix AG-001-015.

Table 3: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA15/1 * Halse Grange Farm	Arable	129	Not known	ELS	Medium
CFA15/2 Falcutt Hall	Arable, sheep	166	Gamebird shoot	ELS	Medium
CFA15/3 Greatworth Field Cottage	Residential – with paddock	1	None	None	Low
CFA15/4 Greatworth Field Farm	Horticulture	12	None	None	High
CFA15/5 Greatworth Hall	Arable	165	Farm buildings let	ELS	Medium
CFA15/6 Whitman's Farm	Arable, sheep	114	None	ELS	Medium
CFA15/7 Marston St Lawrence Estate	Dairy, arable	674	Anaerobic digestion	ELS	High
CFA15/8 Costow Farm	Arable	186	None	ELS	Medium
CFA15/9 Manor Farm and Magpie Farm	Equestrian grazing let	96	None	ELS	Low
CFA15/10 * Lower Thorpe Farm	Grazing	10	Not known	ELS	Low
CFA15/11 * Twin Oaks	Equestrian grazing	7	Not known	None	Low

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA15/12 Park Farm	Arable	182	None	None	Medium
CFA15/13 Culworth Grounds Farm	Arable, equestrian	212	Buildings let for race and eventing horses	ELS	High
CFA15/14 West Mill Farm	Arable, sheep	243	None	ELS	Medium
CFA15/15 * Edgcote Estate	Arable, dairy, equestrian	349	Not known	OELS ²⁶	High
CFA15/16 Warden Farms (including Trafford Bridge Farm)	Arable	809	Farm buildings converted to art studio	ELS and HLS	Medium
CFA15/17 * Bramble Cottage	Grazing	28	Not known	None	Medium
CFA15/18 Appletree Farm	Arable, dairy	324	None	OELS	High
CFA15/19 Manor Farm	Sheep	68	None	ELS	Medium
CFA15/20 Washbrook Farm	Equestrian	65	Gamebird shoot	None	High
CFA15/21 * Cleveland Farm	Grazing	23	Not known	None	Medium
CFA15/22 Old House Farm	Arable, beef	506	Gamebird shoot Bed and breakfast	ELS	Medium
CFA15/23 Cedars Farm	Sheep, beef, arable	304	None	ELS	Medium
CFA15/24 Fir Tree Nursery	Horticulture	4	None	None	High
CFA15/25 Three Shires Farm and Hill Farm	Arable	154	None	ELS	Medium
CFA15/26* Spella Bungalow	Residential with grazing	1	Not known	None	Low

²⁶ Organic Entry Level Stewardship Scheme.

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA15/27 Spella Field	Equestrian grazing	3	None	None	Low
CFA15/28 Manor Park	Smallholding	6	None	None	Low
CFA15/29 * Collins Farm	Arable	20	Not known	None	Medium
CFA15/30 Spella House	Arable	10	Agricultural engineering	None	Medium
CFA15/31 * Fox Covert	Woodland	3	None	None	Low
CFA15/32 * The Bungalow	Horticulture	1	Not known	None	High

* No Farm Impact Assessment interview conducted; data estimated

Future baseline

Construction (2017)

- 3.3.24 No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for agriculture, forestry and soils. A 7.0ha photovoltaic park at Culworth Grounds Farm (CFA15/13) has been granted planning permission but will not adversely affect BMV agricultural land in the area.
- 3.3.25 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)

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

3.4 Effects arising during construction

Avoidance and mitigation measures

- 3.4.1 During the development of the design, the following measures have been incorporated to avoid or mitigate impacts on agriculture, forestry or soils during construction:
- agricultural accommodation bridges incorporated into footpath overbridges at Halse Copse South and North and Greatworth;
 - agricultural overbridge at Culworth Grounds Farm (CFA15/13);
 - agricultural overbridge incorporated into bridleway overbridge for West Mill Farm (CFA15/14);
 - new field accesses associated with Claydon Road overbridge (Lower Boddington);
 - replacement private access to Cedars Farm (CFA15/23); and
 - new field accesses associated with the Claydon Road overbridge.
- 3.4.2 In addition, there is a need to avoid or reduce adverse environmental impacts to soils during construction. It is an essential element of the construction process that the soil resources from the areas required temporarily and permanently are stripped and stored so that land required temporarily for construction purposes which is currently in agricultural use can be returned to that use, where agreed, and to its pre-existing agricultural condition.
- 3.4.3 Subject to the adoption of good practice techniques in handling, storing and reinstating soils on land where agricultural or forestry uses are to be resumed, there will be no reduction in the long-term capability which would downgrade the quality of disturbed land. Some land with heavier textured soils may require careful management during the aftercare period to ensure this outcome.
- 3.4.4 Compliance with the CoCP will avoid or reduce environmental impacts during construction. Of particular relevance to agriculture, forestry and soils are the following measures (see Volume 5: Appendix CT-003-000/1):
- the reinstatement of agricultural land which is used temporarily during construction to agriculture, where this is the agreed end use (draft CoCP, Section 6);
 - the provision of a method statement for stripping, handling, storing and replacing agricultural and woodland soils to reduce risks associated with soil degradation on areas of land to be returned to agriculture and woodland following construction, based on detailed soil survey work to be undertaken prior to construction. This will include any remediation measures necessary following the completion of works (draft CoCP, Section 6);

- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect agriculture, forestry and soil resources during construction (draft CoCP, Section 5);
- arrangements for the maintenance of farm and field accesses affected by construction (draft CoCP, Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (draft CoCP, Sections 6 and 16);
- the protection of agricultural land adjacent to the construction site, including the provision and maintenance of appropriate stock-proof fencing (draft CoCP, Sections 6 and 9);
- the adoption of measures to control the deposition of dust on adjacent agricultural crops (draft CoCP, Section 7);
- the control of invasive and non-native species; and the prevention of the spread of weeds generally from the construction site to adjacent agricultural land (draft CoCP, Section 9);
- the adoption of measures to prevent, as far as reasonably practicable, the spread of soil-borne, crop and animal diseases from the construction area (draft CoCP, Sections 6 and 9); and
- liaison and advisory arrangements with affected landowners, occupiers and agents, as appropriate (draft CoCP, Sections 5 and 6).

Assessment of impacts and effects

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

Temporary effects during construction

Impacts on agricultural land

- 3.4.8 During the construction phase, the total area of agricultural land used will be 521.4ha as shown in Table 4. Of this total, 328.4ha will be restored and available for agricultural use following construction.

Table 4: 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
Grade 2	6.1	1	6.1
Subgrade 3a	79.2	15	50.1
BMV subtotal	85.3	16	56.2
Subgrade 3b	436.1	84	272.2
Grade 4	0	0	0
Grade 5	0	0	0
Total agricultural land	521.4		328.4

3.4.9 The disturbance during construction to 85.3ha of land of BMV quality is assessed as an impact of low magnitude, comprising less than 20% of the agricultural land requirement. However, as BMV land in the study area is a receptor of high sensitivity, the effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme, which is significant.

3.4.10 Following construction the land required temporarily will be primarily reinstated to its pre-existing agricultural condition. 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 locally where land is to be restored to agriculture with slightly thicker topsoil and subsoil layers, where appropriate. This could locally improve the quality of agricultural land, subject to the soil movement plans that will be prepared during the detailed design stage.

Nature of the soil to be disturbed

3.4.11 The sensitivity of the soils is greatest in relation to those which will be disturbed by construction activity and returned to an agricultural or other rural land-based use upon completion of the Proposed Scheme. The quantum of each disturbed soil type is less important than the sensitivity of particular soils to the effects of handling during construction and reinstatement of land.

3.4.12 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as Defra's Code of Practice for the Sustainable Use of Soils²⁷. These principles will be followed throughout the construction period. The clayey Denchworth, Ragdale, Fladbury 1, Wickham 2 and Oxpasture soils are least able to retain their structure when moved in wet conditions or by inappropriate equipment and are susceptible to compaction and smearing which could impede successful reinstatement.

²⁷ Defra (2009), *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*.

3.4.13 Compliance with the draft CoCP will ensure the magnitude of impact on soil is low and the significance of the effect is negligible.

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 Proposed Scheme and it is the combined effect of both that will have the most impact on the holding. In due course some agricultural land will be restored and the impact on individual holdings will reduce, but the following assessment focuses on the combined effect during the construction phase. The residual permanent effects are discussed 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 5. This table shows the total area of land required on a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that will be returned to the holding following the construction period. The degree of impact is based on the proportion of the holding required rather than the absolute area of land. The holding/reference name provides a unique identifier and relates to Map Series AG-01 (Volume 5, Agriculture, Forestry and Soils Map Book) and Appendix AG-001-015, Volume 5.

3.4.16 The effects of severance during construction are judged on the ease and availability of access to severed land. For the most part these will be same during and post construction but occasionally they will differ between the two phases. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Full details of the nature and significance of effects are set out in Volume 5: Appendix AG-001-015. Where the total sum of the land required by ALC grade differs from the total sum of the land required by holding, the difference is because some holdings are affected in more than one CFA and some holdings include non-agricultural land. The combined impact in holdings is reported once in the CFA where the main holding is located.

Table 5: Summary of construction effects on holdings

Holding Ref/Name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA15/1 Halse Grange Farm	13ha (10%) Medium	Accommodation bridge provided Low	Negligible	Moderate adverse due to the proportion of the holding required	7.1ha
CFA15/2 Falcutt Hall	30.5ha (18%) Medium	Accommodation bridge provided Low	Loss of gamebird shoot due to noise and loss of woodland Medium	Moderate adverse due to the proportion of the holding required and impact on commercial shoot	13.4ha

Holding Ref/Name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA 15/3 Greatfield Field Cottage	< 0.1ha (< 1%) Negligible	Negligible	Negligible	Negligible	0ha
CFA15/4 Greatworth Field Farm	0.3ha (2%) Negligible	Accommodation bridge provided Low	Negligible	Moderate adverse due to severance	0.3ha
CFA15/5 Greatworth Hall	70.1ha (43%) High	Access to severed land via public highway Medium	Adverse noise impacts for tenants Medium	Major/moderate adverse due to the proportion of the holding required, severance and noise impacts for non-agricultural tenants	50.6ha
CFA15/6 Whitman's Farm	3.4ha (3%) Negligible	Negligible	Negligible	Negligible	3.1ha
CFA15/7 Marston St Lawrence Estate	41.7ha (6%) Low	Access to severed land via public highway Medium	Negligible	Major/moderate adverse due to proportion of holding required, severance during green tunnel construction and high sensitivity of holding	39.7ha
CFA15/8 Costow Farm	20.2ha (11%) Medium	Negligible	Negligible	Moderate adverse due to proportion of holding required	0.8ha
CFA15/9 Manor Farm and Magpie Farm	26.5ha (28%) High	Access to severed land via public highway Medium	Negligible	Moderate adverse due to proportion of holding required, severance and low sensitivity of holding	10.1ha
CFA15/10 Lower Thorpe Farm	2.8ha (27%) High	Small parcel severed Low	Negligible	Moderate adverse due to the proportion of the holding required and low sensitivity	2.3ha
CFA15/11 Twin Oaks	2.7ha (38%) High	Small parcel accessed via public highway Low	Negligible	Moderate adverse due to the proportion of the holding required and low sensitivity	1.7ha

Holding Ref/Name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA15/12 Park Farm	4.6ha (3%) Negligible	Small parcel not accessible but downgraded due to size Low	Negligible	Minor adverse	0.8ha
CFA15/13 Culworth Grounds Farm	18ha (8%) Low	Accommodation bridge provided Low	Use of gallops ceases due to works so no noise impact on racehorses Negligible	Moderate adverse due to the proportion of the holding required, severance and high sensitivity	1.9ha
CFA15/14 West Mill Farm	28.7ha (12%) Medium	Accommodation bridge provided Low	Negligible	Moderate adverse due to the proportion of the holding required and severance	12.3ha
CFA15/15 Edgcote Estate	22.3ha (6%) Low	Access to severed land via public highway Medium	Noise and disturbance impact on equestrian activities Medium	Major/moderate adverse due to the proportion of the holding required, severance, noise impact on equestrian activities and high sensitivity	8.9ha
CFA15/16 Warden Farms (including Trafford Bridge Farm)	52.3ha (6%) Low	Access to severed land via public highway Medium	Negligible	Moderate adverse due to the proportion of the holding required and severance	43.6ha
CFA15/17 Bramble Cottage	9.9ha (35%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of the holding required	2.8ha
CFA15/18 Appletree Farm	29.1ha (9%) Low	Access to severed land via public highway Low	Negligible	Moderate adverse due to the proportion of the holding required and severance	29.1ha
CFA15/19 Manor Farm	24.2ha (36%) High	Access to severed land via public highway Medium	Negligible	Major/moderate adverse due to the proportion of the holding required and severance	13.8ha

Holding Ref/Name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA15/20 Washbrook Farm	5.9ha (9%) Low	No access to severed land during construction High	Noise impact on equestrian activities and gamebird shoot Medium	Major adverse due to the proportion of the holding required, severance (high sensitivity) and impact on gamebird shoot	2.2ha
CFA15/21 Cleveland Farm	7.4ha (32%) High	Access not provided to small area of land Low impact	Negligible	Major/moderate adverse due to the proportion of the holding required and medium sensitivity of holding	5.7ha
CFA15/22 Old House Farm	48.7ha (10%) Medium	Access not provided to small area of land Low	Negligible	Moderate adverse due to the proportion of the holding required	38.6ha
CFA15/23 Cedars Farm	45.3ha (15%) Medium	Farm severed with new access and use of highway Medium	Negligible	Moderate adverse due to proportion of holding required and severance	36.7ha
CFA15/24 Fir Tree Nursery	3.1ha (70%) High	Negligible	Negligible	Major adverse due to proportion of holding required and high sensitivity of holding	2.1ha
CFA15/25 Three Shires Farm	20.8ha (14%) Medium	Negligible	Negligible	Moderate adverse due to proportion of holding required	2.5ha
CFA15/26 Spella Bungalow	0.2ha (22%) High	Negligible	Negligible	Moderate adverse due to proportion of holding required and low sensitivity of holding	0.2ha
CFA15/27 Spella Field	2.5ha (88%) High	Negligible	Negligible	Moderate adverse due to proportion of holding required and low sensitivity of holding	0.9ha
CFA15/28 Manor Park	0.7ha (12%) Medium	Minor severance during utility works Low	Negligible	Minor adverse	0.4ha

Holding Ref/Name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA15/29 Collins Farm	7ha (35%) High	Negligible	Negligible	Major/moderate adverse due to proportion of holding required	oha
CFA15/30 Spella House	3.6ha (35%) High	2.0ha severed by new road construction Medium	Negligible	Major/moderate adverse due to proportion of holding required and severance	1.3ha
CFA15/31 Fox Covert	1.9ha (58%) High	Negligible	Negligible	Moderate adverse due to proportion of holding required	oha
CFA15/32 The Bungalow	1.4ha (100%) High	Negligible	Negligible	Major adverse due to proportion of holding removed and high sensitivity	1.3ha

3.4.17 Overall, 28 holdings will experience moderate, major/moderate or major adverse effects during construction, which are significant.

3.4.18 For Culworth Grounds Farm (CFA15/13) the loss of the rising finish of the gallops, the extensive earthworks required for a cutting, and the need to take young inexperienced horses over an accommodation bridge with construction activity occurring all around suggest that racehorse training at the farm will cease; other equestrian activities undertaken including event training and show jumping should continue.

3.4.19 The impact of construction on the equestrian activities at Washbrook Farm (CFA15/20) and Edgcote Estate (CFA15/15) will also be significant.

3.4.20 No other agricultural farm enterprises which are sensitive to noise or vibration emitted during the construction phase, for example intensive poultry houses, have been identified near to the Proposed Scheme.

Cumulative effects

3.4.21 As no relevant development has been identified in this study area that will affect agriculture, forestry or soils there are no cumulative effects to report.

Permanent effects

Impacts on agricultural and forestry land

3.4.22 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.

3.4.23 Following construction and restoration, the area of agricultural land that will be permanently required will be 193ha, as shown in Table 6.

Table 6: Agricultural and forestry land required permanently

Agricultural land quality	Permanent works	
	Area (ha)	% agricultural land
Grade 1	0	0
Grade 2	<0.1	0
Subgrade 3a	29.1	15
BMV subtotal	29.1	15
Subgrade 3b	163.9	85
Grade 4	0	0
Grade 5	0	0
Total agricultural land	193	
Forestry land	8.6	

3.4.24 The permanent loss of 29.1ha of land of BMV quality is assessed as an impact of low magnitude, comprising less than 20% of the overall land requirement. BMV land in this study area is a receptor of high sensitivity and the permanent effect on BMV land is therefore assessed as a moderate adverse effect of the Proposed Scheme, which is significant.

3.4.25 Areas of woodland that will be permanently affected include Halse Copse South, the copse at Lower Thorpe, Osierbed Spinney and Fox Covert. Overall, the total amount of forestry land required to implement the Proposed Scheme will be approximately 8.6ha, out of a total land requirement (including non-agricultural land) of approximately 600ha (1%) and is an impact of low magnitude. As the extent of the forest cover in the study area is less than the national average it is a resource of high sensitivity and the loss of this area of woodland is assessed as a moderate adverse effect which is significant. Insofar as forestry land may have some non-commercial value, for example in ecological or landscape terms, the qualitative assessment of this loss is addressed in the relevant sections.

3.4.26 Some areas of agricultural land that are required for the construction of the Proposed Scheme will revert to land for ecological and landscape mitigation and will be removed from mainstream agricultural production. These areas include land adjacent to Halse Copse, around Trafford Bridge and around the green tunnel portals. This agricultural assessment assumes that none of this land will return to agriculture.

3.4.27 A total area of some 8.0ha of agricultural land shown on CT-06 (Operation) (Volume 2, CFA15 Map Book) will be engineered to provide additional flood compensation capacity and will be subject to marginal downgrading in agricultural land quality. This agricultural assessment assumes the majority of this land will return to agriculture.

Impacts on holdings

3.4.28 The permanent residual effects from the construction of the Proposed Scheme on individual agricultural and related interests is summarised in Table 7. The land required column refers to the area of land 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-001-015, Section 4.

Table 7: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA15/1 Halse Grange Farm	5.9ha (5%) Low	Accommodation bridge provided Low	Negligible	Minor adverse
CFA15/2 Falcutt Hall	17.1ha (10%) Medium	Accommodation bridge provided Low	Negligible	Moderate adverse due to proportion of holding required and impact on commercial shoot
CFA 15/3 Greatfield Field Cottage	< 0.1ha (< 1%) Negligible	Negligible	Negligible	Negligible
CFA15/4 Greatworth Field Farm	0ha (0%) Negligible	Accommodation bridge provided Low	Negligible	Moderate adverse due to severance
CFA15/5 Greatworth Hall	19.5ha (12%) Medium	Access to severed land via shared accommodation bridge Medium	Adverse noise impacts for tenants Medium	Moderate adverse due to percentage of holding permanently removed
CFA15/6 Whitman's Farm	0.3ha (< 1%) Negligible	Negligible	Negligible	Negligible
CFA15/7 Marston St Lawrence Estate	2ha (< 1%) Negligible	Negligible	One building and one outbuilding at Dean Barn Low	Moderate adverse due to agricultural property demolition

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA15/8 Costow Farm	19.4ha (10%) Medium	Small parcel severed Low	Negligible	Moderate adverse due to proportion of holding removed
CFA15/9 Manor Farm and Magpie Farm	16.4ha (17%) Medium impact	Access to severed land under viaduct Negligible	Negligible	Minor adverse
CFA15/10 Lower Thorpe Farm	0.5ha (5%) Low	Access to severed land under viaduct Negligible	Residential property and outbuildings demolished High	Moderate adverse due to property demolition but low sensitivity of holding
CFA15/11 Twin Oaks	1ha (14%) Medium	Small parcel accessed via public highway Low	Residential property and two outbuildings demolished High	Moderate adverse due to property demolition but low sensitivity of holding
CFA15/12 Park Farm	3.8ha (2%) Negligible	Small parcel accessed via public highway and track Low	Negligible	Minor adverse
CFA15/13 Culworth Grounds Farm	16.1ha (8%) Low	Accommodation bridge provided Low	Race training gallops removed High	Major adverse due to severance, effect on gallops and high sensitivity of holding
CFA15/14 West Mill Farm	16.4ha (7%) Low	Accommodation bridge provided Low	Negligible	Minor adverse
CFA15/15 Edgcote Estate	13.4ha (4%) Negligible	Land severed to east but accessible via public highway Medium	Two barns at Blackgrounds Farm demolished. High	Major adverse due to land loss, severance, loss of buildings and high sensitivity of holding
CFA15/16 Warden Farms (including Trafford Bridge Farm)	8.7ha (1%) Negligible	Negligible	Negligible	Negligible
CFA15/17 Bramble Cottage	7.1ha (25%) High	Negligible	Negligible	Major/moderate adverse due to proportion of holding required

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA15/18 Appletree Farm	oha (0%) Negligible	Negligible	Negligible	Negligible
CFA15/19 Manor Farm	10.4ha (15%) Medium	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CFA15/20 Washbrook Farm	3.7ha (6%) Low	Access to severed land will be available under Highfurlong viaduct Negligible	Cross-country and eventing areas affected but long-term land use could continue subject to reorganisation Medium	Major/moderate adverse due to the proportion of the holding required, loss of competition arenas and high sensitivity of holding; and adverse effect on gamebird shoot
CFA15/21 Cleveland Farm	1.7ha (7%) Low	Negligible	Negligible	Minor adverse
CFA15/22 Old House Farm	10.1ha (2%) Negligible	Negligible	Grain store demolished High	Major/moderate adverse due to the demolition of grain store
CFA15/23 Cedars Farm	8.6ha (3%) Negligible	Farm severed with new access and use of highway Medium	Principal access removed and replaced by scheme Low	Moderate adverse due to severance
CFA15/24 Fir Tree Nursery	1ha (23%) High	Small area severed; no access Low	Glasshouses and barn demolished High	Major adverse due to demolition of glasshouses and barn, the proportion of the holding required and the high sensitivity of the holding
CFA15/25 Three Shires Farm	18.3ha (12%) Medium	No new severance albeit some trips will require further distances due to reconfigured highway network Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CFA15/26 Spella Bungalow	oha (0%) Negligible	Negligible	Negligible	Negligible

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA15/27 Spella Field	1.6ha (56%) High	Negligible	Loss of three outbuildings and manège High	Moderate adverse due to proportion of holding required and demolitions but low sensitivity of holding
CFA15/28 Manor Park	0.3ha (5%) Negligible	Negligible	Negligible	Negligible
CFA15/29 Collins Farm	7ha (35%) High	Negligible	Negligible	Major/moderate adverse due to proportion of holding required
CFA15/30 Spella House	2.3ha (22%) High	Land severed by new road accessed from public highway Medium	Negligible	Major/moderate adverse due to the proportion of the holding required and severance
CFA15/31 Fox Covert	1.9ha (58%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required but low sensitivity
CFA15/32 The Bungalow	0.1ha (7%) Low	Negligible	Building demolished High	Major adverse due to demolition of building and the high sensitivity of the holding

- 3.4.29 Overall, it is likely that 21 holdings will experience moderate, major/moderate or major permanent adverse effects from the construction of the Proposed Scheme mainly due to the proportion of the holding that will be removed but also due to severance, and these are significant.
- 3.4.30 Eight holdings incur demolition with three holdings losing the residential property (CFA 15/10, 11 and 32); the other units lose buildings or structures.
- 3.4.31 Two large equestrian units are affected. Culworth Grounds Farm (CFA15/13) is likely to cease racehorse training due to the loss of a key section of the training gallops but will be able to continue other equestrian activities (show jumping and eventing). The owners of Washbrook Farm (CFA15/20) have indicated that, subject to reorganisation and/or acquiring replacement land, they would wish to continue to operate as a high-calibre eventing venue. The assessment assumes this may not be possible and is a worst case assessment.
- 3.4.32 Five holdings will cease to operate as a result of demolition and the proportion of land required for the construction of the Proposed Scheme, namely: Lower Thorpe Farm

(CFA15/10); Twin Oaks (CFA15/11); Fir Tree Nursery (CFA15/24); Spella Field (CFA15/27); and The Bungalow (CFA15/32).

- 3.4.33 Although financial compensation will be available, there can be no certainty that this would be used to reduce the above adverse effects by the purchase of replacement land or construction of replacement buildings or structures. Therefore, the above assessment should be seen as the worst case, which could be reduced if the owner and/or occupier are able, and choose, to use compensation payments to replace assets.

Cumulative effects

- 3.4.34 As no relevant development has been identified in this study area that will affect agriculture, forestry or soils there are no cumulative effects to report.

Other mitigation measures

- 3.4.35 Other mitigation measures that are proposed include ecological habitat creation and landscape planting, mainly on land that is presently used for agriculture and over time this will reduce the effect on forestry from significant to non-significant. This planting is described in more detail in the ecology and landscape and visual assessment (Sections 7 and 9, respectively). Soils from the existing woodland areas (including ancient woodland) that will be permanently removed by the Proposed Scheme will be utilised in this process as discussed in the ecology assessment (Section 7). Mitigation will incorporate climate change adaptation and resilience measures, as far as reasonably practicable.

Summary of likely significant residual effects

- 3.4.36 Once the construction process is complete and land required temporarily has been restored, the residual permanent loss of agricultural land will be 193.0ha, of which 29.1ha is BMV. This is assessed as a moderate adverse residual effect, which is significant.
- 3.4.37 The assessment has identified 28 holdings that will experience significant effects, though for seven of those holdings they will be temporary significant adverse effects. A total of 21 holdings have been identified that will experience permanent significant adverse effects. Of these, 16 are likely to remain as agricultural or rural holdings and the use of compensation payments, if chosen by owners, to purchase replacement land or farm buildings could reduce the effects to non-significant. For three holdings residential demolition will occur.

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 The potential impacts arising from the operation of the Proposed Scheme are:
- 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 and for Culworth Grounds Farm and Washbrook Farm it seems likely that some of the equestrian activities undertaken may be able to continue following reorganisation. At Culworth Grounds Farm the majority of the land is farmed with arable crops with the use of gallops for racehorse training; this activity will cease but other equestrian users of the farm should be able to continue.
- 3.5.4 The impact on the recreational facilities at Washbrook Farm is assessed in Section 5. The impact on this holding is concentrated away from the operational base and the owner has expressed a wish to continue running the unit with competitions. HS2 Ltd is engaged in on-going discussions with the owners to assess whether the facility can continue to operate in its current location.
- 3.5.5 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 significant residual effects

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

4 Air quality

4.1 Introduction

- 4.1.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme, covering nitrogen dioxide (NO₂), fine particulate matter (PM₁₀ and PM_{2.5})²⁸ and dust.
- 4.1.2 With regard to air quality, the main potential effects are anticipated to result from the emissions of the above pollutants from road traffic, construction activities and equipment and dust emissions associated with demolition, site preparation works, construction of the infrastructure and the use of haul routes within the sites.
- 4.1.3 Detailed reports on the air quality data and assessments for this area, as well as relevant maps are contained within Volume 5. These include:
- Appendix AQ-001-015;
 - Map AQ-01-015; and
 - Map AQ-02-015-01 to AQ-02-015-02.
- 4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2 Map Books.

4.2 Scope, assumptions and limitations

- 4.2.1 The assessment scope, key assumptions and limitations for the air quality assessment are set out in the SMR (see Volume 5: Appendix CT-001-000/1), the SMR Addendum (see Volume 5: Appendix CT-001-000/2) and appendices presented in Volume 5 (AQ-001-004). This report follows the standard assessment methodology.
- 4.2.2 The study area for the air quality assessment has been determined on the basis of where impacts on air quality might occur from construction activities, from changes in the nature 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)²⁹. 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 impact to cases where the number of properties is small, e.g. fewer than 10 properties within 20m of dust-generating activities. Thus, a single property very close to a construction site cannot experience a 'significant effect' as defined by this methodology. The assessment presented here

²⁸ PM_{2.5} and PM₁₀ describe two size fractions of airborne particles that can be inhaled and therefore are of concern for human health. The designations refer to particles of size less than 2.5 and 10 micrometres in diameter.

²⁹ IAQM (2012), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance*.

reaches a conclusion that incorporates this concept of significance being proportional to the number of people affected. However, in cases where fewer than 10 properties are within 20m of the construction activity, it will still be the case that that mitigation in accordance with the CoCP will be applied.

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

4.3 Environmental baseline

Existing baseline

- 4.3.1 Concentrations of airborne pollutants are low. The environmental baseline reported in this section represents the environmental conditions identified within the study area. The air quality in much of the Greatworth to Lower Boddington area is typical of the generally rural nature of this part of Northamptonshire, with concentrations of airborne pollutants well within air quality standards. There are few roads and road traffic flows (with their associated emissions) are low.
- 4.3.2 Estimates of background air quality have been obtained from Department for Environment, Food and Rural Affairs (Defra) background maps³⁰ for 2012. These data are estimated for 1km grid squares for nitrogen oxides (NO_x), NO₂, PM₁₀ and PM_{2.5}. All average background pollutant concentrations are well within relevant air quality standards.
- 4.3.3 South Northamptonshire District Council conducts routine diffusion tube monitoring at 32 locations. However, almost all of these are at roadside locations or in towns in locations that are away from the Proposed Scheme and not affected by scheme related traffic. On this basis, these monitoring data are not relevant to this assessment and are not considered. Cherwell District Council carries out diffusion tube monitoring across its borough and carried out continuous monitoring at one location in Banbury until 2012. Many of these locations are away from the Proposed Scheme and are not affected by scheme-related traffic. There are, however, a number of monitoring locations within Banbury that are relevant to the assessment, as they are locations where construction traffic is predicted to be present.
- 4.3.4 Cherwell District Council has declared an air quality management area (AQMA) along the A422 Hennef Way in Banbury, because of exceedances of the NO₂ annual mean standard. This area has been identified as a proposed route to be taken by traffic

³⁰ Defra (2010), 2010 Based Background Maps for NO_x, NO₂, PM₁₀ and PM_{2.5}; <http://laqm.defra.gov.uk/maps/maps2010.html>; Accessed October 2013.

during the construction phase and therefore further consideration of this has been made.

- 4.3.5 The available mapping data indicate that all parts of the study area currently experience concentrations of PM₁₀ and PM_{2.5} that meet air quality standards, as supported by the absence of any AQMAs declared for these pollutants. Background map data are shown in Volume 5: Appendix AQ-001-014.
- 4.3.6 An AQMA has been declared for NO₂ in the town of Bicester (see Map AQ-01-015, Volume 5, Air Quality Map Book). This AQMA will not be affected by traffic associated with the Proposed Scheme and is outside of the study area.
- 4.3.7 Potential receptors are primarily those residential properties close to construction activity and alongside roads where traffic flows would change as a consequence of construction activity or temporary realignment and diversion of roads. Notable receptors near to construction activity are properties at Greatworth Hall, Water End, Manor Cottages, Astral House, Spella Bungalow, Blackgrounds Farm, Culworth Road and Fir Tree House. Receptors at greatest risk of dust effects are indicated in Map AQ-02-015-01 (Volume 5, Air Quality Map Book). Properties including Chacombe Lodge Farm, Walnut House, Grimsbury Manor and properties on Banbury Lane, the A361 Byfield Road, A423 Southam Road, Dean Close, Stroud Close, Daventry Road and Fisher Close are potentially affected by construction traffic emissions. No ecological receptors are close enough to emission sources to be affected by changes in air quality.

Future baseline

- 4.3.8 The data used for the air quality assessment take account of predicted changes in traffic, which are derived from a combination of regional traffic growth factors and consideration of major locally consented schemes, as described in Section 12, traffic and transport. In this way, the assessment accounts for cumulative effects.
- 4.3.9 Section 2.1 and Volume 5: Appendix CT-004-000 identifies developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme.

Construction (2017)

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

Operation (2026)

- 4.3.11 Future background pollutant concentrations have been sourced from Defra background maps for 2026. Defra background maps predict NO₂ and PM₁₀ concentrations 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 atmosphere will be controlled and managed during construction through the route-wide implementation of the draft CoCP, where appropriate. The draft CoCP includes a range of mitigation measures that are accepted by the IAQM as being suitable to reduce impacts to as low a level as reasonably practicable. It also makes provision for the preparation of Local Environmental Management Plans (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-003-000/1) will be implemented. These include:

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

Assessment of impacts and effects

Temporary effects

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

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 a with the Proposed Scheme scenario. The traffic data include the additional traffic from future committed developments.

4.4.5 In the Greatworth to Lower Boddington area, dust-generating activities will comprise the construction of a series of cuttings and embankments, green tunnels at Greatworth and Chipping Warden and viaducts at Lower Thorpe, Edgcote and over

the Highfurlong Brook at Aston le Walls. Activities with the potential to generate dust at these sites include the demolition of buildings, earthworks required for the preparation of the ground, bulk excavation, processing and stockpiling of fill materials, construction of structural embankments, landscaping, the construction and use of construction compounds, construction of permanent replacement road infrastructure and bridges, and the movement of vehicles off site onto local roads with a possible transfer of dust and mud. The use of the haul route for the removal of excavated material will be a source of dust emissions that has also been assessed.

- 4.4.6 Given the mitigation contained within the draft CoCP, including the provision to use LEMP to control the impacts at receptors close to the haul route, the assessment of impacts arising from dust emissions has concluded that they will be negligible in magnitude and that the effect on all receptors will not be significant. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-015, which describes the scale of emission and their proximity to receptors.
- 4.4.7 Construction activity could also affect local air quality through the additional traffic generated on local roads as a result of construction traffic routes and changes to traffic patterns arising from temporary road realignments.
- 4.4.8 Examination of the changes in traffic flows for the construction period along the affected roads has identified several roads that meet the criteria set out in Volume 1 of the SMR (Appendix CT-001-000/1) for assessment. This assessment concluded that impacts on air quality, in respect of NO₂, PM₁₀ and PM_{2.5}, for receptors will be slight adverse or negligible. Consequently, there will be no significant effects on any receptors, taking into account the background air quality and air quality standards. Full details of this assessment can be found in in Volume 5: Appendix AQ-001-015.

Permanent effects

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

Cumulative effects

- 4.4.10 The construction dust assessment has considered the potential cumulative air quality effects of the Proposed Scheme and other committed developments. The traffic data used for the assessment include the traffic changes expected from any committed developments and therefore their impacts have been included within the assessment.

Other mitigation measures

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

Summary of likely significant residual effects

- 4.4.12 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 and these have therefore not been assessed. In normal operations there will be no pollutant emissions from vent shafts as there are no air pollutants emitted within the tunnels and indirect emissions from sources such as rail wear and brakes have been assumed to be negligible.
- 4.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data include the additional traffic from future committed developments.
- 4.5.4 Traffic data in the Greatworth to Lower Boddington area have been screened to identify roads that require a more detailed assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026.
- 4.5.5 No roads meet the criteria for further assessment. Therefore, no significant effect associated with the Proposed Scheme is predicted.

Cumulative effects

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

Other mitigation measures

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

Summary of likely significant residual effects

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

5 Community

5.1 Introduction

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

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

- demolition of four residential properties;
- temporary and permanent impacts on residential amenity for properties on Banbury Lane in Thorpe Mandeville;
- temporary impacts on amenity for users of Church of St John the Baptist and The Three Conies public house in Thorpe Mandeville;
- permanent loss of land at Culworth Grounds Farm equestrian facility near Lower Thorpe;
- temporary impacts on amenity for residents of A361 Byfield Road and students and staff at Chipping Warden Primary School;
- temporary and permanent loss of land at Washbrook Farm equestrian centre in Aston le Walls;
- temporary impacts on amenity for residents of Banbury Road and users of The Carpenters Arms public house in Lower Boddington; and
- temporary loss of access to Glyn Davies Wood nature reserve (part of Fox Covert) near Upper Boddington.

5.1.3 Further details of the community assessments and open space surveys and recreational PRoW surveys undertaken within the study area are contained in the Volume 5: Appendix CM-001-025.

5.1.4 Significantly affected community resources are shown in Maps CM-01-047 to CM-01-053 (Volume 5, Community Map Book).

5.1.5 The current assessment draws upon information gathered from local and regional sources including Northamptonshire County Council (NCC), Washbrook Farm and Chipping Warden Primary School.

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 Chipping Warden green tunnel main compound. Construction worker impacts on community resources are considered at a route-wide level in Appendix CM-002-000. The assessment takes into

account the number of workers, the type and location of accommodation, working hours, facilities provided on construction compounds, experience from other large projects (such as HS1) and the measures contained in the draft CoCP. On this basis it is concluded that there will be no significant effects associated with construction worker accommodation.

5.3 Environmental baseline

Existing baseline

- 5.3.1 Baseline data on community resources were collected for up to 1km from the centre line of the Proposed Scheme and, additionally, up to 250m from the boundary of land required for construction.
- 5.3.2 The study area includes the area of land required both temporarily and permanently for the construction and operation of the Proposed Scheme), together with a wider corridor within which receptors or resources could be affected by a combination of significant residual effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routing of construction traffic and takes account of catchment areas for community facilities which could be affected where crossed by the Proposed Scheme. This area includes land at: Greatworth; Thorpe Mandeville and Lower Thorpe; Edgcote; Chipping Warden; Aston le Walls; and Lower Boddington. The area is characterised by farmland interspersed with villages.

Greatworth

- 5.3.3 Greatworth is located north of Brackley and south of the B4525. It is centred on the junction between Marston Road, Chapel Road, South Close and Helmdon Road where there is a range of community facilities including Greatworth Primary School, Greatworth Methodist Church, St Peter's Church, shops, Greatworth Playgroup and The Inn public house.

Thorpe Mandeville and Lower Thorpe

- 5.3.4 The village of Thorpe Mandeville and the hamlet of Lower Thorpe are both centred on Banbury Lane north of Greatworth and the B4525. Community facilities within Thorpe Mandeville include the Church of St John the Baptist, a village hall and The Three Conies public house on Banbury Lane. There are no community facilities within the hamlet of Lower Thorpe. Culworth Grounds Farm equestrian facility is located to the north-east of Lower Thorpe.

Edgcote

- 5.3.5 The small village of Edgcote is located to the south-east of Chipping Warden. The main features of the village are Edgcote House and St James's Church. The Battlefields Trail (Footpaths AE25 and AE6) passes through Edgcote.

Chipping Warden

- 5.3.6 Chipping Warden is a large village centred on the A361 Byfield/Banbury Road to the north-west of Edgcote. The majority of the community facilities within Chipping Warden are located in the centre and include the Parish Church of Chipping Warden,

shops, The Rose and Crown public house, The Griffin public house, a community hall, allotments. Adjacent to the community hall is Chipping Warden Sports Ground which includes a cricket pitch used by Chipping Warden Cricket Club and football posts used by local football clubs. Chipping Warden Primary School on A361 Byfield Road is located on the northern edge of the village. There are two promoted PRoW in the local area: the Macmillan Way (Footpaths AE12 and AE20) and the Jurassic Way (Footpaths AE12 and AE20). Calves Close Spinney is a 5ha area of woodland approximately 600m east of the centre of Chipping Warden. The site is used for a sport similar to paintballing by an organisation called 'R.I.F.T. Airsoft' once or twice a month³¹.

Aston le Walls

- 5.3.7 The village of Aston le Walls is located between Chipping Warden and Lower Boddington. It is bounded to the north-west by Welsh Road; most residences in the village are located along Welsh Road, Main Street or Appletree Lane. There are two churches in the village as well as St Mary's Catholic Primary School. Washbrook Farm, an equestrian centre covering 150 acres (approximately 60 ha) north-west of Aston le Walls on Welsh Road.

Lower Boddington

- 5.3.8 The village of Lower Boddington is located to the north-west of Aston le Walls. The village is centred on Banbury Road and Claydon Road (also known as Hill Road). There is one public house in the village: The Carpenters Arms public house. Approximately 2.1km north of Lower Boddington is Glyn Davies Wood nature reserve (part of Fox Covert). This is a 3ha site located on Banbury Road.

Future baseline

Construction (2017)

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

Operation (2026)

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

5.4 Effects arising during construction

Avoidance and mitigation measures

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

³¹ R.I.F.T. Airsoft; About R.I.F.T. Airsoft; <http://riftairsoft.com/content.php?46-about-r-i-f-t>; Accessed: October 2013.

- access to Calves Close Spinney, which is the location for airsoft activities run by a company called R.I.F.T, has been maintained through the provision of temporary and permanent track for vehicles to use; and
- permanent access to the Glyn Davies Wood nature reserve (part of Fox Covert) will be maintained through the re-provision of the entrance and lay-by for car parking after the construction period.

5.4.2 The draft CoCP includes a range of provisions that will help mitigate community effects associated with construction within this area, including the following (see Volume 5: Appendix CT-003-000):

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

Assessment of impacts and effects

5.4.3 Details of all assessments of community resources are included in Volume 5: Appendix CM-001-015. 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.

Greatworth

Temporary effects

5.4.4 No significant temporary effects have been identified in the community assessment for Greatworth.

Permanent effects

5.4.5 No significant permanent effects resulting from construction have been identified in the community assessment for Greatworth.

Cumulative effects

- 5.4.6 No cumulative effects have been identified in the community assessment for Greatworth.

Thorpe Mandeville and Lower Thorpe

Temporary effects

Residential properties

- 5.4.7 Up to 40 residential properties along Banbury Lane in Thorpe Mandeville are predicted to experience in-combination effects arising from construction activities coordinated by the Lower Thorpe viaduct satellite compound which will be in place for up to two years. These in-combination effects are:

- significant noise effects from construction traffic using Banbury Lane; and
- a significant increase of HGV vehicles, which will use this route to access the Lower Thorpe viaduct satellite compound.

- 5.4.8 Out of the 40 residential properties above, ten of these located at the northern end of Banbury Lane, are also expected to experience significant visual effects to views (from the rear of properties) of the Lower Thorpe viaduct satellite compound and construction of the viaduct itself. These properties will also experience effects from lighting at the satellite compound.

- 5.4.9 The combination of these effects will have a major adverse effect on residential amenity on these properties in Thorpe Mandeville and is therefore considered to be significant.

Community infrastructure

- 5.4.10 Church of St John the Baptist is situated on Banbury Lane in Thorpe Mandeville. It is an Anglican church, which is one of six in the Culworth Benefice. The nearest alternative church is St Mary the Virgin Church in Culworth, which is approximately 2.5km away by road.

- 5.4.11 It is predicted that users of the church will experience in-combination effects arising from construction activities co-ordinated from the Lower Thorpe viaduct satellite compound, which will be in place for approximately two years (see Section 2.3 and Figure 5 for durations of compound operations). These in-combination effects are:

- significant noise effects due to construction traffic using Banbury Lane; and
- a significant increase of HGV vehicles using Banbury Lane to access the Lower Thorpe viaduct satellite compound.

- 5.4.12 It is anticipated that the church's activities will be able to continue. However, the combination of these noise and HGV effects will have a moderate adverse effect on amenity of the church for its users and is therefore considered to be significant.

- 5.4.13 Thorpe Mandeville Village Hall is on The Warren (Banbury Lane) in Thorpe Mandeville. It is available for hire by the community and provides a meeting place for informal clubs. It is predicted that users of the village hall will experience in-combination

effects arising from construction activities co-ordinated from the Lower Thorpe viaduct satellite compound, which will be in place for approximately two years (see Section 2.3 and Figure 5 for more details on duration of operation of the compounds). Durations of compound operations can be found in Section 2.3. These in-combination effects are:

- significant noise effects due to construction traffic using Banbury Lane; and
- a significant increase of HGV vehicles using this route to access the Lower Thorpe viaduct satellite compound.

5.4.14 It is anticipated that activities at the village hall will be able to continue. However, as there is no alternative community resource similar to the village hall in Thorpe Mandeville, the combination of these noise and HGV effects will have a moderate adverse effect on amenity for users and is therefore considered to be significant.

5.4.15 The Three Conies public house is on The Warren (Banbury Lane) in Thorpe Mandeville. There are no other public houses in the village. It is predicted that users will experience in-combination effects arising from construction activities co-ordinated from the Lower Thorpe viaduct satellite compound, which will be in place for approximately two years. These in-combination effects are:

- significant construction noise effects due to construction traffic using Banbury Lane; and
- a significant increase of HGV vehicles using this route to access the Lower Thorpe viaduct satellite compound.

5.4.16 It is anticipated that villagers will still be able to use The Three Conies. However, as there is no alternative public house within Thorpe Mandeville, the combination of these noise and HGV effects will have a moderate adverse effect on amenity for users and is therefore considered to be significant.

Permanent effects

Residential properties

5.4.17 The Proposed Scheme will run on viaduct through Lower Thorpe, crossing a floodplain and Banbury Lane. The construction activities associated with the viaduct and the embankment on the northern side of the viaduct will require the demolition of two residential properties in Lower Thorpe: Lower Thorpe Farm and Twin Oaks (plus outbuildings). This effect is considered to be significant for Lower Thorpe, given that there are only five properties within this hamlet.

Community infrastructure

5.4.18 Culworth Grounds Farm is an equestrian facility north-east of Lower Thorpe. It has an all-weather equestrian facility, offering racehorse training, with 6¼ furlong grass gallops, an indoor wax surface schooling arena, an outdoor schooling arena, monarch stables, a monarch horse walker and secure tack rooms. The total land holding is 212ha, approximately 16ha (8%) of which will be required permanently for the Proposed Scheme. This will result in the partial loss of the gallops and sever some of the land from the main buildings. Due to this, the racehorse training will not be able to

continue. An accommodation overbridge will be put in place to provide access to the severed land.

- 5.4.19 The nearest alternative equestrian centre is Foxhill Equestrian Centre in Eydon near Daventry. It is about 4.5km from Culworth Grounds and provides a range of equestrian facilities, although it is not directly comparable with Culworth Grounds and does not offer racehorse training.
- 5.4.20 Whilst it is expected that some equestrian activities at Culworth Grounds will be able to continue, given that the site will be severed, the gallops and racehorse training will be lost and there is an absence of an alternative comparable local facility, this is a moderate adverse effect on users and is therefore considered significant.

Cumulative effects

- 5.4.21 Residents of Thorpe Mandeville and Lower Thorpe, particularly those living along Banbury Lane, are predicted to experience a combination of residential demolitions, temporary changes to residential amenity and temporary amenity effects on the parish church, village hall and public house. These combined effects are expected to give rise to a community-wide effect.

Edgcote

Temporary effects

- 5.4.22 No significant temporary effects have been identified in the community assessment for Edgcote.

Permanent effects

- 5.4.23 No significant permanent effects resulting from construction have been identified in the community assessment for Edgcote.

Cumulative effects

- 5.4.24 No cumulative effects for the community of Edgcote have been identified during construction.

Chipping Warden

Temporary effects

Residential properties

- 5.4.25 Approximately ten residential properties along the eastern side of the A361 Byfield Road in Chipping Warden are predicted to experience in-combination effects. These effects are:
- significant visual effects from the rear of properties on A361 Byfield Road due to views of the construction of the Chipping Warden green tunnel, the associated main compound and the reinstatement of the A361 Byfield Road and the road head; and
 - significant increases in HGV movements along the A361 Byfield Road.

5.4.26 These effects arise as a result of construction activities co-ordinated by several compounds including: the Chipping Warden green tunnel main compound; the Chipping Warden green tunnel north and south satellite compounds; the Culworth cutting satellite compound; the Claydon Road overbridge satellite compound and the Banbury Road green overbridge compound. The duration of operation of these compounds is set out in Section 2.3 and Figure 5 and further information is also provided in Section 12.

5.4.27 The combination of the above effects will have a major adverse effect on residential amenity in Chipping Warden and this is, therefore, considered to be significant.

Community infrastructure

5.4.28 Chipping Warden Primary School is situated on the A361 Byfield Road. It presently has approximately 60 pupils from ages four to 11, but has capacity for approximately 100. This is a community school which takes children from Chipping Warden, Aston le Walls and Edgcote. Alternative primary schools in the area include St Mary's Catholic Primary School in Aston le Walls (approximately 2.5km away) and Byfield Primary School (approximately 5km away).

5.4.29 The school is predicted to experience in-combination effects arising from construction activities. These in-combination effects are:

- significant visual effects due to open views of the construction of the Chipping Warden green tunnel, the main construction compound and the reinstatement of the A361 Byfield Road and the roadhead;
- significant construction noise effects during the daytime due to activities associated with the realignment of the A361 Byfield Road; and
- significant increases in HGV movements along the A361 Byfield Road.

5.4.30 These effects arise as a result of construction activities co-ordinated by several compounds including: the Chipping Warden green tunnel main compound; the Chipping Warden green tunnel north and south satellite compounds; the Culworth cutting satellite compound; the Claydon Road overbridge satellite compound and the Banbury Road green overbridge compound. The duration of operation of these compounds is set out in Section 2.3 and Figure 5 and further information is also provided in Section 12.

5.4.31 Given the duration of construction activities in this area, the combination of these effects is considered to have a major adverse effect on the amenity of users of Chipping Warden Primary School. This is therefore considered to be significant.

Permanent effects

Residential properties

5.4.32 The Proposed Scheme will run through green tunnel east of Chipping Warden. The Bungalow, on Calves Close off Culworth Road and Stone House on the A361 Byfield Road both lie within the land required for the construction and operation of the Proposed Scheme and will require demolition. The permanent loss of these two properties is not considered significant at a community level.

Cumulative effects

- 5.4.33 Residents of Chipping Warden, particularly those living along A361 Byfield Road, are predicted to experience a combination of residential demolitions, changes to residential amenity and a deterioration of amenity of the primary school. These combined effects are expected to cause a community-wide effect during the construction period.

*Aston le Walls***Temporary effects***Community infrastructure*

- 5.4.34 West of Aston le Walls, the Proposed Scheme will be on embankment and then on viaduct over Highfurlong Brook. It will pass directly through land at Washbrook Farm equestrian centre. Facilities at Washbrook Farm include an international all-weather dressage arena, an all-weather show jumping arena, two grass gallops, a cross-country course, an indoor arena and schooling fields. The centre hosts a regular programme of day activities, dressage and cross-country events as well as providing a wide range of training and schooling sessions. Three-day eventing held at the centre is planned up to three years in advance. The facilities also offer days out for members of local pony clubs. In addition, gamebird shooting takes place at the site.
- 5.4.35 Approximately 10% (6ha) of the land at the equestrian centre will be required for construction of the Proposed Scheme. On the western side of Washbrook Farm, up to 10ha of land will be severed from the farm buildings and the rest of the facility. In total, therefore, up to 16ha (25 – 30%) of land at Washbrook Farm will be unavailable for use throughout the construction period, which will last for approximately a year and a half.
- 5.4.36 The facilities directly affected by construction activities will be the centre's cross-country course and schooling fields. Whilst not within the boundary of the land required for construction, the dressage area to the far west of Washbrook Farm will be inaccessible and unusable; it will be cut off from the buildings and other facilities on the eastern side of the site. Dressage is unlikely to be able to continue so close to the Proposed Scheme due to the potential effect of noise on the horses. Shooting activities will cease from the start of the construction period.. The indoor facilities are not directly affected and could continue.
- 5.4.37 The nearest horse-riding centre to Washbrook Farm is the Holistic Equitation Centre in Daventry (approximately 13km from Washbrook Farm). This has an indoor arena and offers riding lessons and dressage clinics. However, its outdoor facilities are not comparable to those at Washbrook Farm. As such, given that the western side will be severed from the east, as well as the absence of a comparable local alternative, the temporary effect of these impacts is considered to be major adverse and is significant.

Permanent effects*Community infrastructure*

- 5.4.38 The Proposed Scheme will require between 6% and 7% of the total site at Washbrook Farm equestrian centre on a permanent basis for operation. The effects will be the

same as those during construction: the centre's cross-country course and schooling fields will be directly affected and the dressage area will be cut off from the main farm buildings and will be unusable. The western side of the site will not be permanently severed from the main buildings, since the Proposed Scheme is on viaduct. However, it is not anticipated that Washbrook Farm will be able to continue to operate in this configuration.

- 5.4.39 The effect of these impacts is considered to be major adverse and is significant, given that the ability of the centre to function and offer services in its present configuration will be permanently compromised.

Lower Boddington

Temporary effects

Residential properties

- 5.4.40 Residential properties along Banbury Road in the south of Lower Boddington are predicted to experience in-combination effects arising from construction activities . These in-combination effects are:

- significant visual effects due to the activities at the Claydon Road overbridge satellite compound and the construction of the Claydon Road overbridge; and
- significant increases in HGV movements along Banbury Road.

- 5.4.41 These effects arise as a result of construction activities co-ordinated by several compounds including: the Chipping Warden green tunnel north and south satellite compounds; the Culworth cutting satellite compound; and the Claydon Road overbridge satellite compound. The duration of operation of these compounds is set out in Section 2.3 and Figure 5 and further information is also provided in Section 12. The combination of these effects will have a major adverse effect on residential amenity and this is therefore considered to be significant.

- 5.4.42 The combination of these effects will have a major adverse effect on residential amenity in the properties identified above and this is therefore significant.

Community infrastructure

- 5.4.43 The Carpenters Arms public house is situated on the corner of Hill Road and Banbury Road in Lower Boddington. This is the only pub in the village; the nearest alternative is the Plough Inn in Upper Boddington approximately 1.5km from Lower Boddington.

- 5.4.44 The Carpenters Arms is predicted to experience in-combination effects arising from construction activities. These in-combination effects are:

- significant visual effects due to the activities at the Claydon Road overbridge satellite compound and the construction of the Claydon Road overbridge; and
- significant increases in HGV movements along Banbury Road.

- 5.4.45 These effects arise as a result of construction activities co-ordinated by several compounds including: the Chipping Warden green tunnel north and south satellite compounds; the Culworth cutting satellite compound; and the Claydon Road

overbridge satellite compound. The duration of operation of these compounds is set out in Section 2.3 and Figure 5 and further information is also provided in Section 12.

- 5.4.46 It is anticipated that villagers will still be able to use The Carpenters Arms. However, as there is no alternative public house within Lower Boddington, the combination of these effects will have a moderate adverse effect on amenity for users and is therefore considered to be significant.

Open space and recreational PRow

- 5.4.47 West of Upper Boddington the Proposed Scheme will pass through the south-western section of Glyn Davies Wood nature reserve (part of Fox Covert). The Banbury Ornithological Society (BOS) manages this 3ha site; of the area that it manages approximately a third will be required permanently for the Proposed Scheme. The entrance to the nature reserve and lay-by on Banbury Road, which BOS members use for parking, are both within the land required and therefore will be temporarily removed during construction, which will last for approximately one year. Without an alternative entrance and parking facilities, access to the nature reserve will not be possible.
- 5.4.48 Glyn Davies Wood nature reserve (part of Fox Covert) is used for the enjoyment of wildlife and bird-watching and is managed by BOS. BOS has approximately 120 members in the region. It owns and/or manages five other sites for members to use, the nearest of which is Grimsbury Plantation Reserve near Banbury, which is approximately 15km from the Glyn Davies site.
- 5.4.49 Whilst there are alternative sites for members to use, given that a third of the nature reserve will be permanently lost and the remaining section of the nature reserve will temporarily be inaccessible, the effect is considered to be moderate adverse and is therefore significant.

Permanent effects

- 5.4.50 No significant permanent effects resulting from construction have been identified in the community assessment for Lower Boddington.

Cumulative effects

- 5.4.51 No cumulative effects for the community of Lower Boddington have been identified during construction.

Other mitigation measures

- 5.4.52 The assessment has concluded there are significant adverse effects arising during construction in relation to community resources.
- 5.4.53 HS2 Ltd will continue to work with the owners of Washbrook Farm to assist them with identifying a solution to promote the continued operation of the equestrian facility within the scope of the Compensation Code.
- 5.4.54 HS2 Ltd will work closely with Chipping Warden Primary School to identify reasonably practicable measures to mitigate the residual significant amenity effects, including discretionary measures identified in the draft CoCP.

Summary of likely significant residual effects

- 5.4.55 There will temporary significant effects on users of Glyn Davies Wood nature reserve, which will be inaccessible during the construction phase. The loss of two properties in Lower Thorpe will have a significant permanent effect on the community of this small hamlet. Permanent significant effects will also be experienced by users of Culworth Grounds Farm and Washbrook Farm, as a result of the loss of land for the Proposed Scheme.
- 5.4.56 Some residential properties on Banbury Lane as well as users of Church of St John the Baptist, the village hall and The Three Conies public house in Thorpe Mandeville will experience temporary adverse effects on amenity. There will also be temporary adverse amenity effects for some residential properties and Chipping Warden Primary School on the A361 Byfield Road and some residential properties and The Carpenters Arms on Banbury Road in Lower Boddington.

5.5 Effects arising from operation

Assessment of impacts and effects

Greatworth

- 5.5.1 No significant effects resulting from operation have been identified in the community assessment for Greatworth.

Thorpe Mandeville and Lower Thorpe

Residential properties

- 5.5.2 The residents of approximately ten residential properties along and in the vicinity of Banbury Lane in Thorpe Mandeville and Lower Thorpe are predicted to experience in-combination effects during operation of the Proposed Scheme. These in-combination effects are:
- significant visual effects, due to views of the Lower Thorpe viaduct, cutting and embankment, passing trains, noise barriers, overhead line equipment and the Banbury Lane overbridge; and
 - significant operational noise effects from the Proposed Scheme; residents could experience high levels of annoyance, sleep disturbance and activity disturbance within the properties.
- 5.5.3 The combination of these effects will have a major adverse effect on residential amenity and is therefore considered to be significant.

Edgcote

- 5.5.4 No significant effects resulting from operation have been identified in the community assessment for Edgcote.

Chipping Warden

- 5.5.5 No significant effects resulting from operation have been identified in the community assessment for Chipping Warden.

Aston le Walls

Community infrastructure

- 5.5.6 No significant effects resulting from operation have been identified in the community assessment for Aston le Walls.

Lower Boddington

- 5.5.7 No significant effects resulting from operation have been identified in the community assessment for Lower Boddington.

Cumulative effects

- 5.5.8 No cumulative effects for the area have been identified during construction.

Other mitigation measures

- 5.5.9 The assessment has concluded there are significant adverse effects arising during construction in relation to community resource.
- 5.5.10 No other mitigation measures have been identified.

Summary of likely significant residual effects

- 5.5.11 Up to 10 residential properties around Banbury Lane, in the north of Thorpe Mandeville and in Lower Thorpe will be affected permanently by the views of and expected noise arising from the operation of the Proposed Scheme.

6 Cultural heritage

6.1 Introduction

- 6.1.1 This section of the report provides a description of the current baseline for heritage assets and 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 heritage value (significance) of assets including archaeological and palaeoenvironmental 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, CFA15 Map Book. Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5, Cultural Heritage Map Book. 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-001-015 – Baseline Report;
 - Appendix CH-002-015 – Gazetteer of Heritage Assets;
 - Appendix CH-003-015 – Impact Assessment Table; and
 - Appendix CH-004-015 – Survey Reports.
- 6.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, GLBXXX; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-015.
- 6.1.5 Engagement has been undertaken with Northamptonshire County planning archaeologist and the South Northamptonshire District Council conservation officer 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 (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.
- 6.2.2 The setting of all designated heritage assets the Zone of Theoretical Visibility (ZTV) of the Proposed Scheme has been considered. The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out, is defined as the land required, temporarily or permanently, to construct the Proposed Scheme plus 500m.

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

6.2.4 In undertaking the assessment the following limitations were identified:

- the LiDAR³² data examined did not encompass the full extent of the study area; and
- not all areas of survey as identified in the archaeological risk model³³ were available for survey.

6.2.5 However, non-intrusive field surveys were 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-001-015.

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

- walkover and site reconnaissance from areas of public access or in locations where access was granted. This was undertaken to understand the character and form of heritage assets and the historic landscape; to review the setting of assets; and to identify previously unknown assets.
- desk-top review of remote sensing data including LiDAR, aerial photographs and hyperspectral data (see Volume 5: Appendix CH-004-015); and
- a programme of non-intrusive surveys including geophysical surveys (see Volume 5: Appendix CH-004-015).

Designated assets

6.3.3 The following designated heritage assets are located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme (see Maps CH-01-047 to CH-01-053, Volume 5, Cultural Heritage Map Book):

- Edgcote Battlefield, a registered battlefield of high value (GLB108);
- Halse Copse South ancient woodland of high value (GLB010);
- Thorpe Mandeville (GLB080), a conservation area of moderate value;

³² Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.

³³ 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.

- Lower Thorpe Farmhouse, a Grade II listed building of moderate value (within grouping GLBo86); and
- Trafford Bridge, a Grade II listed building of moderate value (GLB132).

6.3.4

The following designated assets are located within the ZTV (see Maps CT-10-035 to CT-10-041, Volume 2, CFA15 Map Book and Maps CH-02-025 to CH-02-027, Volume 5, Cultural Heritage Map Book):

- six scheduled monuments of high value: the bowl barrow at Lower Thorpe (GLBo83); Castle Ringwork, Sulgrave (within grouping GLBo65); Castle Hill, Culworth (within grouping GLB118); Roman villa at Edgcote (GLB138); Market Cross at Chipping Warden (within grouping GLB151); and Arbury Banks (GLB152);
- eight Grade I listed buildings of high value: Church of St Lawrence, Marston St Lawrence (within asset grouping GLBo57); Church of St John the Baptist, Thorpe Mandeville (within grouping GLBo80); Sulgrave Manor (within asset grouping GLBo65); Edgcote House (within asset grouping GLB141); Church of St James, Edgcote (within asset grouping GLB141); ; Church of St Peter and St Paul, Chipping Warden (within grouping GLB151); Church of St Leonard, Aston le Walls (within grouping GLB176); and Church of St John the Baptist, Upper Boddington (within grouping GLB207);
- seven Grade II* listed buildings of high value: : Church of St Peter, Greatworth (within grouping GLBo29); Marston House, Marston St Lawrence (within grouping GLBo57); The Manor House, Thorpe Mandeville (within grouping GLBo80); Church of St James, Sulgrave (within grouping GLBo65); Church of St Mary, Culworth (within grouping GLB118); the wall and gatepiers associated with Church of St Mary, Culworth (within grouping GLB118); The Manor House, Chipping Warden (within grouping GLB151);
- two areas of ancient woodland of high value: Halse Copse South (GLBo15); and Redhill Wood (GLB161);
- six conservation areas of moderate value: Greatworth (GLBo29); Marston St Lawrence (GLBo57); Sulgrave (GLBo65); Culworth (GLB118); Chipping Warden (GLB151); and the Oxford Canal (GLB183); and
- a total of 242 Grade II listed buildings of moderate value. These include Greatworth Hall (GLBo22), with most of the others lying within the historic settlements of , Greatworth (GLBo29), Marston St Lawrence (GLBo57), Sulgrave (GLBo65), Culworth (GLB118), Aston le Walls (within grouping GLB176), and Chipping Warden (GLB151).

Non-designated assets

6.3.5

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

- ridge and furrow south of Trafford Bridge (GLB129);

- Romano-British remains at Blackgrounds (GLB144); and
- Oxford Canal feeder (GLB196).

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

- prehistoric and/or Romano-British cropmarks south of Halse Copse South (GLB007);
- cropmark of possible Bronze Age ring-ditch to south of Greatworth Hall (GLB213);
- cropmark of possible Bronze Age ring-ditch to south of Greatworth Hall (GLB214);
- 17th century enclosures around Greatworth (GLB220);
- potential prehistoric archaeology near Dean Barn (GLB050);
- prehistoric flint scatter to west of Moreton Road (GLB051);
- undated cropmarks to the west of Moreton Road (GLB056);
- prehistoric and/or Romano-British cropmarks between Moreton and Banbury Roads (GLB061);
- deserted medieval settlement around Costow House (GLB072);
- fishponds between Costow House and Thorpe Mandeville (GLB078);
- ridge and furrow north of Thorpe Mandeville (GLB081);
- ridge and furrow north-west of Thorpe Mandeville (GLB082);
- ridge and furrow to north-east of Thorpe Mandeville (GLB084);
- ridge and furrow between Costow House and Magpie Farm (GLB221);
- the system of ponds to the east of Lower Thorpe (GLB085);
- Thorpe Mandeville and Lower Thorpe landscape (GLB224);
- cropmarks on hill to the north- west of Culworth Grounds (GLB105);
- buried archaeology and palaeoenvironment at Trafford Bridge (GLB131);
- landscape between Trafford House and Trafford Bridge (GLB226);
- Edgcote House Park (GLB134);
- Chipping Warden Airfield (GLB162);
- potential prehistoric activity on Chipping Warden Airfield (GLB165);
- Lower Boddington landscape (GLB228);

- prehistoric and later cropmarks to south of Three Shires (GLB202);
- prehistoric and later cropmarks to the north of Three Shires (GLB208);
- prehistoric and later cropmarks at Fox Covert (GLB211); and
- 29 hedgerows identified as historically important under the criteria of the Hedgerows Regulations 1997.

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

- park pale of the medieval hunting park at Greatworth (GLB003);
- ridge and furrow between Halse Copse South and Halse Copse North (GLB215);
- ridge and furrow to the west of Bungalow Farm (GLB216);
- ridge and furrow to the west of Greatworth Hall (GLB217);
- ridge and furrow to the north-east of Greatworth Park (GLB218);
- Northampton and Banbury Junction Railway (GLB024);
- Greatworth Park (GLB036);
- probable medieval trackways and lynchets to the north of Costow House (GLB222);
- Banbury branch of the Great Central Railway (GLB094);
- probable World War II structures in Calves Close Spinney (GLB154);
- Stone House (GLB159), a post medieval building;
- East and West Junction Railway (GLB180); and
- ridge and furrow is present in twelve locations (GLB008, 032, 043, 081, 082, 084, 129, 153, 154, 189, 199 and 206) within the study area.

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-002-015 and identified on Maps CH-01-047 to CH-01-053, (Volume 5, Cultural Heritage Map Book). There are a number of heritage assets, the setting of which have been considered, for example:

- Manor Farm Halse (GLB004);
- the 17th century enclosures around Greatworth (GLB220);
- deserted medieval village earthworks at Costow (GLB072);
- manorial fishponds between Costow and Thorpe Mandeville (GLB078);

- the Thorpe Mandeville and Lower Thorpe landscape (GLB224);
- Magpie Farm (GLBo63);
- Culworth Mill (GLB130);
- manorial earthworks at Aston le Walls (GLB177);
- shrunken medieval village and manorial earthworks at Lower Boddington (GLB201);
- ridge and furrow (GLB129) which forms part of the setting of Edgcote Battlefield;
- Edgcote House Park (GLB134); and
- the Lower Boddington landscape (GLB228).

Cultural heritage overview

- 6.3.9 The study area lies within a watershed between the Cherwell, Nene and Great Ouse. North of Lower Boddington, the ground falls away towards the Warwickshire plain and the catchment of the Itchen, which feeds north and west towards Warwickshire and the River Avon.
- 6.3.10 The area is generally characterised by an undulating landform becoming an upland plateau with incised valleys to the south of Thorpe Mandeville. The present settlement character is predominantly one of rural settlement focused on the nucleated villages and hamlets of Greatworth (GLBo29), Thorpe Mandeville (GLBo80), Sulgrave (GLBo65), Culworth (GLB118), Chipping Warden (GLB151), Aston le Walls (GLB176), Lower Boddington (GLB198) and Upper Boddington (GLB207).
- 6.3.11 Human activity through all periods in the study area has largely been concentrated in the principal valley systems, specifically within and immediately adjacent to the valley of the Cherwell. The higher ground flanking the Cherwell may also have provided access between the valley systems of the Cherwell, Nene and Great Ouse.
- 6.3.12 Within the valley of the Cherwell and its tributaries there is a potential for waterlogged and other deposits of palaeoenvironmental interest. Archaeological deposits may also be relatively deeply buried in these localities by the build-up of alluvium in the valley floors and colluvium on the lower slopes.
- 6.3.13 The line of Welsh Lane (GLB115), that extends from Lower Boddington through Aston le Walls, across Trafford Bridge and on towards Brackley, is believed to follow the route of a Roman road. This route may have an Iron Age precursor and appears to have still been in use into the Anglo-Saxon period when it became an important route linking the Saxon Burhs (fortified town) at Buckingham and Warwick. Settlement evidence of later prehistoric to medieval date appears to be concentrated adjacent to this routeway, especially where it crosses watercourses.
- 6.3.14 No Palaeolithic remains (circa 500,000 – 10,000 BC) have been recorded within the study area. The study area lies outside of the south-eastern regions of Britain in which

Palaeolithic remains are typically found. It is, therefore, unlikely that Palaeolithic remains will be found within the study area.

- 6.3.15 Mesolithic (circa 10,000 – 4,000 BC) sites are often found in areas which have commanding views close to reliable water sources; the upper slopes of the valley of the Cherwell would therefore be a location where evidence for Mesolithic activity would be expected. It is possible that this was a suitable location from which to exploit the resources available in each of these river systems.
- 6.3.16 Results from fieldwalking surveys suggest that there was moderately widespread activity in the study area during the Neolithic (circa 4,000 – 2,400 BC) to Early Bronze Age periods (circa 2,400 – 1,500 BC), mainly associated with the Cherwell Valley or the headwaters of streams within the upland watershed between Thorpe Mandeville and Greatworth.
- 6.3.17 A number of possible ring ditches have been identified on aerial photographs within the south-western section of the airfield at Chipping Warden (GLB165). These are in a typically prominent location overlooking the headwaters of the Cherwell. Another possible round barrow has been identified at Lower Thorpe (GLBo83) and is a scheduled monument (although it is also possible that this may be a medieval or later mill mound).
- 6.3.18 Activity of Late Bronze Age (circa 1,100 – 700 BC) to Early Iron Age (circa 700 – 400 BC) date will typically be located on the lighter free draining soils over the permeable limestones where these outcrop on valley sides. It is likely that activity of these periods will not be as well represented in areas where the limestone is overlain by deposits of Till or in areas of clay overlying Lias.
- 6.3.19 To the west of Culworth Grounds, a hill top enclosure is visible on aerial photographs (GLB105). Here, a curvilinear enclosure conforms to the contours of the top of the hill and may be associated with other cropmark features on the same hill top. A similar, but slightly larger, hill top enclosure has been identified on aerial photographs to the east of Drunken Meadow Spinney (GLB149).
- 6.3.20 Excavated evidence for later prehistoric settlement and associated field-systems has been recorded during archaeological investigations on the line of the Greatworth to Thorpe Mandeville pipeline near Stuchbury Manor Farm (GLBo39) and to the north of Greatworth Hall (GLBo34).
- 6.3.21 Fieldwalking and metal detection at Blackgrounds, to the north of the scheduled monument of Edgcote Romano-British villa (GLB138 and 144) recovered artefacts that suggest there may be an Iron Age precursor to the villa in this area. Fieldwalking surveys have also recovered later prehistoric finds from the area around Greatworth (GLBo28) and from east of Marston Hill Farm (GLBo49). Reports of undated cinerary urns from north-east of Greatworth (GLBo28) could indicate Bronze Age burials in this area although a Roman and/or Anglo-Saxon date may be more likely.
- 6.3.22 The Roman road known as Welsh Lane (GLB115) is likely to have been a focus for settlement during the Roman period. A Romano-British settlement has been identified at Edgcote (GLB138) on the northern valley side of the headwaters of the

River Cherwell. This site is a scheduled monument. Although the site is scheduled as a villa, it also appears to form part of a larger roadside settlement or even small Romano-British town (GLB144) adjacent to a Roman road on the line of Welsh Lane.

- 6.3.23 Settlement activity of early medieval date (AD 410 – 1066) is most likely to be identified on the lighter soils over the limestones where they are not covered in Till and outside of clay areas overlying the Lias; activity may also be identified within the valley of the Cherwell. Artefacts dating between circa AD 750 – 950 have been recovered from within or close to a number of extant settlements suggesting that their origin lies in the Late Saxon period.
- 6.3.24 By the time of the Norman Conquest (AD 1066) the present settlement pattern had probably developed, focused on the settlements at Greatworth (GLB029), Sulgrave (GLB065), Thorpe Mandeville (GLB080), Culworth (GLB118), Edgcote (GLB141/142), Chipping Warden (GLB151), Aston le Walls (GLB176) and Lower Boddington (GLB198). Routeways that are also known to have existed by the medieval period include the Welsh Road (GLB115), Banbury to Daventry Road (GLB160) and Banbury Lane (GLB079). Many of the other local roads and tracks may also have been established by the medieval period.
- 6.3.25 Medieval village earthworks are present near Costow House (GLB072), at Lower Thorpe (GLB086), at Thorpe Mandeville (GLB080), at Edgcote (GLB142), at Trafford (GLB147), at Appletree Farm (GLB172) near Aston le Walls, and at Aston le Walls (GLB176). Medieval enclosures, which are likely to be croft boundaries and paddocks, also survive as earthworks to the south of Lower Boddington (GLB198).
- 6.3.26 Portions of medieval ridge and furrow (remains of medieval open field communal strip farming) survive throughout the study area at Greatworth Park (GLB043), at Lower Thorpe (GLB081, 082 and 084), near Trafford Bridge (GLB129), near Calves Close Spinney (GLB153) and particularly to the south and west of Lower Boddington (GLB189 and 199).
- 6.3.27 Another aspect of the medieval countryside was the establishment of royal and private forests and parks for hunting. Parts of the study area near Greatworth may have fallen within the south-western edge of Whittlewood Forest, which although a Royal hunting preserve could still contain medieval settlement and associated agricultural features. The layout of modern field boundaries and trackways between Radstone and Halse Grange, on the boundary between the Newton Purcell and Brackley area (CFA14) and the Greatworth to Lower Boddington area (CFA15), could indicate that a former park of medieval date lies in this area. This could be associated with the documentary record of a park at Greatworth (GLB003) although the northern and western extent of the park cannot be plotted from modern mapping.
- 6.3.28 A significant military action is recorded to have occurred in the parish of Edgcote during the Wars of the Roses (AD 1455 – 1487). The battle was a serious defeat by rebels loyal to Warwick the Kingmaker of forces loyal to King Edward IV under the command of the Earls of Pembroke and Stafford. The defeat resulted in the death of a relatively large portion of the nobility of Wales and their followers. There is uncertainty surrounding the precise location of the battle with little archaeological

evidence available to where the fighting took place. The most reliable documentary sources suggest that the main focus of the fighting is likely to have occurred on Danesmoor, to the east of Edgcote, although it is also possible that fighting took place near Trafford Bridge. The rebels are known to have received reinforcements who arrived over the higher ground from the direction of Culworth. Some elements of the medieval landscape still survive including the remains of ridge and furrow near Trafford Bridge. The battlefield (GLB108) will probably contain archaeological remains such as arrow-heads, discarded equipment and weaponry (mainly metal artefacts). Other archaeological evidence for the battle could include burial pits.

- 6.3.29 It is likely that the pattern of settlement established in the medieval period forms the basis for the arrangement that continued through the post-medieval period (1540 – 1900) to the present day. The post-medieval period also witnessed the widespread abandonment of the medieval agricultural organisation based on open fields with its ridge and furrow strips divided by headlands. This was replaced by enclosed fields.
- 6.3.30 Many of the farmhouses and associated agricultural buildings in the area, including Greatworth Hall (GLB022) and Lower Thorpe Farmhouse (within grouping GLB086) were built between the 17th and 19th centuries but it is generally buildings within the settlements of Greatworth (GLB029), Thorpe Mandeville (GLB080), Culworth (GLB118), Sulgrave (GLB065), Edgcote (GLB141), Chipping Warden (GLB151), Aston le Walls (GLB176), Lower Boddington (GLB198) and Upper Boddington (GLB207) that comprise the majority of this period's built heritage. Many of the farmsteads that now exist outside of these village centres may be estate farms dating to the enclosures of the 18th and early 19th centuries.
- 6.3.31 There has been very little change in the field boundaries within the study area since the 1st Edition Ordnance Survey (OS) mapping of the 1880s. Twenty-nine hedgerows that qualify as historically important under the Hedgerow Regulations 1997 lie within the land required, temporarily or permanently, to construct the Proposed Scheme. Generally there is a good survival of hedgerows that meet the criteria throughout the study area and in particular around within the 17th century enclosures around Greatworth (GLB220) where many of the field boundaries are depicted on an Enclosure map dating to 1634.
- 6.3.32 A number of the post-medieval houses in the area are associated with the growth of a rich landowning class that became established after the dissolution of the monasteries. These houses are often associated with designed landscapes. Examples include the Manor and Rectory in Thorpe Mandeville (GLB080), Edgcote (GLB141/134), Trafford House (GLB147) and the Manor House at Chipping Warden (GLB151). The large farmhouse of Greatworth Hall (GLB022) may also be an example of a gentrified farmer's house.
- 6.3.33 The parkland at Edgcote (GLB134) is an integral part of the setting of the Grade I listed Edgcote House (GLB141), a Georgian mansion dating to the 1740s and built for the Chauncys, a local mercantile family with interests in the East India trade. The associated park comprises a relatively well preserved example of a mid to late 18th century landscape park (in the then naturalised vogue) focused on a series of former mill ponds that were linked together to form an ornamental lake with adjacent

decorative plantings and osier beds. A key view is identified from the salon of Edgcote House looking eastward across the park and the ornamental lakes.

- 6.3.34 The Oxford Canal (GLB183) was constructed in the late 18th century and remained in regular use for freight through to the 1960s. It is now acknowledged to be one of the most scenic and popular canal cruising routes in the UK. The canal comes within the ZTV as it loops to the east of the village of Claydon approximately 1.5km from the Proposed Scheme. A canal feeder (GLB196) delivering water to the canal's summit near Claydon runs past Lower Boddington.
- 6.3.35 Three railway lines (GLB024, GLB094 and GLB180) were built in the later 19th and early 20th century to link the quarries and villages of the district with main lines at Banbury, Stratford-upon-Avon and Towcester. All were closed in the 1950s – 60s, but remains of their embankments and track-beds still partly survive.
- 6.3.36 In 1939, a wireless receiving and transmitting station was established by the Royal Air Force (RAF) at Greatworth Park (GLB036).
- 6.3.37 During World War II the airfield at Chipping Warden (GLB162) was established on the higher ground overlooking two headwaters of the River Cherwell. Abandoned infrastructure related to the airfield is also apparent on LiDAR imaging at Calves Close Spinney (GLB154).

Future baseline

Construction (2017)

- 6.3.38 Volume 5: Appendix CT-004-000/1 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)

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

6.4 Effects arising during construction

Avoidance and mitigation measures

- 6.4.1 The draft CoCP sets out the provisions that will be adopted to control effects on cultural heritage assets. The provisions include the following (see Volume 5: Appendix CT-003-000/1):
- management measures that will be implemented for assets that are to be retained within the land required, temporarily or permanently, for the construction of the Proposed Scheme (draft CoCP, Section 8);
 - the preparation of project wide principles, standards and techniques for works affecting heritage assets (draft CoCP, Section 8);

- a programme of archaeological investigation and recording to be undertaken prior to/or during construction works affecting the assets (draft CoCP, Section 8); and
- a programme of historic building investigation and recording to be undertaken prior to modification or demolition of the assets (draft CoCP, Section 8).

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

- the alignment past Edgcote House and its associated landscape (GLB141 and GLB134) and Trafford Bridge (GLB132) has avoided the need for an overbridge in this location thereby reducing the visual impact of the Proposed Scheme;
- the placement of the horizontal alignment of the Proposed Scheme has taken account of the location of the scheduled monument at Edgcote (GLB138), ensuring no direct physical impact on the scheduled area; and
- the Oxford Canal feeder (GLB196) will be culverted under the Proposed Scheme to preserve its function of providing water to the summit of the Oxford Canal (GLB183).

Assessment of impacts and effects

Temporary effects

- 6.4.3 The construction works, comprising excavations and earthworks and including temporary works such as construction compounds, storage areas, and diversion of existing roads and services, have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required, temporarily or permanently, 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 following significant effects will occur as a result of temporary impacts on the setting of designated or non-designated heritage assets.
- 6.4.5 Greatworth Hall (GLB022) lies immediately adjacent to the land required, temporarily or permanently, to construct the Proposed Scheme with the route in cutting within 50m. Construction activities associated with construction of the Greatworth south cutting, Greatworth south embankment, the Footpath AN22 accommodation overbridge and landscaping will be immediately adjacent to the south of Greatworth Hall. The construction works will take place over approximately three years. The construction works will comprehensively change views from the front of the house across the associated agricultural landscape to its south that forms a key aspect of its setting and contributes to its value. This is an asset of moderate value and will be subject to a high adverse impact resulting in a major adverse effect.
- 6.4.6 The historic settlement of Greatworth (GLB029), which has an asset grouping of high value comprising its conservation area, Grade I listed church and 22 Grade II listed buildings, will have views across its associated historic landscape (GLB220) changed. This landscape forms a key aspect of Greatworth's setting, placing it within a clearly

legible historic landscape context dating to at least 1634. This association will be interrupted by construction of Greatworth south cutting and Greatworth green tunnel. Construction will be undertaken over approximately four years. This will constitute a medium adverse impact and a major adverse effect.

- 6.4.7 The historic landscape context of the scheduled monument of a mound at Lower Thorpe (GLBo83), an asset of high value, will be entirely disrupted during construction of the Proposed Scheme on embankment and the Lower Thorpe viaduct across the valley beside which it is situated. Construction will take place over approximately two years and will interrupt the primary view from the mound across the valley to its south. This will constitute a medium adverse impact resulting in a major adverse effect.
- 6.4.8 The historic landscape context of the hamlet at Lower Thorpe (GLBo86), an asset of moderate value, will be disrupted during construction of Lower Thorpe south embankment, Lower Thorpe north embankment and the Lower Thorpe viaduct across the valley in which it is situated. Construction will take place over approximately two years. This will disrupt the agricultural landscape in which the hamlet lies, and which provides a setting with historic legibility that adds to the hamlet's value. This will include demolition of Lower Thorpe Farmhouse that lies at the heart of, and forms a focus for, the landscape and the imposition of construction activities across the middle of the historic landscape associated with Lower Thorpe and Thorpe Mandeville (GLB224), which is of moderate value. Construction activities will also interrupt the southward views across the valley towards Thorpe Mandeville (GLBo80) from the scheduled monument of a mound at Lower Thorpe (GLBo83), both of which are of high value. These changes will constitute a high adverse impact resulting in a major adverse effect.
- 6.4.9 The historic landscape context of the hamlet at Thorpe Mandeville (GLBo80), which is of high value, will be disrupted during construction of Lower Thorpe south embankment, Lower Thorpe north embankment and the Lower Thorpe viaduct beside which it is situated. Construction will take place over a period of approximately two years. This will entail disruption of the agricultural landscape in which the village lies, and which provides a setting with historic legibility that adds to the village's value. This will include the imposition of construction activities within the heart of the historic landscape associated with Lower Thorpe and Thorpe Mandeville (GLB224), an asset of moderate value. The changes in the setting will be particularly noticeable from the peaceful churchyard of the Grade I listed Church of St John the Baptist. This will constitute a medium adverse impact resulting in a major adverse effect.
- 6.4.10 The registered Edgcote Battlefield (GLB108), an asset of high value, will be disrupted by the construction of the Edgcote viaduct, Edgcote north embankment, Edgcote south embankment, Danes Moor auto-transformer station and the Culworth cutting satellite compound will take place over a period of approximately two years. The eastern edge of the battlefield is a focus for the understanding of the battle as it is the direction from which the rebel reinforcements that turned the day against the Royalist forces arrived and it is along this side of the battlefield that the Battlefields Trail (the principal route from which the battlefield can be appreciated) is routed. The battlefield lies within an agricultural landscape. Construction of the Proposed Scheme

will disrupt this setting and sever access to the battlefield from its eastern side through temporary closure of a section of the Battlefields Trail. This will constitute a high adverse impact and a major adverse effect.

- 6.4.11 The Grade II listed Trafford Bridge (GLB132), an asset of moderate value, will be affected by construction of the Edgcote viaduct within 50m of the asset, and use of the local road for construction traffic. Construction will take place over a period of approximately two years. This will disrupt the isolated agricultural landscape (which contributes to the value of the bridge) in which the bridge lies. This will block views from the bridge across the meadows and parkland in the valley floor to the west and interrupt views over the farmland and likely site of the Battle of Edgcote to the south. Construction of the Proposed Scheme will also change the rural nature of the setting which contributes to the appreciation and value of the asset. This will constitute a high adverse impact and a major adverse effect.
- 6.4.12 The historic landscape of Edgcote House Park (GLB134) will have construction activities associated with the Edgcote viaduct within its eastern boundary and specifically within the probably designed view across it to the agricultural landscape beyond from Edgcote House (GLB141). Construction will take place over a period of approximately two years. The peaceful nature of the parkland is a key aspect of its value and will be changed during the construction phase. The eastern edge of the parkland will be severed altering the value of the asset. This is an asset of high value and will be subject to a medium adverse impact resulting in a major adverse effect.
- 6.4.13 Edgcote House and associated hamlet (GLB141) will be affected by construction activities associated with the Edgcote viaduct within its setting over a period of approximately two years. Construction activities will be present within the key view from Edgcote House across its designed landscape towards Trafford Bridge. This will disrupt the ability to appreciate the quality of this historic landscape context. This is an asset of high value and will be subject to a medium adverse impact resulting in a major adverse effect.
- 6.4.14 The historic landscape context of the 17th century enclosures around Greatworth (GLB220) will be affected by construction of the Greatworth north cutting, Greatworth south cutting, Greatworth south embankment, Greatworth green tunnel, the Footpath AN22 accommodation overbridge and establishment of landscaping. Construction will take place over a period of approximately four and a half years. This will noticeably change the ability to appreciate the quality of this historic landscape and change its relationship with Greatworth (GLB029) and Greatworth Hall (GLB022). This is an asset of moderate value and will be subject to a medium adverse impact resulting in a moderate adverse effect.
- 6.4.15 The historic settlement at Chipping Warden (GLB151) is a conservation area and includes a scheduled monument of a market cross base, Grade I listed church, Grade II* listed manor house and 31 Grade II listed structures; it is an asset grouping of high value. Construction activities associated with the Chipping Warden green tunnel the use of the A361 for construction traffic will noticeably change the existing local sound environment. This impact will have a slight effect on one's ability to appreciate the historic context of the Chipping Warden. Construction will take place over a period of

approximately five years. This will constitute a low adverse impact and a moderate adverse effect.

- 6.4.16 The historic settlement at Culworth (GLB118), an asset of moderate value, with its conservation area focused on the scheduled monument of Castle Ringwork and Grade II* listed Church of St Mary will have views southward towards construction of the Lower Thorpe viaduct. An important view, identified in the Culworth Conservation Appraisal³⁴ southward from the village core and across the agricultural landscape that defines its setting, will have construction activities visible within it over a period of approximately two years. This will slightly alter the appreciation of the historical context of Culworth. This will constitute a low adverse impact resulting in a moderate adverse effect.
- 6.4.17 A farmstead on Culworth Road (GLB150) shown on the 1st edition OS mapping of 1883 will be entirely surrounded by construction activities associated with the Edgcote cutting and the Claydon Road overbridge and footpath. Construction will take place over a period of approximately two years. This will divorce the farmstead from the agricultural landscape that defines its setting and contributes to its value. This is a low value asset that will be subject to a high adverse impact resulting in a moderate adverse effect.
- 6.4.18 Construction of the Edgcote south embankment, Edgcote viaduct and Edgcote north embankment will disrupt the connection between the Trafford Bridge to Trafford House landscape component (GLB226) and the landscape within the Edgcote House Park (GLB134) to the west. Both are assets of moderate value. The connection with the Edgcote Battlefield (GLB108) landscape, an asset of high value, will also be disrupted. Construction will take place over a period of approximately two years. This will noticeably alter the ability to understand and appreciate how these landscapes interact, specifically at the focal point of Trafford Bridge (GLB132), which is of moderate value. This will result in a medium adverse impact and a moderate adverse effect.
- 6.4.19 The historic settlement at Aston le Walls (GLB176), an asset of high value, and in particular the areas around the Grade I listed Church of St Leonard and Grade II listed Manor House will experience changes within the agricultural landscape that forms part of the setting of the settlement that contributes to its value on its north-western side. Construction works will be associated with the Lower Boddington embankment, Lower Boddington cutting and Highfurlong Brook viaduct, and will take place over a period of approximately three years. This will result in a slight change in the understanding of the historic landscape association of Aston le Walls. This will constitute a low adverse impact and a moderate adverse effect.
- 6.4.20 The historic settlement at Lower Boddington (GLB198), an asset of moderate value, and particularly the Grade II listed Paradise Farmhouse (GLB194) and surrounding medieval village earthworks (GLB201), both of moderate value, will experience changes within the agricultural landscape that defines the setting that contributes to its value on the western edge of the village. Construction works will be associated with

³⁴ South Northamptonshire Council (2013), *Culworth Conservation Area Appraisal and Management Plan*.

the Lower Boddington embankment, Lower Boddington cutting and Highfurlong Brook viaduct, and will take place over a period of approximately three years. This will sever the settlement from the western part of the historic landscape component (GLB228) that contributes to the legibility of the settlement within its historic landscape context. This will constitute a medium adverse impact and a moderate adverse effect.

Cumulative effects

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

Permanent effects

- 6.4.22 The following significant effects will occur as a result of physical impacts on heritage assets within the land required, temporarily or permanently, for the construction of the Proposed Scheme.
- 6.4.23 Approximately 6% of the ancient woodland of Halse Copse South (GLBo10), an asset of high value will be removed through the construction of a cutting, a new farm overbridge and the establishment of temporary excavated material storage and haul road. This will include most of the western boundary of the wood, including potential wood bank(s). Buried archaeology within the woodland will also be removed. This will constitute a medium adverse impact and a major adverse effect.
- 6.4.24 Buried archaeological remains in the location of the cropmark of a possible ring-ditch to the south of Greatworth (GLB213) and any associated surrounding remains will be removed within the land required, temporarily or permanently, to construct the Proposed Scheme. Construction at this location will include establishment of temporary haul route, establishment of temporary excavated material storage, construction of the route in cutting, construction of the Greatworth auto-transformer station and landscaping. This will be a high adverse impact resulting in a major adverse effect.
- 6.4.25 Two buildings at the former wireless reception and interception centre at Greatworth Park (GLBo36), an asset of moderate value, will be demolished to construct the Greatworth green tunnel, landscaping and establishment of temporary haul routes and excavated material storage. This will constitute a high adverse impact and a major adverse effect.
- 6.4.26 Buried archaeology in the location of cropmarks to the west of Moreton Road (GLBo56) will be removed during construction within the land required, temporarily or permanently, to construct the Proposed Scheme. Construction will include establishment of temporary haul route, construction of the route in cutting and landscaping. These remains are likely to be prehistoric and/or Roman in date. Removal of these remains will constitute a high adverse impact resulting in a major adverse effect.
- 6.4.27 Buried archaeology in the location of cropmarks between Moreton and Banbury Roads (GLBo61) will be removed during construction within the land required, temporarily or permanently, to construct the Proposed Scheme. Construction here

will entail establishment of temporary haul routes, establishment of temporary roadhead, establishment of temporary excavated material storage and construction of the route within cutting with balancing pond and landscaping. These remains are likely to be prehistoric and/or Roman in date. Removal of these remains will constitute a high adverse impact resulting in a major adverse effect.

- 6.4.28 Buried archaeological remains of the system of medieval fishponds between Costow House and Thorpe Mandeville (GLBo78) will be removed within the land required, temporarily or permanently, for construction of the Proposed Scheme. Works will entail construction of the route on embankment. This will constitute a high adverse impact resulting in a major adverse effect.
- 6.4.29 The Grade II listed Lower Thorpe Farmhouse (within grouping GLBo86) will be demolished. This will be a high adverse impact resulting in a major adverse effect.
- 6.4.30 Buried archaeological remains of the system of ponds to the east of Lower Thorpe (GLBo85), assets of moderate value, will be removed through the construction of the Lower Thorpe south embankment, Lower Thorpe viaduct, balancing pond, landscaping and the establishment of the Thorpe Mandeville cutting satellite compound, excavated material storage and haul routes. These remains may include evidence for a former mill of medieval or early post-medieval date and/or possibly an early post-medieval industrial complex. This will constitute a high adverse impact and a major adverse effect.
- 6.4.31 Cropmarks, probably representing remains of prehistoric date, on the hill top to the north-west of Culworth Grounds (GLB105), an asset of moderate value, will be removed through the construction of the Culworth cutting, Bridleway AG9 overbridge and the establishment of temporary excavated material storage and haul routes. This will constitute a high adverse impact and a major adverse effect.
- 6.4.32 Buried archaeology associated with the Battle of Edgcote, an asset of high value, as well as surviving elements of the medieval landscape across which it was fought (GLB108) will be removed through the construction of the route on the Culworth embankment and in the Culworth cutting and Edgcote south embankment, Danes Moor auto-transformer station, Danes Moor auto-transformer station satellite compound, Bridleway AG10 accommodation overbridge, balancing ponds, landscaping and the temporary establishment of excavated material storage and haul roads. This will constitute a medium adverse impact and a major adverse effect.
- 6.4.33 Removal of approximately 50% of the ridge and furrow to the south of Trafford Bridge (GLB129), which is the only extant ridge and furrow within the area of and likely contemporary with the Battle of Edgcote (making it of high value) will constitute a medium adverse impact and a major adverse effect.
- 6.4.34 Buried remains of a probable Romano-British settlement at Blackgrounds (GLB144), an asset of high value (associated with the adjacent scheduled monument of Edgcote villa (GLB138) that lies just outside the land required, temporarily or permanently, for construction of the Proposed Scheme) will be removed through the construction of the Proposed Scheme on the Edgcote viaduct, on the Edgcote north embankment, Edgcote cutting, balancing pond, landscaping and the establishment of temporary

excavated material storage and haul routes. This will constitute a high adverse impact and a major adverse effect.

- 6.4.35 Buried archaeological remains related to cropmarks south of Halse Copse South that may indicate prehistoric and/or Romano-British activity (GLB007) will be removed within the land required, temporarily or permanently, for construction of the Proposed Scheme. This will be a medium adverse impact resulting in a moderate adverse effect.
- 6.4.36 Removal of approximately 75% of the ridge and furrow to the west of Greatworth Hall (GLB217) within the land required, temporarily or permanently, to construct the Proposed Scheme. This ridge and furrow also represents part of the historic landscape context for Greatworth Hall (GLB022). This is an asset of low value that will be subject to a high adverse impact resulting in a moderate adverse effect.
- 6.4.37 An area of ridge and furrow to the north-east of Greatworth Park (GLB218) will be removed within the land required, temporarily or permanently, to construct the Proposed Scheme. This ridge and furrow also constitutes part of the historic landscape context for Greatworth. This is an asset of low value that will be subject to a high adverse impact resulting in a moderate adverse effect.
- 6.4.38 The historic integrity and coherence of the 17th century enclosures around Greatworth (GLB220) will be permanently changed by removal of elements during the construction phase noticeably affecting the ability to appreciate it as a heritage asset in its own right and its association with Greatworth (GLB029) and in particular Greatworth Hall (GLB022). This will constitute a medium adverse impact resulting in a moderate adverse impact.
- 6.4.39 Buried archaeological remains of prehistoric date near Dean Barn (GLB050), an asset of moderate value, will be removed within the land required, temporarily or permanently, for construction of the Proposed Scheme. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.40 Buried archaeological remains of prehistoric date associated with a flint scatter to the west of Moreton Road (GLB051) will be removed within the land required, temporarily or permanently, for construction of the Proposed Scheme. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.41 Ridge and furrow to the north of Thorpe Mandeville (GLB081), an asset of moderate value, will be partially (approximately 20%) removed within the land required, temporarily or permanently, for construction of the Proposed Scheme. This will also remove part of the historic landscape component (GLB224) that contributes to the setting of Thorpe Mandeville (GLB080) and Lower Thorpe (GLB086). This will constitute a high adverse impact resulting in a moderate adverse effect.
- 6.4.42 Approximately 20% of the ridge and furrow between Costow House and Magpie Farm (GLB221) along with associated trackways and lynchets (GLB222) will be removed within the land required, temporarily or permanently, to construct the Proposed Scheme. This is an asset of moderate value and will be subject to a medium adverse impact resulting in a moderate effect.

- 6.4.43 Possible palaeoenvironmental remains and potential archaeology associated with a mill in the valley floor of the Cherwell at Trafford Bridge (GLB131), assets of moderate value, will be removed through the construction of the Proposed Scheme, including a balancing pond and landscaping. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.44 Removal of most of the ridge and furrow to the south of Calves Close Spinney (GLB153) within the land required, temporarily or permanently, to construct the Proposed Scheme, an asset of low value, will result in a high adverse impact and a moderate adverse effect.
- 6.4.45 Stone House (GLB159) shown on the 1st edition OS map of 1883 will be demolished. This is an asset of low value that will be subject to a high adverse impact resulting in a moderate adverse effect.
- 6.4.46 Buried remains associated with the World War II airfield at Chipping Warden (GLB162), an asset of moderate value, will be removed through the construction of the route within the Chipping Warden green tunnel, Chipping Warden mid-point auto-transformer station, Chipping Warden green tunnel main compound, excavated material storage and haul roads. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.47 Possible buried features of prehistoric date that lie within the airfield perimeter (GLB165), an asset of moderate value, will be partially removed through the construction of the route within the Chipping Warden green tunnel and the establishment of the construction compound, excavated material storage and haul roads. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.48 Approximately 75% of ridge and furrow to the south-east of Lower Boddington (GLB189) an asset of low value, will be removed through the construction of the route within the Lower Boddington cutting and the establishment of landscaping and new road. This will constitute a high adverse impact and a moderate adverse effect.
- 6.4.49 Approximately 90% of ridge and furrow to the north-west of Lower Boddington (GLB199), an asset of low value, will be removed through construction of the route in the Lower Boddington cutting and the establishment of landscaping. This will constitute a high adverse impact resulting in a moderate adverse effect.
- 6.4.50 Buried remains of likely prehistoric and/or Roman date associated with cropmarks to the south of Three Shires (GLB202), an asset of moderate value, will be partially removed through landscaping and the establishment of temporary excavated material storage, and haul roads. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.51 Buried remains of likely prehistoric and/or Roman date associated with cropmarks to the north of Three Shires (GLB208), an asset of moderate value, will be removed through landscaping and the establishment of temporary excavated material storage, haul roads and landscaping. This will constitute a medium adverse impact and a moderate adverse effect.

- 6.4.52 Buried archaeological remains at Fox Covert (GLB211) will be partially removed through construction of the main alignment within cutting. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.53 Sections of 29 hedgerows, of moderate value and identified as being historically important by the Hedgerow Regulations 1997 will be removed along the route (GLB017, GLB021, GLB023, GLB025 – 027, GLB030, GLB031, GLB 040 – 042, GLB044 – 047, GLB058 – 060, GLB071, GLB 090, GLB091, GLB093, GLB100, GLB103, GLB112 – 114, GLB 185 and GLB186). These are hedgerows that lie along parish boundaries and/or can be shown to pre-date parliamentary enclosure and/or form a constituent part of a feature mapped by the Historic Environment Record (HER). This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.54 The following significant effects will occur as a result of permanent impacts on the setting of historic assets.
- 6.4.55 The Grade II listed 18th century farmhouse of Greatworth Hall (GLB022), an asset of moderate value, will have its setting changed by the Proposed Scheme adjacent to its grounds. The Proposed Scheme will sever this asset from its rural hinterland to the south and links (both physical and visual) with Greatworth (GLB029). In addition, a section of ridge and furrow (GLB217) that provides time depth to the landscape immediately adjacent to Greatworth Hall will be removed. This will comprehensively alter Greatworth Hall's relationship with the agricultural landscape in which it developed. This will constitute a high adverse impact and a major adverse effect.
- 6.4.56 The historic settlement of Greatworth (GLB029) with its conservation area, Grade I listed church and 22 Grade II listed buildings, an asset grouping of high value, will have views to and from its eastern periphery towards the Proposed Scheme approximately 600m distant changed, as well as a degree of severance of the settlement from its rural hinterland on its north and north-eastern side. A section of the 17th century enclosed landscape (GLB220) that provides historical legibility to setting and hence contributes to the value of Greatworth will also be removed. This will constitute a medium adverse impact and a major adverse effect.
- 6.4.57 The fishponds between Costow House and Lower Thorpe (GLB078) will be severed by the Proposed Scheme on the Thorpe Mandeville viaduct and Thorpe Mandeville south embankment. This will also disrupt the understanding and appreciation of the Thorpe Mandeville and Lower Thorpe landscape component (GLB224). This will have a noticeable effect on this asset's value resulting in a medium adverse impact and a moderate adverse effect.
- 6.4.58 The historic settlement at Thorpe Mandeville (GLB080) with its Grade I listed church, Grade II* listed Manor House with associated designed landscape and six other Grade II listed buildings, an asset grouping of high value, will have partial views towards the Proposed Scheme, approximately 200m distant from its northern periphery. This will particularly be the case from the churchyard of the Grade I listed Church of St John the Baptist. There will also be open views towards the village across the line of the Proposed Scheme on the Lower Thorpe viaduct and Lower Thorpe north and south embankments from public footpaths and the scheduled monument of a mound

approximately 50m from the Proposed Scheme at Lower Thorpe to the north. This will result in severance of the historic landscape component (GLB224) between Thorpe Mandeville and the adjoining hamlet of Lower Thorpe (GLBo86) and dislocation of views towards more distant Culworth (GLB118). This will constitute a medium adverse impact and a major adverse effect.

- 6.4.59 The Thorpe Mandeville and Lower Thorpe landscape (GLB224) comprises the historic landscape component in which Thorpe Mandeville (GLBo80) and Lower Thorpe (GLBo86) lie, thereby contributing to their values. It will be altered by insertion of the scheme on the Lower Thorpe North and South embankments and Lower Thorpe viaduct across its centre. Elements of this historic landscape component will be removed or altered. This will include demolition of Lower Thorpe Farmhouse and associated buildings within its grounds (within grouping GLBo86), removal of sections of the water management systems within the valley to the east of Lower Thorpe (GLBo85) and valley between Costow and Thorpe Mandeville (GLBo78), removal of sections of ridge and furrow (GLBo81, GLBo82 and GLB221) and removal of sections of historically important hedgerows (GLBo90, GLBo91, GLBo93 and GLB100) This is an asset of moderate value and will be subject to a high adverse impact resulting in a major adverse effect.
- 6.4.60 Key views across the likely location of the battlefield at Edgcote (GLB108), an asset of high value, will be severed by the presence of the Proposed Scheme between the areas where the two armies deployed and probably fought and the higher ground towards Culworth where the rebel reinforcements arrived from. This will constitute a medium adverse impact and a major adverse effect.
- 6.4.61 Grade II listed Trafford Bridge (GLB132), an asset of moderate value, will be affected by construction of the Proposed Scheme within 50m. This will involve the addition of the Edgcote viaduct with Edgcote north and south embankments almost adjacent to and blocking views from the bridge across the meadow and parkland landscape to the west that provides its historical landscape context in being broadly the same landscape as was present when the bridge was built. Views towards the probable site of the Battle of Edgcote to the south-west will also be blocked appreciably altering the view from the Battlefields Trail (a national heritage walking route) that uses the 18th century bridge to cross the Cherwell. The bridge is also used in an annual commemoration ceremony for the battle. This will constitute a high adverse impact and a major adverse effect.
- 6.4.62 The eastern edge of the designed landscape of Edgcote Park (GLB134) will be severed at Osierbed Spinney, a section of which will be removed. Osierbed Spinney also serves to frame on the northern side of what is likely to have been a designed view from Edgcote House (GLB141) over the parkland and beyond. The isolated and peaceful nature of the parkland is an important aspect of its design and appreciation. This will result in a medium adverse impact and a major adverse effect.
- 6.4.63 The historic settlement at Edgcote (GLB141) focused on the Grade I listed Georgian mansion of Edgcote House, an asset grouping of high value, will have its setting changed by the introduction of the Proposed Scheme into the designed landscape associated with Edgcote House. A key view from the Grade I listed Edgcote House will

be altered by the addition of a viaduct, embankments and landscaping within the designed landscape. Parts of the designed landscape including Osierbed Spinney that frames the view will also be removed. There will be no appreciable effect on the value of any of the other buildings within this asset grouping. The changes in the setting of Edgcote House will constitute a medium adverse impact and a major adverse effect.

- 6.4.64 The scheduled monument of a possible round barrow at Lower Thorpe (GLBo83), an asset of high value, will have its setting changed by the insertion of the Proposed Scheme on the Lower Thorpe viaduct within 100m and within its principal view across the valley and historic landscape component (GLB224) between Thorpe Mandeville (GLBo80) and Lower Thorpe (GLBo86). Field inspection and aerial photography indicate that this feature lies over ridge and furrow and is unlikely to be a prehistoric feature but more likely to be a medieval or later windmill mound. No key views will be interrupted resulting in a low adverse impact and a moderate adverse effect.
- 6.4.65 The Edgcote viaduct will frame the western edge of the Trafford Bridge to Trafford house landscape component (GLB226) and serve as a backdrop to views from it towards Trafford Bridge. The connection with the Edgcote House Park (GLB134) landscape beyond will remain severed and the connection to the Edgcote Battlefield (GLB108) disrupted. This will noticeably affect the appreciation of this asset as part of the historic landscape context of this portion of the Cherwell Valley. This will constitute a medium adverse impact and moderate adverse effect.
- 6.4.66 A post medieval farmstead on Culworth Road (GLB150) that is depicted on the 1st edition OS of 1883, an asset of low value will be surrounded by new landscaping removing it from the agricultural landscape in which it developed. This will result in a high adverse impact and a moderate adverse effect.
- 6.4.67 The historical settlement at Lower Boddington (GLB198) and particularly the Grade II listed Paradise Farmhouse (GLB194) and surrounding medieval village earthworks (GLB201) will experience changes within the agricultural landscape that defines the setting that contributes to its value on the western edge of the village. Lower Boddington will effectively be severed from the western part of the historic landscape component (GLB228) that contributes to the legibility of the settlement within its historic landscape context. Elements of ridge and furrow (GLB189 and GLB199) that form part of this historic landscape component will also be removed. This will result in a noticeable change in the understanding of the relationship of Lower Boddington with its associated historic landscape context. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.68 Large tracts of the ridge and furrow (GLB189 and 199) that forms an intrinsic element of the historic landscape component (GLB228) in which Lower Boddington (GLB201) lies will be removed and the settlement severed from any remaining historic landscape context on its western side. This will constitute a medium adverse impact and a moderate adverse effect.
- 6.4.69 The Lower Boddington landscape component (GLB228) will have its connection severed with the medieval village earthworks (GLB201) at Lower Boddington and will have sections of ridge and furrow (GLB189 and GLB199) removed within its western

extent. This will mean it loses integral elements and association that contribute to both its value and the value of the medieval village earthworks at Lower Boddington (GLB201). This will result in a noticeable change in the understanding of the relationship of Lower Boddington with its associated historic landscape context. This will constitute a medium adverse impact and a moderate adverse effect.

Permanent cumulative effects

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

Other mitigation measures

6.4.71 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

6.4.72 A range of archaeological assets will be permanently lost due to the construction of the Proposed Scheme. These assets include prehistoric cropmark sites, Romano-British settlement remains (notably near Edgcote) and remains that may be associated with the Battle of Edgcote. A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.73 The Proposed Scheme will result in the demolition of a number of built heritage assets including Lower Thorpe Farmhouse (a Grade II listed building), the non-designated Stone House and a former wireless station within Greatworth Park. A programme of built heritage works will be prepared to investigate, analyse, report and archive these assets.

6.4.74 The Proposed Scheme will sever elements of the historic landscape, for example hedgerows and ancient woodland. Some 29 lengths of historic hedgerow and part of the ancient woodland of Halse Copse South will be permanently removed. In addition, elements of ridge and furrow that contribute to the setting of historic settlements and buildings such as Greatworth Hall and Thorpe Mandeville will be removed.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 Measures incorporated into the design of the Proposed Scheme to reduce the impacts and effects on assets include:

- noise mitigation measures around Lower Thorpe to reduce impacts on the historic settlement (GLBo86) and scheduled monument (GLBo83);

- landscape planting will over time reduce the impacts from changes to the setting of identified assets, especially at Edgcote where planting will screen the Grade I listed mansion (GLB134) and historic settlement (GLB141); and
- green tunnels at Greatworth and Chipping Warden reduce potential noise effects.

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 The following significant environmental effects will occur as a result of permanent changes to the setting of any heritage assets arising from the impacts of railway operation.
- 6.5.4 Greatworth Hall (GLBo22) will experience a change in setting during the operational phase. This change will be caused by the movement of trains and the associated increase in noise. This will constitute a medium adverse impact resulting in a moderate adverse effect. In combination with the presence of the Proposed Scheme this will result in a high adverse impact resulting in a major adverse effect.
- 6.5.5 The village of Thorpe Mandeville (GLBo8o) lies within an area identified as being subject to operational noise from passing trains. Trains will also be visible on the Lower Thorpe viaduct from the Grade I listed Church of St John the Baptist. This will constitute a medium adverse impact resulting in a major adverse effect. In combination with the permanent construction impacts of the Proposed Scheme this will result in a high adverse impact resulting in a major adverse effect.
- 6.5.6 The scheduled monument of a mound at Lower Thorpe (GLBo83) will experience noise and visual intrusion from passing trains. This will constitute a medium adverse impact resulting in a major adverse effect. In combination with the presence of the Proposed Scheme this will result in a high adverse impact resulting in a major adverse effect.
- 6.5.7 The registered Edgcote Battlefield (GLB1o8) will experience noise and visual intrusion from passing trains. This will constitute a medium adverse impact resulting in a major adverse effect. In combination, the presence and operation of the Proposed Scheme will result in a high adverse impact resulting in a major adverse effect.
- 6.5.8 Edgcote House Park (GLB134) will experience noise and visual intrusion from passing trains. This will constitute a medium adverse impact resulting in a major adverse effect. In combination, the presence and operation of the Proposed Scheme will result in a high adverse impact resulting in a major adverse effect.

- 6.5.9 Edgcote House and associated hamlet (GLB141) will experience disturbance and visual intrusion from passing trains. This will constitute a medium adverse impact resulting in a major adverse effect. In combination, the presence and operation of the Proposed Scheme will result in a high adverse impact resulting in a major adverse effect.
- 6.5.10 The Thorpe Mandeville and Lower Thorpe landscape (GLB224) will experience noise and visual intrusion from passing trains. This will constitute a medium adverse impact resulting in a moderate adverse effect. In combination, the presence and operation of the Proposed Scheme will result in a high adverse effect resulting in a major adverse effect.
- 6.5.11 The historic settlement of Greatworth (GLB029) will experience a change in setting during the operational phase. This change will be caused by the movement of trains and the associated increase in noise. This will constitute a medium adverse impact resulting in a moderate adverse effect. In combination with the presence of the Proposed Scheme this will result in a high adverse impact resulting in a major adverse effect.
- 6.5.12 Trafford Bridge (GLB132) will experience noise and visual intrusion from passing trains. This will constitute a medium adverse impact resulting in a moderate adverse effect. In combination, the presence and operation of the Proposed Scheme will result in a high adverse effect resulting in a major adverse effect.

Cumulative effects

- 6.5.13 Assessment of inter-project effects on cultural heritage assets arising from the interaction of the Proposed Scheme with cumulative development projects has been undertaken. These are listed in Section 2.1 and shown in Maps CT-13-035 to CT-13-041 (Volume 5, Cross Topic Appendix 1 Map Book). No significant cumulative effects have been identified in relation to cultural heritage.

Other mitigation measures

- 6.5.14 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. Refinements to the mitigation measures incorporated into the design of the Proposed Scheme will be considered during detailed design to reduce further the significant effects described above.

Summary of likely residual significant effects

- 6.5.15 The setting of several historic settlements, buildings and landscapes will be affected visually and by noise once the Proposed Scheme becomes operational. This includes Edgcote House and associated parkland, the landscape of the Battle of Edgcote, Edgcote, Greatworth, Thorpe Mandeville and Lower Thorpe. In due course visual effects will reduce as planting matures and the new railway assimilates into the landscape.

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 from Halse Copse South Local Wildlife Site (LWS), part of which is ancient woodland; loss of habitat from Aston le Walls LWS; loss of fen and marshy grassland from Trafford Bridge Marsh LWS; potential disturbance of breeding otter; loss of breeding ponds and terrestrial habitat for great crested newt; and the removal of hedgerows throughout the land required for the construction of the Proposed Scheme.
- 7.1.3 Volume 5 of the ES contains supporting information to the ecological assessment reported in this section, including:
- ecological baseline data (Appendices EC-001-002, EC-002-002, EC-003-002, and EC-004-002); and
 - a register of local/parish level effects, which are not reported individually in Volume 2 (Appendix EC-05-002).
- 7.1.4 As well as survey data, the assessment draws on existing information gathered from national organisations and from regional and local sources including: Environment Agency; Northamptonshire Bat Group; Bedfordshire, Cambridgeshire and Northamptonshire Wildlife Trust; Banbury Ornithological Society; Northamptonshire Biodiversity Records Centre; Oxfordshire Badger Group; Northamptonshire Bird Club; and Northamptonshire County Recorder for Diptera.

7.2 Scope, assumptions and limitations

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

south-west of Eydon; Washbrook Farm north-west of Aston le Walls; and land west of Upper Boddington. In addition, access was not secured for land near Redhill Wood, east of Aston le Walls; a large area of farmland west of Culworth including Mire Spinney Wood; and a large area of farmland between Aston le Walls and Lower Boddington until June 2013, thus limiting survey work in this area. Further details are provided in Volume 5: Appendices EC-001-002, EC-002-002, EC-003-002, and EC-004-002.

- 7.2.4 Where data are limited, a precautionary baseline has been built up according to the guidance provided in 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

- 7.3.1 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in this area. Further details are provided in the reports and maps presented in Volume 5 (Appendices EC-001-002, EC-002-002, EC-003-002 and EC-004-002 and Map Book – Ecology, Maps EC-01 to EC-12). Statutory and non-statutory designated sites are shown on Map EC-01 (Volume 5, Map Book – Ecology).
- 7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists of arable and pasture with intact and established hedgerows. There are three disused railways that support trees, grassland and scrub; one is to the east of Greatworth, one at Lower Thorpe and one at Aston le Walls. Woodlands is uncommon in this area, the largest being Halse Copse South near Greatworth and Fox Covert (Glyn Davies Wood) near Lower Boddington. Extensive areas of semi-improved neutral grassland are present at Thorpe Mandeville and Lower Thorpe. Aquatic and wetland habitats crossed by the Proposed Scheme include the River Cherwell and its tributaries, the Highfurlong Brook, and Trafford Bridge Marsh. There is a large number of ponds in this area with groups of ponds near Aston le Walls and Lower Boddington.

Designated sites

- 7.3.3 There is one statutory designated site located within 500m of the land required for the construction of the Proposed Scheme; Helmdon Disused Railway Site of Special Scientific Interest (SSSI). It is partly within this area and partly within the adjoining Newton Purcell to Brackley area (CFA14). The SSSI is located approximately 300m to the east of land required for the construction of the Proposed Scheme. Further details on the SSSI are provided in the Newton Purcell to Brackley area report (CFA14).
- 7.3.4 There are seven LWS relevant to the assessment, and each is of county/metropolitan value. They are:
- Radstone Road Verge LWS (0.5ha) – designated for species-rich neutral grassland and plant species such as common centaury and common spotted orchid. A section of the road verge lies within land required for the

construction of the Proposed Scheme. It is partly within this area and partly within the adjoining Newton Purcell to Brackley area (CFA14);

- Halse Copse South LWS (13.1ha) – designated for woodland, all of which is a habitat of principal importance³⁵ and a local Biodiversity Action Plan (BAP) habitat³⁶, and of which approximately 6ha (46%) is ancient semi-natural woodland. The southern part of the LWS, some of which is ancient woodland, lies within the land required for the construction of the Proposed Scheme;
- Halse Copse North LWS (8.6ha) – designated for woodland, of which all is ancient semi-natural woodland, a habitat of principal importance and a local BAP habitat. Its western boundary will be next to an area of the Proposed Scheme that will be used for ecological compensation;
- Washbrook Spinney LWS (15.2ha) – designated for semi-natural broadleaved woodland comprising ash and field maple with a ground flora dominated by dog's mercury. The site is approximately 470m north of the land required for the construction of the Proposed Scheme but it may be subject to changes in ground water;
- Washbrook Lake LWS (18.6ha) – designated for open standing water and marshy grassland. The site is approximately 675m north of land required for the construction of the Proposed Scheme but it may be subject to changes in ground water;
- Trafford Bridge Marsh LWS (1.7ha) – designated for semi-improved grassland, swamp and lowland fen, of which the latter is a habitat of principal importance and local BAP habitat. It also includes part of the River Cherwell. The LWS is partly within the land required for construction of the Proposed Scheme; and
- Aston le Walls Railway Line LWS (4.1ha) – designated for species-rich neutral grassland. The central section of this linear site is within land required for construction of the Proposed Scheme.

Habitats

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

Watercourses

7.3.6 The River Cherwell, Culworth Brook (a tributary of the River Cherwell at Lower Thorpe), the Highfurlong Brook, the Boddington Canal Feeder and several drainage ditches are crossed by land required for the construction of the Proposed Scheme. These are described below:

- The River Cherwell qualifies as a habitat of principal importance due to its natural and varied channel, and is a local BAP habitat. The land required for construction of the Proposed Scheme crosses the river twice at Trafford Bridge; at this point the channel is unmodified, approximately 3-4m wide and

³⁵ *The Natural Environment and Rural Communities Act 2006 (Chapter 16)*, London, Her Majesty's Stationery Office.

³⁶ Northamptonshire Biodiversity Partnership (2008), Northamptonshire Biodiversity Action Plan 2nd Edition. Version 1.4 074/09/09.

meanders through pasture and fen. Due to its high ecological quality and connectivity with a range of other wetland habitats the River Cherwell is of county/metropolitan value³⁷;

- The Highfurlong Brook has been over-deepened in the past but its natural meanders remain. The brook has few aquatic plants due to the shading from adjacent mature trees, the water flow is slow and the bed is heavily silted. The Brook is of local/parish value;
- Both channels of the Culworth Brook have been straightened and are very shallow, with little aquatic vegetation. The Brook is of local/parish value; and
- The Boddington Canal Feeder is a slow flowing artificial channel that directs water from the Highfurlong Brook to the Oxford Canal. It has steep banks and areas of dense scrub immediately adjacent to it. The canal feeder is of local/parish value.

Woodland

- 7.3.7 The northern part of woodland at Halse Copse South LWS is dominated by ash and field maple, with the majority being described in the National Vegetation Classification (NVC)³⁸ as lowland ash and field maple *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, *Primula vulgaris-Glechoma hederacea* sub-community. It is botanically rich and is a good example of this habitat. Ten ancient woodland ground flora indicator species are present including bluebell and wood sorrel. The southern part of the wood is dominated by pedunculate oak and is less species-rich. The entire site is lowland mixed deciduous woodland, a habitat of principal importance, and is a local BAP habitat. It is of county/metropolitan value.
- 7.3.8 There are four further areas of lowland mixed deciduous woodland (a habitat of principal importance), which will be within or partly within land required for construction of the Proposed Scheme. Fox Covert (Glyn Davies Wood), managed by the Banbury Ornithological Society, is dominated by ash and pedunculate oak (including several old trees), with hazel, honeysuckle, bramble, hawthorn and elder in the understorey; and bluebell in the ground flora. Osierbed Spinney consists partly of a poplar plantation and is largely species-poor. Calves Close Spinney is dominated by sycamore but contains older pedunculate oak. An unnamed woodland near Lower Thorpe comprises of pedunculate oak, ash and occasional Scot's pine with a dense understorey of hazel, elder and hawthorn and common nettle and bramble in the ground flora. None are ancient woodland but all are of sufficient size and maturity to be individually of district/borough value.
- 7.3.9 There are several small areas of semi-natural woodland or plantation in or adjacent to land required for the construction of the Proposed Scheme that do not qualify as lowland mixed deciduous woodland. They include Painters Spinney to the north of Greatworth, and small areas of woodland near Culworth, Aston le Walls and Lower

³⁷ Wildlife Site Selection Criteria Northamptonshire (2007) Local Wildlife Sites Panel 'Criteria for the selection of riverine Local Wildlife Sites have not been developed and specific sections of rivers will not be designated as Wildlife Sites. All rivers in the County are recognised as of importance to wildlife and should be treated as of equal importance to Wildlife Sites'.

³⁸ NVC is a detailed survey and classification system that is used to compare plant communities with a range of defined community types.

Boddington. They are all of limited extent, most are isolated from other woodland and each is therefore of local/parish value.

Grassland

- 7.3.10 The northern part of Trafford Bridge Marsh LWS contains neutral grassland with a range of grass species including cock's-foot, Yorkshire fog, crested dog's-tail and a limited range of broadleaved species such as lesser stitchwort, cut-leaved cranesbill and red clover. As grassland is a principal reason for the designation of the site, this habitat is of county/metropolitan value.
- 7.3.11 The site description for Radstone Road Verge LWS contains common species typical of neutral grassland including black knapweed and agrimony. It also has species tolerant of moderate levels of disturbance including common centaury, common spotted orchid and strawberry clover, as well as an uncommon lichen. Long-stalked yellow sedge a rare species³⁹ has also been recorded in an adjacent drain. As grassland is the principal reason for the designation of the site, this habitat is of county/metropolitan value.
- 7.3.12 An extensive area of semi-improved neutral grassland is present to the east of Thorpe Mandeville. An area approximately 5.5ha near Lower Thorpe, of which part is within the land required for the construction of the Proposed Scheme was un-grazed, species-rich and of sufficient quality to be the habitat of principal importance, lowland meadow. It was identified as neutral grassland community MG5b *Cynosurus cristatus-Centaurea nigra* grassland, *Galium verum* sub-community. It contains various grasses including meadow fescue, downy oat grass, upright brome and meadow brome, as well as several broadleaved species such as yellow rattle, black knapweed and lady's bedstraw. This area of semi-improved neutral grassland is of district/borough value. The surrounding grassland is more heavily grazed and contains a less diverse range of grasses and broadleaved species although pignut, an indicator of lowland meadow⁴⁰ (a habitat of principal importance), is widespread. It is therefore of up to district/borough value.
- 7.3.13 At Costow Field to the south-east of Thorpe Mandeville there is a further area of semi-improved neutral grassland adjacent to land required for the construction of the Proposed Scheme, comprising rush-pasture, MG5a *Cynosurus cristatus-Centaurea nigra* grassland, *Lathyrus pratensis* sub-community. Tufted hair grass is dominant in wetter areas, associated with hairy sedge, marsh thistle, meadowsweet, greater bird's-foot trefoil and marsh horsetail. Parts of the grassland are of sufficient quality to be lowland meadow, a habitat of principal importance, and the grassland is of district/borough value.
- 7.3.14 Although Aston le Walls Disused Railway LWS includes areas of species-rich grassland that is of county/metropolitan value as it is the principal reason for designation, the parts of the site that lie within the land for the construction of the Proposed Scheme

³⁹ Rare refers to species found in only a few parts of the county and then only in small numbers – known from less than 10 but greater than three sites in the county. Gent, G and Wilson, R. (2012). The Flora of Northamptonshire and the Soke of Peterborough. Rob Wilson Designs, NBRC and BSBI.

⁴⁰ Natural England (2010), *Higher Level Stewardship Farm Environment Plan (FEP) Manual*.

contained relatively species-poor neutral grassland dominated by false oat grass. This is of local/parish value.

Hedgerows

- 7.3.15 There are about 55km of hedgerows within the land required for the construction of the Proposed Scheme. These have good connectivity and comprise common shrub and tree species, of which the most abundant are hawthorn, blackthorn, field maple, ash and rose species. Field surveys throughout the area indicate that of the 134 hedgerows surveyed, a total of 62 hedges (approximately 19km) qualify as important hedgerows (under the Hedgerows Regulations 1997)⁴¹, of which approximately 18km (55 hedgerows) are within or partly within the land required for the construction of the Proposed Scheme. The important hedgerows are all habitats of principal importance, approximately 60% are present between Greatworth and Thorpe Mandeville and 40% between Aston le Walls and Lower Boddington. Due to the proportion of established, well connected hedgerows the network is of district/borough value.

Fen

- 7.3.16 Two areas of wetland habitat qualifying as the habitat of principal importance lowland fen were recorded. The community present at Trafford Bridge Marsh LWS is dominated by meadowsweet with frequent wild angelica, and as such is an example of M27b *Filipendula ulmaria-Angelica sylvestris* mire, *Urtica dioica-Vicia cracca* sub-community. This community grades into a less species-rich vegetation dominated by great pond sedge. As fen is a principal reason for the designation of the site, together the habitats are of county/metropolitan value. Trafford Bridge Marsh LWS lies partially within the land required for construction of the Proposed Scheme.
- 7.3.17 A similar fen community to that recorded at Trafford Bridge Marsh LWS is present in the wettest parts of Costow Field, which will be next to the land required for the construction of the Proposed Scheme. The area is smaller in extent and of district/borough value.

Ponds

- 7.3.18 A total of 29 ponds are within land required for the construction of the Proposed Scheme. Most are near Aston le Walls, Lower Boddington, Edgcote and Thorpe Mandeville. Of these four support great crested newts and therefore qualify as habitats of principal importance. Of the seven ponds that were surveyed, six were recorded as having limited plant species diversity, the seventh, a pond at Manor Farm, near Aston le Walls, had a higher diversity, but several species are understood to have been planted. Based on habitat alone, each of the surveyed water bodies is of local/parish value.

⁴¹ *The Hedgerows Regulations 1997* (1997 No. 1160). London. Her Majesty's Stationery Office. The Hedgerows Regulations 1997 comprise two criteria for determining whether a hedgerow is important or unimportant: Wildlife and Landscape, and Archaeology and History. The Ecology section and the Technical Appendix for hedgerows (Volume 5: Appendix EC-001-002) refer to the Wildlife and Landscape criteria. Therefore it is likely that there will be differences between the total number of important hedgerows in the Ecology and the Cultural Heritage sections of this report.

7.3.19 For the purpose of this assessment and as they are in similar habitat to the ponds that were surveyed, the ponds where access was unavailable are considered to be of up to local/parish value.

Protected and/or notable species

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

Table 8: Protected and/or notable species

Species/ species group	Value	Receptor	Baseline and rationale for valuation
Bats	County/metropolitan	Brown long-eared bat population at Lower Thorpe	Three brown long-eared bat roosts were recorded in separate buildings during field surveys at Lower Thorpe and in adjacent farmland. One of the roosts was considered to be a maternity roost for 1-5 bats (estimated from droppings); the other two are summer/transient roosts (estimated from the low number of droppings; 10-20). Maternity roosts are uncommon and necessary to maintain populations of species over wide areas. The maternity roost and one of the summer/transient roosts are within land required for the construction of the Proposed Scheme. Brown long-eared bat is a species of principal importance. ⁴² Low numbers of brown long-eared bats were recorded foraging and commuting along the disused railway at Lower Thorpe.
	County/metropolitan	Common pipistrelle population at Lower Thorpe	Field surveyed recorded 21 common pipistrelles emerging from a roost in a residential building during field surveys at Lower Thorpe. Given the numbers it is likely to be a maternity roost. A single common pipistrelle was recorded emerging from another building on a farm near Lower Thorpe. The roost is likely to be a transient roost. High numbers of common pipistrelle were recorded foraging and commuting along a disused railway and adjoining watercourses and hedgerows south of Lower Thorpe.
	County/metropolitan	Bat assemblage associated with habitats south of Lower Thorpe	Static monitoring surveys recorded moderate to high activity of soprano pipistrelle and <i>Myotis</i> sp. Unidentified large bats (noctule or serotine) were also recorded in low numbers. All bats were recorded foraging and commuting along the disused railway, hedgerows and watercourses, and around woodland. Soprano pipistrelle and noctule are species of principal importance.
	County/metropolitan	Natterer's bat population associated with habitat at Halse Copse North and Halse Copse South	Field surveys recorded low numbers of Natterer's bats commuting between Halse Copse North LWS and Halse Copse South LWS. The species is relatively scarce in Northamptonshire.
	County/metropolitan	Natterer's bat population near Lower Thorpe	Field surveys recorded the presence of at least one Natterer's bat (estimated from a low numbers of droppings) and the emergence of a single bat from a likely transient roost at Culworth Grounds Farm, near Lower Thorpe. As a

⁴² Natural Environment and Rural Communities Act 2006 (Chapter 16). Her Majesty's Stationery Office, London.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
			<p>scarce species in the county, the small roost will contribute to maintaining its status.</p> <p>Low numbers of Natterer's bats were recorded foraging and commuting south of Lower Thorpe along the edges of woodland and watercourses.</p>
County/metropolitan		Brown long-eared bat population at Greatworth	Two brown long eared-bat roosts were recorded in separate buildings near Greatworth. Both are likely to be maternity roosts. The larger had several hundred droppings and the smaller had over 50 droppings. Maternity roosts are uncommon and necessary to maintain populations of species over wide areas.
County/metropolitan		Bat assemblage associated with a disused railway line to the south-east of Greatworth	Static monitoring surveys recorded low numbers of common pipistrelle, soprano pipistrelle, <i>Myotis</i> sp. and noctule commuting and foraging along the disused railway. The disused railway connects to the wider network of suitable habitat including watercourses, small woods and other unused railways.
County/metropolitan		Bat assemblage associated with foraging habitat at Halse Copse North, Halse Copse South and surrounding hedgerows and watercourses	Static monitoring and transect surveys recorded low to high numbers of at least seven species of bat; common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, serotine, brown long-eared bat, Leisler's bat and noctule, as well as records for unidentified <i>Myotis</i> sp, and Pipistrellus species. The assemblage includes species that are rare ⁴³ and uncommon such as serotine and Nathusius' pipistrelle.
County/metropolitan		Noctule bat population at Fox Covert (Glyn Davies Wood)	Field surveys recorded a maternity roost with a peak count of five bats using a bat box attached to a tree. Maternity roosts are uncommon and necessary to maintain populations of species over wide areas.
Up to county/metropolitan		Possible bat assemblage associated with habitats at Trafford Bridge	Parts of the River Cherwell are bounded by woodland, which together provide suitable habitat for foraging and commuting bats. There are several old farm buildings nearby which have potential to support roosting bats. This habitat corridor has potential to support large numbers of bats of a range of species.
Up to county/metropolitan		Possible bat assemblage associated with habitat north of Aston le Walls	The Highfurlong Brook and the Aston le Walls disused railway are both important landscape features that support optimal habitat for commuting and foraging bats. They are both connected to other habitat corridors and foraging sites. These habitat corridors have the potential to support large numbers of bats of a range of species.
District/borough		Brandt's' bat population at Greatworth	A day roost for a low number of Brandt's bat (estimated to be less than five individuals) was estimated from the small number of droppings recorded. Brandt's bat are uncommon in Northamptonshire, but day roosts are more numerous and less valuable to the viability of the population than maternity or hibernation roosts.

⁴³ Bat Conservation Trust (BCT) (2012), *The state of the UK's bats: National Bat Monitoring Programme Population Trends 2012*, BCT, London.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
	Local/parish	Common pipistrelle population at Fox Covert (Glyn Davies Wood)	A low number of individuals (two to three) were recorded emerging from a summer/transient roost in a tree. Such roosts are common throughout Northamptonshire. Emergence surveys detected low to moderate levels of commuting and foraging activity of common pipistrelle bats in Fox Covert (Glyn Davies Wood).
	Local/parish	Brown long eared bat population at Fox Covert (Glyn Davies Wood)	Emergence surveys detected low to moderate levels of commuting and foraging activity within and around the woodland. No roosts were recorded.
Otter	County/metropolitan	Otter populations using the Culworth Brook	A single active otter holt was recorded at the Culworth Brook near Culworth Grounds Farm. The holt is close to but outside land required for the construction of the Proposed Scheme. Otter is a species of principal importance. These records meet the threshold for county importance ⁴⁴ .
	District/borough	Otter activity associated with the River Cherwell, Highfurlong Brook, Boddington Canal Feeder and several drainage ditches	Otter footprints, feeding remains and spraints were recorded on all watercourses within land required for the construction of the Proposed Scheme. Otters are using the watercourses to forage and move across the area.
Birds	County/metropolitan	Barn owl population east of Greatworth	Two barn owl nest locations were recorded within 1.5km of the Proposed Scheme. The barn owl breeding population is of county significance (more than 1% of the county population) ⁴⁵ .
	County/metropolitan	Barn owl population south-west of Chipping Warden	Two barn owl nest locations were recorded within 1.5km of the Proposed Scheme. The barn owl population meets the threshold for county importance (more than 1% of the county population).
	County/metropolitan	Barn owl population north of Lower Boddington	Six barn owl nest locations were recorded within 1.5km of the Proposed Scheme. The barn owl population meets the threshold for county importance (more than 1% of the county population).
	County/metropolitan	Breeding willow tits in Fox Covert (Glyn Davies Wood)	A pair of breeding willow tit was recorded nesting in the centre of the woodland. As a scarce species in Northamptonshire this population meets the threshold for county importance (more than 1% of the county population).
	County/metropolitan	Breeding tree sparrow near Aston le Walls	One pair of breeding tree sparrow was recorded at Appletree Farm and two pairs at Paradise Farm. As a scarce species in Northamptonshire this population meets the threshold for county importance (more than 1% of the county population). Tree sparrow is a species of principal importance.

⁴⁴ Northamptonshire Biodiversity Partnership (The Wildlife Trusts) 2007 (2010), *Wildlife Site Criteria: Northamptonshire*.

⁴⁵ Jackson, P. (2012), *The Barn Owl in Northamptonshire 2012*. Stoke Bruerne.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
	District/borough	Breeding bird assemblage north of Lower Boddington	Field surveys recorded 54 bird species. Notable species include marsh tit (one breeding territory). Desk study records include firecrest, lesser spotted woodpecker and grasshopper warbler. Lesser spotted woodpecker and grasshopper warbler are species of principal importance.
	District/borough	Breeding bird assemblage south-west of Chipping Warden	Field surveys recorded 67 bird species within this area. Notable species included marsh tit and little grebe breeding territories and a possible kingfisher breeding territory. Desk study records also include red kite, hobby, peregrine and willow tit.
	Local/parish	Breeding bird assemblage south-east of Radstone	Field surveys recorded 49 bird species including non-breeding raven, wheatear and redstart. Desk study records include curlew (a species of principal importance) and teal.
	Local/parish	Breeding bird assemblage south-west of Sulgrave	Field surveys recorded 61 bird species including two confirmed willow warbler breeding territories. Most species recorded are common and widespread, typical of open countryside. Desk study records include little ringed plover, oystercatcher, crossbill, whinchat and nightingale.
	Local/parish	Breeding bird assemblage east of Greatworth	Field surveys recorded 54 bird species. Notable species were grey partridge, a species of principal importance, and one probable kestrel breeding territory. Most species recorded are common and widespread, typical of open countryside. Desk study records include turtle dove.
	Local/parish	Wintering bird assemblage at Greatworth and Lower Boddington	Field surveys recorded 65 bird species. Notable species include raven but no large or significant populations of rare birds were recorded. Desk study records are for common and widespread species, typical of farmland.
Reptiles	County/metropolitan	Adder population near Halse Copse South LWS	Field surveys recorded a single adder, a species of principal importance. Habitat for adder is limited to woodland edge habitat but the species is rare in Northamptonshire. As a precaution it is assumed that these habitats support a breeding population, which meets the criteria for being of county importance ⁴⁶ . There are no desk study records.
	Up to county/metropolitan	Potential common reptile populations near Radstone, Chipping Warden and Aston le Walls	Rough grassland, arable field margins, disused railways and water bodies are frequent through these areas and adder and grass snake have been recorded at other nearby sites. In view of this and as a precaution, it is assumed that sustainable breeding populations of common reptiles may be present. This population may qualify as being of county importance.
	District/borough	Potential of grass snake near Thorpe Mandeville)	Field surveys recorded nine grass snakes, which represents a medium population size class. Grass snake are a species of principal importance.

⁴⁶ Buckinghamshire & Milton Keynes Environmental Records Centre (2009), *Criteria for the Selection of Local Wildlife Site in Berkshire, Buckinghamshire and Oxfordshire*.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
	Local/parish	Welsh Lane (north of Greatworth)	Field surveys recorded one grass snake, which represents a low population size class.
	Local/parish	Land south-west Wormleighton (west of Lower Boddington)	Field surveys recorded one grass snake, which represents a low population size class.
Water vole	Up to county/metropolitan	Potential population at the River Cherwell	Field surveys recorded no evidence but habitat suitable for water vole, a species of principal importance, is present. Desk study results confirm a single record at the River Cherwell from 1997. No mink, a predator of the water vole, have been recorded. As part of the precautionary assessment it is assumed that a population may be present in low numbers. This population could be of county value.
Amphibians	County/metropolitan	Great crested newt metapopulation ⁴⁷ at Thorpe Mandeville	Analysis of field and desk study data identified a metapopulation of great crested newt spread throughout four ponds, near Thorpe Mandeville. With a peak nightly count (for all four ponds) of 16 individuals the metapopulation is of medium population size class. Great crested newt is a species of principal importance.
	County/metropolitan	Great crested newt metapopulation at Culworth Grounds Farm	Analysis of field and desk study data identified a metapopulation at Culworth Grounds Farm of medium population size class, present at two ponds. The peak nightly count (for the two ponds) was 21 individuals.
	County/metropolitan	Great crested newt metapopulation at Chipping Warden Manor	Analysis of field and desk study data identified a metapopulation at Chipping Warden Manor of medium population size class, present within three ponds. The peak nightly count (for the three ponds) was 32 individuals.
	County/metropolitan	Great crested newt to the south-west of the road from Wormleighton to Upper Boddington	Field survey results indicate a medium population size class in a single pond. Peak count of 11 great crested newts.
	Up to county/metropolitan	Potential great crested newt population west of Aston le Walls	There are five ponds within 250m of the land required for the construction of the Proposed Scheme that were not surveyed due to access restrictions. Woodland and grassland suitable for this species during its terrestrial phase are well connected by intact hedgerows. In view of this and as a precaution, it is assumed that all of these ponds support a medium population size class, which could form a metapopulation and qualify as being of county importance.
	District/borough	Great crested newt population at Fox Covert (Glyn Davies Wood)	Field survey results indicate a low population size class in a single pond. Peak count of 10 great crested newts.
Aquatic macro-invertebrates	Up to district/borough	Aquatic invertebrate assemblage at the River Cherwell	No surveys were possible due to access restrictions; however, the river has the potential to support a diverse assemblage of aquatic invertebrates, including notable species.

⁴⁷ A set of local populations within some larger area, where typically migration from one local population to at least some other patches is possible.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
	Local/parish	Aquatic invertebrate assemblages at the Highfurlong Brook and the Boddington Canal Feeder and several drainage ditches	Field surveys recorded a low diversity of common species (freshwater shrimps, mayfly and caddis fly larvae) in the watercourses surveyed. Desk study records support the presence of low species diversity.
Terrestrial invertebrates	District/borough	Notable invertebrate populations at Halse Copse South	Field surveys recorded individuals of two nationally scarce ⁴⁸ beetles associated with wood decay (<i>Ischnomera cyanea</i>) and un-shaded early successional mosaic vegetation (<i>Rhinocyllus conicus</i>). There are also recent records for white-letter hairstreak and purple hairstreak. This exceeds the threshold for local importance but does not meet the threshold for county importance ⁴⁹ .
	District/borough	Notable invertebrate populations at Fox Covert (Glyn Davies Wood)	Single records for the nationally scarce beetle associated with wood decay (<i>Ischnomera cyanea</i>) and a nationally scarce Hymenoptera ⁵⁰ species associated with wood decay (<i>Lasius brunneus</i>) were obtained from field surveys. This exceeds the threshold for local importance but does not meet the threshold for county importance.
	District/borough	Notable beetle populations at Manor Farm, Aston le Walls	A single record for a nationally scarce beetle associated with permanent wet mire (<i>Stenus butrintensis</i>) was recorded. This exceeds the threshold for local importance but does not meet the threshold for county importance.
	District/borough	Notable beetle populations at Culworth Grounds Farm	Single records for a nationally scarce beetle associated with wood decay, (<i>Ischnomera cyanea</i>) were obtained from field surveys. This exceeds the threshold for local significance but does not exceed the threshold for county significance.
Fish	Local/parish	Fish assemblages at River Cherwell, Highfurlong Brook, and Boddington Canal Feeder	Field surveys recorded poor quality fish habitat except at the River Cherwell and Highfurlong Brook where sections of the channel are more natural. Common species were recorded in low densities. Environment Agency data from 2011 identifies the River Cherwell as supporting relatively high densities of fish but low species richness.
Flora	Local/Parish	Corn spurrey near Halse Copse South	No rare or notable species were recorded during field surveys. The only desk study record for this area was corn spurrey, a county scarce arable plant, which was recorded in a field to the south of Halse Copse South LWS. The main distribution for this species in Northamptonshire is in the north of the county.
Badger	Local/parish	Badger populations	Eighteen setts including six main setts, four subsidiary setts, one annex setts and seven outlying setts were recorded within 500m of the Proposed Scheme. Habitat suitable for badgers is present along the route. Badgers are common and widespread in Northamptonshire and the UK and the species is not threatened or vulnerable.

⁴⁸ Nationally scarce is relevant for invertebrates that are recorded in 16-100 hectads (10km squares) but are not included in one of the Red List Categories.

⁴⁹ Colin Plant Associates (2006), *Invertebrates and Ecological Assessment. Unpublished Report to the Institute of Ecology and Environmental Management.*

⁵⁰ The Hymenoptera are one of the largest orders of insects, comprising the sawflies, wasps, bees and ants. There are at least 6,700 species in the British Isles.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
Hazel dormouse	Negligible	Potential populations throughout the area	No dormice were recorded during field surveys and habitat suitable for this species is uncommon. There are no records from this area. Hazel dormice is unlikely to be present.
White-clawed crayfish	Negligible	Potential populations throughout the area	No white-clawed crayfish were recorded during field surveys. A signal crayfish ⁵¹ was recorded in a tributary of the River Cherwell at Thorpe Mandeville. Desk study records from 2008 further confirm the presence of signal crayfish in the River Cherwell at Trafford Bridge. The presence of signal crayfish suggests that white-clawed crayfish are unlikely to be present in the area.

Future baseline

Construction (2017)

- 7.3.21 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-004-000.
- 7.3.22 There are no known proposed developments that will be under construction or operational that are likely to alter the current baseline.

Operation (2026)

- 7.3.23 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:
- viaducts at the River Cherwell, Culworth Brook and at Highfurlong Brook will avoid loss of habitat from these watercourses and associated floodplain habitat;
 - planning the use of land required for construction of the Proposed Scheme to reduce loss of woodland from Halse Copse South LWS;
 - planning the use of land required for the construction of the Proposed Scheme to reduce the loss of woodland south-east of Lower Thorpe;
 - planning the use of land required to store excavated material next to Greatworth Green Tunnel to avoid the loss of Painters Spinney woodland; and

⁵¹ A non-native invasive species that out-competes native white-clawed crayfish and also carries crayfish plague.

- all culverts will be suitably designed, to allow passage for mammals such as badger, otter and water vole, taking into account flood events, or an alternative dry tunnel will be installed.

7.4.2 The assessment also assumes implementation of the measures set out within the draft CoCP (Volume 5: Appendix CT-003-000/1), which includes translocation of protected species where appropriate.

Assessment of impacts and effects

Designated sites

- 7.4.3 Woodland from the southern and western edges at Halse Copse South LWS will be affected. The characteristics of the woodland plant assemblage and the 13.1ha extent of the woodland, of which 6ha is ancient woodland, are important to the integrity of the LWS. Construction of the Greatworth south cutting and the Footpath AN22 accommodation overbridge will remove 1.4ha (11%), of which 0.3ha is ancient woodland and therefore irreplaceable. The majority of habitat removed (approximately 1.1ha) will be from the less botanically rich woodland, which is not ancient. The southern edge of the retained woodland will be next to the 4m deep Greatworth south cutting and thus will be affected by increased light and reduced water retention. These changes could alter the woodland plant assemblage. Although the avoidance and mitigation measures described above have reduced the extent of loss and avoided the most ecologically valuable parts of the wood, these impacts will result in a permanent adverse effect on the integrity of the LWS that is significant at the county/metropolitan level.
- 7.4.4 Parts of Trafford Bridge Marsh LWS will be affected during the construction of the Edgcote viaduct. The extent of the habitats and the assemblage of plants associated with lowland fen and swamp are important to the integrity of the site. The construction of eight pairs of viaduct piers will remove 0.7ha (40%) of the LWS, which comprises fen, swamp and semi-improved neutral grassland. Of this area the piers will permanently occupy 0.04ha (2%) of the LWS, the remaining area will be used for access to the piers and construction for up to two years. Once construction is complete, shading by the viaduct will favour shade tolerant species and change the value of any vegetation that develops beneath it. A reduction in extent, and subsequent change in plant species assemblage due to shading, will result in an adverse effect on site integrity that will be significant at the county/metropolitan level.
- 7.4.5 The central part of the 2.5km long (4.1ha) Aston le Walls Railway Line LWS will be affected. The extent and continuity of the species-rich neutral grassland and scrub is important to the integrity of the site. Approximately 0.6ha (14.5%) of grassland and scrub will be removed during the construction of the Aston le Walls embankment (the southern embankment for the Highfurlong Brook viaduct). The loss of habitat will divide the LWS, fragmenting its habitat. Although the habitat that will be removed comprises relatively species-poor neutral grassland dominated by false oat grass, its loss and the fragmentation will result in an adverse effect on the integrity of the LWS that will be significant at the county/metropolitan level.

- 7.4.6 Species-rich neutral grassland at the Radstone Road Verge LWS will be affected. Retaining the extent of the habitat and its plant assemblage is important to the integrity of the site. The construction of an access track that will service a balancing pond will cause the loss of 0.04ha (9%) of the LWS. Of this loss, 0.01ha (3%) is in this area and 0.03ha (6%) is in the Newton Purcell to Brackley area (CFA14), to the south. Habitat loss of this extent, including the likely removal of plant species for which this site is designated, will result in a permanent adverse effect on the integrity of the LWS that will be significant at the county/metropolitan level.
- 7.4.7 Helmdon Disused Railway SSSI is approximately 300m from land required for construction of the Proposed Scheme and will not be subject to any significant effects in this area.
- 7.4.8 No significant effects above the local/parish level are anticipated on Halse Copse North LWS and although there could be some reduction in flow to Washbrook Spinney LWS and Washbrook Lake LWS, the effect will not be significant

Habitats

- 7.4.9 The loss of 0.3ha (6%) of ancient woodland from Halse Copse South, as described previously will be permanent and irreversible. As habitat that cannot be easily replaced, a loss of this extent will result in an adverse effect on the conservation status of ancient woodland that will be significant at county/metropolitan level.
- 7.4.10 The neutral grassland at Trafford Bridge Marsh LWS will be adversely affected, as described previously for the assessment on the designated site of the same name. Construction will remove part of the grassland and divide the remaining area into two separate blocks, each of which is likely to be 0.3ha in area or less. As part of the precautionary approach the remaining grassland blocks may be smaller than the minimum viable area⁵² required and their nature conservation value is likely to decline. This will result in an adverse effect on the conservation status of the neutral grassland that will be significant at the county/metropolitan level.
- 7.4.11 The fen at Trafford Bridge Marsh LWS will be adversely affected, as previously described for the assessment on the designated site of the same name. For the same reasons given in the assessment of the neutral grassland in Trafford Bridge Marsh, and as part of the precautionary approach these impacts will result in an adverse effect on the conservation status of this fen that will be significant at the county/metropolitan level.
- 7.4.12 Woodland will be lost at various other locations during construction. As woodland is not a common habitat in the arable landscape, its extent is important to its conservation status. A total of 6.3ha of woodland that qualifies as a habitat of principal importance will be removed including 1.4ha from Halse Copse South LWS, 2.0ha from an unnamed woodland near Lower Thorpe, 1.5ha from Fox Covert (Glyn Davies Wood) and 1.0ha from a part of Osierbed Spinney. Even with the avoidance and mitigation measures described above habitat loss of this extent will result in a

⁵² Minimum viable area is the smallest possible size (extent) at which the a habitat can maintain its biological and ecological functions (e.g. being species-rich) and exist without being damaged due to increased vulnerability by external environmental factors.

permanent adverse effect on the conservation status of each woodland that will be significant at district/borough level.

- 7.4.13 Construction of the Thorpe Mandeville cutting will permanently affect wet lowland meadow at Costow Field, near Thorpe Mandeville. The extent and plant assemblage of the rush-pasture are important to its conservation status. The construction of the cutting is likely to reduce base flow to the upper 800m of the Culworth Brook, which is the main watercourse that feeds Costow Field, as described in Section 13, Water resources and flood risk assessment. These changes could favour species adapted to drier soils and thus alter the assemblage of rush-pasture plants resulting in a permanent adverse effect on the conservation status that will be significant at the district/borough level.
- 7.4.14 The area of lowland fen present at Costow Field will also be adversely affected by the reduction in water availability caused by the construction of Thorpe Mandeville cutting. The permanent adverse effects on the conservation status of this habitat will be significant at the district/borough level.
- 7.4.15 Lowland meadow at land lying to the east of Thorpe Mandeville will be affected. The conservation status of this habitat is partly dependant on its extent and plant assemblage being maintained. The construction of the Thorpe Mandeville cutting, Lower Thorpe viaduct, Lower Thorpe south embankment and Lower Thorpe south cutting, as well as the Lower Thorpe viaduct satellite compound will result in the permanent loss of approximately 2.2ha of lowland meadow. Due to the quality of the affected habitat and the extent that is within the land required for the construction of the Proposed Scheme, there will be a permanent adverse effect on the conservation status that will be significant at the district/borough level.
- 7.4.16 Fifty-five important hedgerows will be affected. The extent of hedgerows and the high proportion of important hedgerows are key to the conservation status of this habitat, as is the continuity of the network as a wildlife corridor. Much of the loss is in the south of this area, between Radstone (in the Newton Purcell to Brackley area, CFA14) and Thorpe Mandeville, where they will be removed for the construction of the Brackley north cutting, the Greatworth south cutting, the Greatworth green tunnel and the Thorpe Mandeville cutting. Further north, hedgerows will be removed for the construction of landscape earthworks near Lower Boddington. During construction at least 18km of important hedgerow will be lost. Habitat loss and of this extent and fragmentation of the network will result in a permanent adverse effect on the conservation status of hedgerows that will be significant at the district/borough level.
- 7.4.17 No significant effects are expected on the grassland within the Radstone Road Verge LWS. Despite the reduction in extent as described for the LWS previously, over 90% of the species-rich neutral grassland will remain unaffected. Therefore there no significant effect on the conservation status of the habitat is expected.
- 7.4.18 No significant effects are expected on the species poor neutral grassland at the Aston le Walls LWS. The limited reduction in extent is unlikely to permanently adversely affect the conservation status.

7.4.19 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 Appendix EC-005-002 in Volume 5.

Species

- 7.4.20 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.
- 7.4.21 Construction will affect a population of brown long-eared bats near Greatworth. The construction of the Greatworth green tunnel will require the demolition of a building in which the bats have one of the two maternity roosts that were recorded near Greatworth. The second brown long-eared maternity roost near Greatworth will remain unaffected but as maternity roosts are essential to the breeding success of the species this loss will result in a permanent adverse effect on conservation status of the species that will be significant at the county/metropolitan level.
- 7.4.22 Construction will affect the population of noctule bats that utilise a tree as a maternity roost at Fox Covert (Glyn Davies Wood). Construction of the Boddington cutting will result in the removal of the roost and much of the surrounding woodland. As maternity roosts are essential to the breeding success of this species the loss of the roost will result in a permanent adverse effect on their conservation status that will be significant at the county/metropolitan level.
- 7.4.23 No significant effects are expected on the bats that utilise Culworth Grounds Farm or other building near Lower Thorpe. The brown long-eared bat maternity roost and transient roosts, the common pipistrelle bat roosts (one of which is likely to be a maternity roost) and the Natterer's bat transient roost will be retained. As some bats, particularly brown long-eared bats, are susceptible to the effects of fragmentation the loss of habitat from the land required for the construction of the Proposed Scheme is likely to reduce the frequency with which the bats fly west but will not create a complete barrier to dispersal as some sections of the construction corridor will remain sufficiently narrow (up to 40m wide) for most species to cross if needed. These bat populations and the assemblage of other bat species that is associated with habitats around Lower Thorpe will continue to commute along the disused railway, watercourses, and forage within the farmland and woodland to the east.
- 7.4.24 No significant effects are expected on the day roost that is utilised by a low number of Brandt's bats near Greatworth. The roost will be retained and the bat population is likely to disperse to, and forage within habitat in the remaining eastern stretch of the disused railway, the nearby watercourses and Washbrook Spinney and surrounding woodland.
- 7.4.25 Losses of other habitat within the land required for the construction of the Proposed Scheme may require some bats to travel further, and expend more energy during day to day foraging and movement throughout their home range for the duration of

construction. However, such effects alone are for all species considered unlikely to result in sufficient disturbance of the populations concerned to result in an adverse effect on their conservation status.

- 7.4.26 No significant effects are expected on the assemblage of at least seven species of bat or the Natterer's bat population that forage and commute near Halse Copse South and Halse Copse North. Approximately 1km of woodland edge and approximately 2ha of grassland to the south and west of the Halse Copse South will be removed due to the construction of Greatworth south cutting. This mosaic of habitat is an optimal foraging resource for these bats, however, it is likely that all component species will continue to forage around the retained habitat as well as disperse to, and forage within the abundant surrounding habitats.
- 7.4.27 No significant effects are expected on the assemblage of bats (common pipistrelle, noctule, soprano pipistrelle and *Myotis* sp.) that are associated with the disused railway at Greatworth. The assemblage is likely to disperse to, and forage within habitat in the remaining eastern stretch of the disused railway, the nearby watercourses and Washbrook Spinney and surrounding woodland.
- 7.4.28 No significant effects are expected on the bat assemblages that are likely to be present along the disused railway and watercourses near Aston le Walls and along the River Cherwell and adjacent habitats at Trafford Bridge. Construction will remove a small proportion of the available foraging habitat but any effects due to habitat fragmentation will be reduced to a level that is not significant by the abundance of alternative commuting and foraging sites at both locations.
- 7.4.29 A single otter holt near Culworth Grounds Farm is approximately 100m from land required for construction of the Proposed Scheme. The population of otter will be affected during the construction of the Lower Thorpe viaduct and adjacent Lower Thorpe south embankments and cuttings. The presence of suitable habitat (good water quality, marginal vegetation and shelter/resting places), food sources, and an absence of disturbance are key to the conservation status of this species. Water-margin vegetation will be removed from Culworth Brook and light and noise disturbance will increase in the wider area during construction of the viaduct (up to two years). These impacts will isolate the active holt, which as a precaution is assumed to be a breeding holt and, therefore, fragment the breeding territory. This disturbance of otter will result in a temporary adverse effect on the conservation status of otters that will be significant at the county/metropolitan level.
- 7.4.30 No significant effects are expected on potential otter populations on other watercourses during the construction of the Edgcote viaduct and Highfurlong Brook viaduct or any culverts. Only small areas of water-margin vegetation will be removed, extensive areas of habitat suitable for breeding and foraging will remain unaffected throughout the wider area and the likely increases in disturbance are unlikely to stop all movement across the area.
- 7.4.31 Construction of the Greatworth south cutting will affect adders at Halse Copse South LWS where woodland edge and grassland will be lost. The extent and continuity of foraging and sheltering habitat is important to the conservation status of a viable

population. Approximately 1km of woodland edge and approximately 2ha of grassland to the south and west of the Halse Copse South LWS will be removed, which, given the overall heavily managed arable landscape, is likely to be a significant proportion of locally available habitat. A loss of this extent will result in a permanent adverse effect on the conservation status of this species that will be significant at the county/metropolitan level.

- 7.4.32 Construction activities throughout this area will remove habitat suitable for other widespread reptiles (grass snake, common lizard and slow worm). The conservation status of these species depends on maintaining the size of populations and the connectivity between them. Habitat removal and fragmentation will have a permanent adverse effect on the conservation status of these species at up to the county/metropolitan level.
- 7.4.33 The loss of habitat is unlikely to result in any significant effects on the population of grass snake near Thorpe Mandeville due to the abundance of suitable habitat in the surrounding area.
- 7.4.34 The Edgcote viaduct will cross habitat that may be used by water vole. Vegetation clearance would remove habitat suitable for foraging and sheltering. As part of the precautionary assessment, it is assumed that loss of these habitats would result in a permanent adverse effect on conservation status that is significant up to the county/metropolitan level.
- 7.4.35 Breeding ponds for great crested newts will be removed during construction. Maintaining the extent of and connectivity between ponds suitable for breeding adjacent to terrestrial vegetation that provides foraging opportunities and features for hibernating is important to the conservation status of this species. Likely impacts include:
- loss of one pond used great crested newts and all terrestrial habitat at land south-west of the road between Upper Boddington and Wormleighton;
 - loss of a potential breeding pond and a small extent of terrestrial habitat to the west of Aston le Walls; and
 - loss of one breeding pond and half of the surrounding woodland from Fox Covert (Glyn Davies Wood), which forms a large part of the locally available terrestrial habitat.
- 7.4.36 The reduction in habitat available for breeding, foraging and hibernating at these locations will reduce the viability of each breeding metapopulation. It is therefore assumed that losses of this extent will result in a permanent adverse effect on the conservation status of the great crested newt population present between Upper Boddington and Wormleighton and the population to the west of Aston le Walls. The effects will be significant at up to the county/metropolitan level. The impacts will also result in a permanent adverse effect on the conservation status of the great crested newt population at Fox Covert (Glyn Davies Wood) that will be significant at the district/borough level.

- 7.4.37 Construction of a cutting and two embankments at Lower Thorpe may result in impacts to great crested newts at Culworth Grounds Farm. One breeding pond will be lost and the removal of a small extent of terrestrial habitat will isolate the remaining single pond from the majority of the retained foraging habitat near Thorpe Mandeville. While alone these impacts may not be significant, in combination, they would limit foraging opportunities and fragment movement corridors thereby affecting the viability of the breeding population. Such impacts are likely to result in a permanent adverse effect on the conservation status of this great crested newt metapopulation that will be significant at the county/metropolitan level.
- 7.4.38 No significant effects are expected on the conservation status of the great crested newt metapopulations at Thorpe Mandeville and Chipping Warden Manor, due to the minor loss of habitat and the distance between them and the main construction works.
- 7.4.39 A barn owl nesting site will be removed during the construction of the Chipping Warden green tunnel. Nesting sites are reused annually and are therefore important to the conservation status of this species. Much of the surrounding habitat suitable for foraging will also be removed. The loss of this individual nesting site will result in a permanent adverse effect on its conservation status that is significant at the district/borough level⁵³. It is unlikely that the other territories will be subject to any more than minor temporary disturbance.
- 7.4.40 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-005-002.

Other mitigation measures

- 7.4.41 This section describes and assesses additional elements designed to reduce or compensate for significant ecological effects. These include habitat creation, linking existing habitats, and providing crossing points to enable bats to cross the Proposed Scheme.
- 7.4.42 There are seven ecological compensation areas in the Greatworth to Lower Boddington area, these are:
- an area of lowland mixed deciduous woodland and lowland meadow grassland (both habitats of principal importance) in an area of approximately 9.0ha to connect Halse Copse South LWS with Halse Copse North LWS;
 - an area of lowland meadow to the east of Thorpe Mandeville (approximately 4.0ha);
 - an area of open water and wet grassland north-east of Thorpe Mandeville and south-east of Lower Thorpe Farm (approximately 3.0ha);

⁵³ A single breeding pair of barn owl, which alone represents less than 1% of the county population will not meet the criteria for being of county importance but as a scarce and vulnerable species is greater than local importance. The impact is therefore of district/borough value.

- an area of lowland meadow with lowland broadleaved woodland with ponds west of Culworth Grounds Farm (approximately 4.0ha);
- two areas of fen and wet grassland around Trafford Bridge Marsh LWS (approximately 2.5ha);
- an area of lowland meadow with scattered trees and ponds west of Aston le Walls (approximately 0.5ha); and
- an extension to Fox Covert (Glyn Davis Wood), which will comprise grassland with ponds and scattered trees (approximately 6.0ha, 1.0ha of which is lowland mixed deciduous woodland) near the Northamptonshire-Warwickshire border.

7.4.43 Other habitat that will be created primarily for landscape screening or compensation and will provide ecological benefits, for example foraging and sheltering opportunities for wildlife.

7.4.44 The loss of 1.4ha of woodland from Halse Copse South LWS will be compensated through the creation of the ecological compensation area between Halse Copse South and Halse Copse North. The site will comprise of 6.5ha of lowland mixed deciduous woodland, which will be interspersed with 2.5ha of lowland meadow. Until maturation (up to 50 years) there will be a temporary adverse effect on secondary woodland. Following the implementation of these measures any adverse impacts on Halse Copse South LWS will be reduced to a level at which that will not result in a significant permanent adverse effect on the integrity of this site.

7.4.45 Ancient woodland is irreplaceable. However, the loss of 0.3ha of ancient woodland from Halse Copse South LWS will be compensated through a range of measures. Ancient woodland soil with its associated seed bank will be salvaged and translocated to the ecological compensation area between Halse Copse South and Halse Copse North and planted with broadleaved trees so as to increase the extent of woodland and increase connectivity across the landscape. 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 will be undertaken in accordance with the ecological principles of mitigation (Volume 5: Appendix CT-001-000/2). While not fully replicating the ancient woodland that will be lost, the large increase in woodland extent will maintain the conservation status of woodland in the area, and when mature it will result in a separate beneficial effect that is significant at the district/borough level.

7.4.46 Loss of 0.7ha of fen, swamp and semi-improved grassland from Trafford Bridge Marsh LWS will be compensated for by providing two areas of fen and wet grassland within the ecological compensation area next to the site (approximately 2.5ha). These are on the floodplain of the River Cherwell and are therefore suitable for habitat creation of wetland habitat. This will reduce the effect of habitat loss to a temporary adverse effect lasting until the replacement habitat becomes established. Following maturity, the compensation planting would reduce effects on the integrity of Trafford Bridge Marsh LWS to a level that is not significant.

- 7.4.47 The habitat loss and associated fragmentation at Aston le Walls Railway Line LWS caused by construction of the Aston le Walls embankment will be mitigated for and compensated by planting a linear strip of grassland with scrub with scattered trees (between 25 – 100m wide and 3.4ha in size) over the northern portal of the Chipping Warden green tunnel. Part of the new habitat will be in land required for the construction of the Proposed Scheme so will be planted after construction. Once established this will reduce the effect to a level that is not significant on the integrity of this site.
- 7.4.48 Habitat loss of approximately 0.04ha from the Radstone Road Verge LWS will be compensated for by providing species-rich grassland along the eastern end of the access road and therefore adjacent to the LWS, and approximately 2.6ha of species-rich grassland close to Halse Copse South LWS. In combination, these measures will reduce the effect of habitat loss to a temporary adverse effect lasting until the replacement grassland becomes established (at least five years). Following the implementation of the measures proposed the adverse impacts on Radstone Road Verge LWS will be reduced to a level at that will not result in any significant permanent effects on the integrity of this site.
- 7.4.49 The compensation for the loss of woodland, including ancient woodland, from Halse Copse South has been described as part of the compensation for the loss of habitat from the LWS of the same name.
- 7.4.50 Loss of woodland from Fox Covert (Glyn Davies Wood) will be compensated for by the creation of lowland mixed deciduous woodland in the ecological compensation area adjacent to the remaining woodland, as well as large areas of additional planting within the Ladbroke and Southam area (CFA16).
- 7.4.51 Compensation for the loss of woodland close to the River Cherwell, including part of Osierbed Spinney, will be achieved by creating woodland within the ecological compensation areas and with the additional landscape planting, which will create approximately 8ha of new woodland near the Edgcote viaduct. This will form part of a mosaic of newly created habitat at Trafford Bridge. Extensive areas of landscape woodland creation elsewhere between Greatworth to Lower Boddington are situated either side of the Lower Thorpe north and south cutting and at the northern end of the Edgcote cutting. Following maturity, the compensation planting will reduce effects on woodland to a level that is not significant.
- 7.4.52 Lowland meadow that will be lost from fields to the east of Thorpe Mandeville will be compensated for by the creation of new habitat within the ecological compensation area in the same area. In accordance with the ecological principles of mitigation as set out in the Volume 5: Appendix CT-001-000/2, the seedbank of the grassland that will be lost will be translocated to the receptor site to help the establishment of the new grassland sward. Where reasonably practicable, areas of the lowland meadow that will be temporarily used will be returned to grassland after construction. After five to ten years when the replacement habitat has become established, the adverse effects on the conservation status of lowland meadow at Thorpe Mandeville will be reduced to a level which is not significant.

- 7.4.53 Compensation for the loss of habitat due to a reduction in water flows at Costow Field will include the creation of wet lowland meadow and fen at the ecological compensation area north-east of Thorpe Mandeville and near Trafford Bridge Marsh LWS (as previously described). After five to ten years when the replacement habitat has become established, the adverse effects on the conservation status of this wet lowland meadow and fen will be reduced to a level which is not significant.
- 7.4.54 New hedgerows connected to existing habitat within the landscape will be created to compensate for the losses of wildlife corridors that hedgerows provide. The hedgerow replanting will be in accordance with the principles of mitigation (Appendix 5: CT-001-000/2). The species composition of the new hedges will take account of both the hedgerows lost and those that remain in the surrounding area. Following maturation of the planting any adverse impacts on hedgerows and the wildlife corridors they provide are expected to be reduced so that effects on conservation status are not significant.
- 7.4.55 Bat roosts to compensate for the loss of the brown long-eared bat maternity roost at Greatworth Park and the noctule bat maternity roost at Fox Covert (Glyn Davies Wood) will be provided in accordance with the ecological principles of mitigation (Volume 5: Appendix CT-001-000/2). The former will be created in either the ecological compensation area to the north of the disused railway near Lower Thorpe or in the compensation area at Halse Copse South LWS. The latter will be created in the ecological mitigation area adjacent to Fox Covert (Glyn Davies Wood). The compensatory roosts will be created prior to the loss of habitat. Following the implementation of the measures proposed it is anticipated that any adverse impacts on these populations of bats during construction of the Proposed Scheme will be reduced so the effects on their conservation status are not significant.
- 7.4.56 Although no significant effects on the conservation status of any other bat populations or assemblages are expected, measures will be undertaken to maintain habitat continuity across and along the route. The measures will be undertaken in accordance with the ecological principles of mitigation as set out in Volume 5: Appendix CT-001-000/2. These are:
- planting on the embankments of the new Footpath AN22 accommodation overbridge adjacent to Halse Copse South LWS, the Helmdon Road overbridge, the Culworth Grounds accommodation overbridge and the Banbury Road overbridge to encourage bats to cross the route, particularly the species that are susceptible to fragmentation such as the brown long-eared bat;
 - after construction, habitat fragmentation of the disused railway at Lower Thorpe and adjacent woodland and watercourses will be restored by planting along both sides of the Thorpe Mandeville cutting and Thorpe Mandeville embankment. This will re-connect fragmented habitats and provide a corridor along which bats can fly to reach foraging sites and a crossing point at the Lower Thorpe viaduct;

- the fragmentation of flight lines along the disused railway at Thorpe Mandeville will also be addressed by tree, scrub and grassland planting on the embankments of the Culworth Grounds accommodation overbridge, and on adjacent land. This will link the two separated parts of the disused railway and encourage bats to fly at height over the Proposed Scheme;
- the creation of habitat along the banks of the realigned sections of the River Cherwell and Highfurlong Brook to restore the connectivity of this flight line used by bats; and
- planting from the Aston le Walls disused railway over the top of the northern portal of the Chipping Warden green tunnel to reinstate linear flight line used by bats.

7.4.57 These measures are in addition to the creation of new woodland, grassland and water bodies within the ecological compensation areas, as described previously, which are likely to provide additional habitat continuity and foraging opportunities.

7.4.58 Measures including the provision of temporary habitat corridors to maintain important movement corridors for otter will be provided during the construction of the Lower Thorpe viaduct and adjacent Lower Thorpe south embankments and cuttings. These will enable otters to continue to use the potential breeding holt and reach foraging habitat along the Culworth Brook during the approximately 18 month construction period. All measures will be provided in accordance with the ecological principles of mitigation as set out in Volume 5: Appendix CT-001-000/2. Following the implementation of the measures proposed it is likely that any effects on the otter population will be reduced to a level that will not be significant on its conservation status.

7.4.59 Compensatory habitat to address impacts on adder at Halse Copse South LWS will be provided by the creation of suitable grassland and scrub habitat amongst new woodland in the ecological compensation area between Halse Copse South LWS and Halse Copse North LWS. In accordance with the ecological principles of mitigation (Volume 5: Appendix CT-001-000/2) where it is not reasonably practicable to retain adders in situ, they will be translocated prior to commencement of works. With the implementation of these measures it is likely that the effects will be reduced to a level that will not be significant.

7.4.60 The other ecological compensation areas (as previously described) will provide suitable habitat for any small populations of common reptile that would be disturbed (if present) and will compensate for the loss of any associated habitat. Following the implementation of the measures proposed it is expected that any adverse impacts on reptiles will be reduced to a level that will not result in a significant effect on the conservation status of the populations concerned.

7.4.61 The planting that will be undertaken along the diverted sections of the River Cherwell near the Edgcote viaduct, will provide compensatory habitat for water vole, if they are present. All planting will be designed and implemented in accordance with the principles of mitigation (Volume 5: Appendix CT-001-000/2) and will ensure the conservation status of the population is not adversely affected.

7.4.62 Compensatory habitat to address impacts on great crested newt populations will be provided where breeding ponds and terrestrial habitat are lost and in accordance with the principles of mitigation (Volume 5: Appendix CT-001-000/2). This includes:

- compensation for the loss of one breeding pond from land south-west of the road between Upper Boddington and Wormleighton by creating new habitat in the ecological compensation area west of Culworth Grounds Farm. The site will provide approximately 4ha of habitat suitable for breeding, foraging and hibernating great crested newts;
- compensation for the loss of one breeding pond and terrestrial habitat from Culworth Grounds Farm by creating new lowland meadow with ponds in the ecological compensation area west of Culworth Grounds Farm;
- compensation for the loss of one breeding pond and terrestrial habitat from Fox Covert (Glyn Davies Wood) by creating new habitat in the ecological compensation area adjacent to Fox Covert (Glyn Davis Wood); and
- compensation for the loss of a breeding pond and small extent of terrestrial habitat west of Aston le Walls by creating new habitat in the ecological compensation areas west of Aston le Walls LWS.

7.4.63 Following the implementation of the measures proposed it is expected that any adverse impacts on the great crested newt populations will be reduced to a level that will not result in a significant effect on the conservation status of the populations concerned.

7.4.64 There will be an adverse effect on the conservation status of barn owl at the district/borough level due to loss of a breeding territory. 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 1.5km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

Summary of likely residual significant effects

7.4.65 The mitigation, compensation and enhancement measures described will reduce the effects to a level that is not significant, except for the following:

- the permanent loss of 0.3ha of ancient woodland from Halse Copse South LWS, which is irreplaceable;
- when mature, there will be a separate beneficial increase in the extent of semi-natural broadleaved woodland between Halse Copse South and Halse Copse North; and
- the permanent loss of one barn owl territory represents a residual significant effect. However, if the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that is not significant.

7.5 Effects arising from operation

Avoidance and mitigation measures

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

- Greatworth green tunnel and Chipping Warden green tunnel provide habitat connectivity across the route of the Proposed Scheme;
- creation of planted embankments either side of road, footpath and access crossing points will encourage bats to fly at a safe height over the Proposed Scheme and reduce the risk of train strike, particularly at the Footpath AN22 accommodation overbridge, Culworth Grounds accommodation overbridge, Buckingham Road overbridge, the planted link at Aston le Walls Disused Railway LWS and the Banbury Road overbridge;
- the clearance of vegetation where the disused railway at Thorpe Mandeville crosses the Proposed Scheme to encourage bats to use the alternative crossing point, thus reducing the risk of collision or injury to bats;
- the clearance of vegetation from where the Aston le Walls disused railway crosses the Proposed Scheme to encourage bats to use the new planting over the top of the northern portal of the Chipping Warden green tunnel and thus reducing the risk of collision or injury to bats; and
- the Lower Thorpe viaduct, Edgcote viaduct and Highfurlong Brook viaduct will allow bats and other animals to safely pass under the Proposed Scheme.

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 populations concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat populations and/or assemblages concerned in determining the likely effects of the Proposed Scheme on each of these receptors.

7.5.3 Noise, vibration and lighting from passing trains have the potential to disturb bat species foraging and commuting within habitats close to the Proposed Scheme. Understanding of the impact of noise on bats caused by passing trains is limited. There is some evidence to suggest that gleaning bats, such as brown long-eared, will have reduced foraging success within areas where there is persistent noise from busy roads. However, noise generated from passing trains will be regular but temporary and as such will differ from that resulting from a busy road.

7.5.4 Due to the large areas over which bats forage it is likely that any loss of, or displacement from, suitable foraging habitat in the vicinity of the Proposed Scheme would in itself amount to only a small proportion of the wider available resource. However, the impact of any such disturbance or displacement could be greatly

increased if bats are hampered in moving between breeding sites, hibernation sites and other roosts which they commonly utilise.

- 7.5.5 Where the route of the Proposed Scheme bisects, or is located in close proximity to existing features known to be utilised regularly by foraging or commuting bats, there is an increased risk that bats could be killed or injured as a result of collisions with passing trains or associated turbulence. The significance of any such effect will be dependent on both the flight habitat of the species or species concerned and the vertical alignment of the Proposed Scheme (i.e. is the railway in cutting, on embankment, on a viaduct, or at grade) at the point the impact occurs.
- 7.5.6 The risk of bat colliding with or being injured by trains is greatest where the level of bat activity was highest and where habitats that are optimum for commuting or foraging are crossed. The provision of the crossing points described within the avoidance and mitigation measures section previously will encourage bats to fly at a safe height over the Proposed Scheme or under it, thus reducing the risk of train strike. These measures are likely to be particularly important near the woodland edge habitat and watercourses near Halse Copse North and Halse Copse South; along the disused railways and network of hedgerows near Greatworth, Thorpe Mandeville and Lower Thorpe; the River Cherwell; and the wet grassland near Trafford Bridge; and along Aston le Walls disused railway and nearby Highfurlong Brook. The measures will provide increased habitat connectivity across the area and reduce the impacts to a level that will not result in a significant adverse effect on the conservation status of the bat populations and assemblages present.
- 7.5.7 The noise made by passing trains has the potential to disturb birds within habitats close to the Proposed Scheme. Birds habituate to loud noises that they hear regularly and frequently, and hence it is considered that this will not generally cause significant effects. There is some evidence to suggest that breeding bird densities can be reduced where there is persistent noise from busy roads, due to birds being unable to hear each-others songs. However, this is not expected to occur with the Proposed Scheme as the trains will pass any one point quickly. The effect of train noise on breeding birds is therefore considered not significant.
- 7.5.8 The majority of bird species that are known to be present in the area are not considered to be particularly vulnerable to collision with trains. However, barn owls are often killed by cars and trains. This is because they hunt low over the rough grassland habitats that are associated with road verges and railway embankments and are slow moving. Evidence suggests that such mortality is likely to result in the loss of all breeding populations of barn owls within 1.5km of the Proposed Scheme.
- 7.5.9 The land required for the operation of the Proposed Scheme in this area includes wide cuttings and embankments that will be colonised by vegetation that may be suitable for foraging barn owl, and may therefore increase their risk of mortality from contact with trains. It is likely that two breeding pairs that nest east of Greatworth will continue to access foraging sites on both sides of the route, thus increasing the risk of colliding with or being injured by a passing train. The mortality of barn owl will result in a permanent adverse effect on the conservation status of this species at the county/metropolitan level.

- 7.5.10 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-005-002.

Other mitigation measures

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

Summary of likely residual significant effects

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

8 Land quality

8.1 Introduction

- 8.1.1 This section presents the baseline conditions that exist along the Proposed Scheme in relation to land quality and reports the likely impacts and any significant effects resulting from construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, either from a scientific, mining or mineral resources point of view including: geological sites of special scientific interest (SSSI), local geological sites (LGS), areas of current underground or opencast mining and areas of designated mineral resources. Mitigation measures are presented and any residual effects are summarised.
- 8.1.2 Potentially contaminated areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (for example, contaminated soils may need to be removed or the construction may alter existing contamination pathways). Each of these areas has been studied to evaluate the scale of potential impacts caused by existing contamination (if present) and what needs to be done to avoid significant consequences to people and the wider environment. In addition, a review has been undertaken to establish whether the operation of the Proposed Scheme will lead to contamination of its surrounding environment and what needs to be done to prevent such contamination.
- 8.1.3 The main environmental features of this area include the River Cherwell; three dismantled railway lines crossing the route west of Greatworth Hall, north-west of Lower Thorpe, and west of Aston le Walls; and the principal aquifers of the Blisworth Limestone and Taynton Limestone Formations which underlie the study area.
- 8.1.4 The main land quality issues in this area include:
- historical quarrying in the area of Lower Thorpe, Trafford Bridge and Culworth Road;
 - former military land (RAF Chipping Warden Airfield and RAF Greatworth Wireless Transmission Station); and
 - four areas of sand and gravel resources that have been identified by Northamptonshire County Council as Mineral Safeguarding Areas – one underlies the route and the other three partially encroach onto land required to construct the Proposed Scheme.
- 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-001-015: 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. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3: Section 16.

- 8.1.7 Engagement has been undertaken with South Northamptonshire Council, the Environment Agency and the Ministry of Defence (MoD) regarding contaminated land, and Northamptonshire County Council with regards to mineral policy. To date, information has been received from Northamptonshire County Council on mineral extraction and Mineral Safeguarding Areas and from South Northamptonshire Council on land contamination.

8.2 Scope, assumptions and limitations

- 8.2.1 The assessment scope, key assumptions and limitations for the land quality assessment are set out in Volume 1 and in the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This section follows the standard assessment methodology.
- 8.2.2 Baseline data were reviewed for the area of land required to construct the Proposed Scheme excluding utility works on the highway together with a buffer extending out for a minimum of 250m, but in the case of groundwater data up to 1km. This is defined as the study area.
- 8.2.3 Familiarisation visits to the study area were made in July 2012 where the location of the Proposed Scheme was viewed from points of public access only. Due to access constraints not all sites considered to have the greatest potential for contamination were visited. However, the purpose of site visits is to verify desktop information and the lack of complete site walkovers is considered unlikely to have substantially affected the land quality assessment. Site visit notes are presented in Volume 5: Appendices LQ-001-015.

8.3 Environmental baseline

Existing baseline

- 8.3.1 Unless otherwise stated, all features described in this section are presented in Map Series LQ-001-035 to LQ-01-041 (Volume 5, Land Quality Map Book).

Geology

- 8.3.2 This section describes the underlying ground conditions within the study area. It first describes any made ground present, followed by near surface superficial deposits and lastly describes the deeper bedrock geology. The geological mapping is illustrated on Map WR-02-015 (Volume 5, Water Resources and Flood Assessment Map Book).
- 8.3.3 There may also be pockets of made ground within potentially in-filled pits within the study area. These include areas of historical quarrying in the vicinity of Lower Thorpe (Map LQ-01-037, grid reference C7, Volume 5, Land Quality Map Book), Trafford Bridge (Map LQ-01-038, grid reference C6 and D6, Volume 5, Land Quality Map Book) and Culworth Road (Map LQ-01-39, grid reference H6, Volume 5, Land Quality Map Book).

- 8.3.4 A shallow cover of track-bed material or made ground may be present within the area of land required for the Proposed Scheme where it crosses the dismantled railway lines.
- 8.3.5 Superficial deposits across the southern section of the route consist of glacial till. They are absent from the majority of the remainder of the route, with the exception of localised alluvium associated with the River Cherwell and Highfurlong Brook.
- 8.3.6 From Greatworth to Lower Boddington, the route is underlain by bedrock geology of the following formations, which outcrop progressively along the route from south to north:
- Blisworth Limestone Formation, described as limestone of the Great Oolite Group;
 - Rutland Formation, described as mudstone of the Great Oolite Group;
 - Taynton Limestone Formation, described as ooidal limestone of the Great Oolite Group;
 - Horsehay Sand Formation, described as sandstone of the Great Oolite Group;
 - Northampton Sand Formation, described as sandstone, limestone and ironstone of the Inferior Oolite Group;
 - Whitby Mudstone Formation, described as mudstone of the Lias Group;
 - Marlstone Rock Formation, described as ferruginous limestone and ironstone of the Lias Group;
 - Dyrham Formation, described as interbedded siltstone and mudstone of the Lias Group; and
 - Charmouth Mudstone Formation, described as mudstone of the Lias Group.

Groundwater

- 8.3.7 In this route section, two limestone formations have been designated as principal aquifers (Blisworth Limestone and Taynton Limestone Formations). The remaining limestone, sandstone (Horsehay Sand, Northampton Sand and Marlstone Rock Formations) and alluvium have been designated as Secondary A aquifers. The Rutland Formation has been designated as a Secondary B aquifer and the Dyrham Formation has been designated as Secondary (undifferentiated). The Whitby and Charmouth Mudstones and glacial till have been designated as unproductive.
- 8.3.8 No groundwater Source Protection Zones (SPZs) are present in the study area.
- 8.3.9 A search for groundwater abstractions confirmed that the Environment Agency reports ten licensed abstractions and seven unlicensed abstractions within the area.
- 8.3.10 Further detail on the groundwater beneath the Proposed Scheme can be found in Section 13 Water resources and flood risk assessment.

Surface waters

- 8.3.11 The route crosses the River Cherwell at Trafford Bridge, and Highfurlong Brook to the west of Aston le Walls.
- 8.3.12 There are two large ponds at Lower Thorpe Farm. There are also a number of smaller ponds and streams along the route in this study area.
- 8.3.13 There is one surface water abstraction within this study area. Further information on surface waters is provided in Section 13.

Current and historical land use

- 8.3.14 Current potentially contaminative land uses include sewage works east of Thorpe Mandeville (Volume 5: Appendix LQ-01-015 and Map LQ-01-037, grid reference E7, Volume 5, Land Quality Map Book).
- 8.3.15 Historical potentially contaminative land uses are shown on Map Series LQ-01 (Volume 5, Land Quality Map Book) and listed in Volume 5: Appendix LQ-01-015, and include:
- historical quarrying in the area of Lower Thorpe (Map LQ-01-037, grid reference C7), Trafford Bridge (Map LQ-01-038, grid reference C6 and D6) and Culworth Road (Map LQ-01-39, grid reference H6) (all maps are within Volume 5, Land Quality Map Book);
 - former military land (former RAF Chipping Warden Airfield) (Map LQ-01-039, centred on grid reference D6, Volume 5, Land Quality Map Book);
 - former RAF Greatworth Wireless Transmission Station (Map LQ-01-036, centred on grid reference B8, Volume 5, Land Quality Map Book);
 - tanks at Blackgrounds Farm (Map LQ-01-038, grid reference B6, Volume 5, Land Quality Map Book); and
 - disused railway west of Greatworth Hall (Map LQ-01-036, centred on grid reference E7, Volume 5, Land Quality Map Book).
- 8.3.16 Contaminants commonly associated with these uses could include metals, semi-metals, asbestos, organic and inorganic chemicals, and radiological substances associated with military uses. In addition, there may be pathogens associated with the sewage works.

Other regulatory data

- 8.3.17 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). No significant data were noted.

Mining/mineral resources

- 8.3.18 Policy CS7 of Northamptonshire Minerals and Waste Development Framework Core Strategy (2010)⁵⁴ states that new built development should seek to utilise the efficient use of resources in both its construction and its operation.
- 8.3.19 There are four Mineral Safeguarding Areas within the study area. These are all designated by Northamptonshire County Council for sand and gravel resources. They are located:
- at the southern end of the route section, north of Radstone;
 - at Halse Copse;
 - in the vicinity of Trafford Bridge; and
 - south of Chipping Warden.
- 8.3.20 Five Britpit (British Pits) locations have been identified by BGS. These are likely to have been used historically for abstraction of minerals. There are located at Greatworth, Culworth Grounds, Danesmoor Spinney, Culworth Mill and Jobs Hill Sand Pit. No other mining or quarrying activities have been identified in the area. All the pits are classified by BGS as having 'pit status C' (a site which, at date of entry, has ceased to extract minerals).
- 8.3.21 The BGS has identified the presence of deep coal resources north of Greatworth and Thorpe Mandeville. These increase in depth from approximately 200m in the south to 600m in the north.
- 8.3.22 There are no mining or mineral sites in this part of the Proposed Scheme that are currently being worked or that have planning permission.

Geo-conservation resources

- 8.3.23 There are no geological conservation resources identified within the study area.

Receptors

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

⁵⁴ Northamptonshire County Council (2010), *Northamptonshire Minerals and Waste Development Framework Core Strategy Development Plan Document*.

Table 9: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents in existing properties	High
		Local employees (farming)	Moderate
	Controlled waters	Principal aquifers of Blisworth Limestone Formation and Taynton Limestone Formation	High
		Secondary aquifers of the Rutland Formation, Horsehay Sand Formation, Northampton Sand Formation, Marlstone Rock Formation and the Dyrham Formation	High
		Secondary A alluvium aquifer	High
		River Cherwell and tributaries	High
	Mineral resources	Mineral resources of sand and gravel	Low
	Built environment	Buildings and property	Low to high
		Underground structures and services	Low
Impact on mining/mineral sites (severance and sterilisation of mineral sites)	Natural environment	Mineral resource of sand and gravel	Moderate
		Mineral resource of coal	Low

Future baseline

8.3.25 There are currently no identified committed development sites within the study area which are likely to change the land quality baseline during either construction or operation of the Proposed Scheme. The only committed developments are for agricultural building, industrial and leisure uses, which are unlikely to impact land quality beyond their site boundary.

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 The construction assessment takes into account the mitigation measures contained within the draft CoCP (see Volume 5: Appendix CT-003-000/1). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work. Such requirements include:

- methods to control noise, waste, dust, odour, gasses and vapours (draft CoCP, Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (draft CoCP Section 5);
- the management of human exposure for both construction workers and people living and working nearby (draft CoCP, Section 11);

- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (draft CoCP, Sections 7 and 15);
- management of any unexpected contamination found during construction (draft CoCP, Section 11);
- a post remediation permit to work system (draft CoCP, Section 11);
- storage requirements for hazardous substances such as oil (draft CoCP, Section 16);
- traffic management to ensure that there is a network of designated haul roads to reduce compaction/degradation of soils (draft CoCP, Section 7); and
- methods to monitor and manage flood risk and other extreme weather events which may affect land quality during construction (draft CoCP, Section 16).

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

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)⁵⁵. The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

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

Assessment of impacts and effects

8.4.5 The southern end of the route will run through a 2.5km long cutting of depth up to 10m, with the exception of two short stretches on embankment at the start of the route section and south of Greatworth Hall over the dismantled railway. The route section will then pass into the 2.1km long green tunnel from Greatworth to the south-east of Thorpe Mandeville. This will be followed by a series of cuttings and

⁵⁵ Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*.

embankments, with two viaducts, Lower Thorpe viaduct and Edgcote viaduct over the River Cherwell. The route will then enter a 2.5km long green tunnel at Chipping Warden, before finally moving into a series of cuttings and embankments, with a viaduct over the Highfurlong Brook.

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

8.4.7 Auto-transformer stations are proposed at three locations: east of Greatworth, at Hill Farm south-east of Edgcote (Danes Moor), and west of Aston le Walls (Chipping Warden mid-point).

8.4.8 Seven construction sites will be located within this study area: a main compound at Chipping Warden, and six satellite compounds at Greatworth, Thorpe Mandeville, Lower Thorpe, Culworth, Claydon Road (also known as Boddington Road) and Banbury Road.

Land contamination

8.4.9 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, 20 areas were considered during this screening process; nine of these areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. The sites taken forward are a mixture of historical landfills, infilled pits or ponds and other industrial uses such as railway land, sewage works, tank storage and RAF land. All areas assessed are shown on Maps LQ-01-035 to LQ-01-041 (Volume 5, Land Quality Map Book) and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

8.4.10 Conceptual site models (CSM) have been produced for the 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 on or off the Proposed Scheme or associated offline works; e.g. roads;
- the vertical alignment, i.e. whether the Proposed Scheme is in cut or on embankment;
- the presence of underlying Principal or Secondary A aquifers or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

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

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

Area ref ⁽¹⁾	Area name	Main potential impacts	Main baseline risk ^{(2) (3)}
15-1	Dismantled railway crossing the Proposed Scheme (Map LQ-01-036, centred on grid reference E7)	Exposure of off-site human receptors (commercial) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Low risk
		Exposure of off-site human receptors (commercial) to contamination by inhalation of migrating ground-gas and volatile vapours from contaminated water.	Low risk
		Exposure of off-site human receptors (commercial) to asphyxiative or explosive gases.	Moderate/low risk
		Exposure of principal Taynton Limestone aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Moderate/low risk
		Exposure of on-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low risk
		Exposure of off-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low risk
15-4	Historical limestone quarry (Map LQ-01-037, grid reference C7)	Exposure of principal Taynton Limestone aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Moderate/low risk
15-6	Historical quarry (Map LQ-01-038, grid reference D6)	Exposure of secondary A Marlstone Rock Formation and Alluvium aquifers and secondary undifferentiated Dyrham Formation aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Very low risk
15-7	Historical limestone quarry (Map LQ-01-038, grid reference C6)	Exposure of secondary A Marlstone Rock Formation aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Very low risk
15-8	Tanks at Blackgrounds Farm (Map LQ-01-038, grid reference B6)	Exposure of on and off-site human receptors (residential and commercial) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Low risk
		Exposure of on and off-site human receptors (residential and commercial) to contamination by inhalation of migrating ground-gas and volatile vapours from contaminated water.	Low risk
		Exposure of on and off-site human receptors (residential and commercial) to asphyxiant or explosive gases.	Moderate/low risk
		Exposure of secondary A Marlstone Rock Formation aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Very low risk
		Exposure of on-site properties to lateral migration and build up of asphyxiative or explosive gases.	Moderate/low risk

Area ref ⁽¹⁾	Area name	Main potential impacts	Main baseline risk ^{(2) (3)}
		Exposure of on-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low risk
15-9	Historical quarry (Map LQ-01-039, grid reference H6)	Exposure of secondary A Marlstone Rock Formation aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Very low risk
15-10	Former RAF Chipping Warden Airfield (Map LQ-039, centred on grid reference D6)	Exposure of on and off-site human receptors (residential and commercial) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Low risk
		Exposure of on and off-site human receptors (residential and commercial) to contamination by inhalation of migrating ground-gas and volatile vapours from contaminated water.	Low risk
		Exposure of on and off-site human receptors (residents and commercial) to asphyxiative or explosive gases.	None
		Exposure of secondary A Marlstone Rock Formation aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Low risk
		Exposure of on and off-site properties to lateral migration and build up of asphyxiative or explosive gases.	None
		Exposure of on and off-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low risk
15-12	Sewage works (Map LQ-01-040, grid reference C6)	Exposure of on and off-site human receptors (commercial) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Moderate/low risk
		Exposure of on and off-site human receptors (commercial) to contamination by inhalation of migrating ground-gas and volatile vapours from contaminated water.	Low risk
		Exposure of on and off-site human receptors (commercial) to asphyxiative or explosive gases.	Moderate/low risk
		Exposure of on and off-site properties to lateral migration and build up of asphyxiative or explosive gases.	Moderate/low risk
		Exposure of on and off-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low risk
15-20	Former RAF Greatworth Wireless Transmission Station, now Greatworth Park Trading Estate and farmland (Map LQ-01-036, grid reference B8)	Exposure of on-site human receptors (commercial) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Moderate/low risk
		Exposure of on-site human receptors (commercial) to contamination by inhalation of migrating ground-gas and volatile vapours from contaminated water.	Moderate/low risk
		Exposure of on and off-site human receptors (commercial) to asphyxiative or explosive gases.	None
		Exposure of principal Taynton Limestone aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Low risk

(1) Each area is assigned a unique identification number (see Volume 5: Appendix LQ-001-015).

(2) CSMs have been prepared as part of the detailed land contamination methodology (refer to Volume 5) for baseline, construction and post-construction.

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

Temporary effects

- 8.4.12 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.
- 8.4.13 Table 11 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment takes into account the implementation of the mitigation measures set out within the draft CoCP. The details of these comparisons are presented in Volume 5: Appendix LQ-001-015.
- 8.4.14 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 the construction boundary.

Table 11: Summary of temporary (construction) effects

Area ref	Area name	Main baseline risk	Main construction risk ⁽²⁾	Temporary effect and significance
15-1	Dismantled railway crossing the Proposed Scheme	Very low to moderate/low	Very low to moderate/low	Negligible (not significant)
15-4	Historical limestone quarry	Moderate/low	Moderate/low	Negligible (not significant)
15-6	Historical quarry	Very low	Very low	Negligible (not significant)
15-7	Historical limestone quarry	Very low	None	Minor beneficial effect (not significant)
15-8	Tanks at Blackgrounds Farm	Very low to moderate/low	None	Minor beneficial effect (not significant)
15-9	Historical quarry	Very low	Very low	Negligible (not significant)
15-10	Former RAF Chipping Warden Airfield	None to low	None to low	Negligible (not significant)
15-12	Sewage works	Very low to moderate	Very low to moderate	Negligible (not significant)

Area ref	Area name	Main baseline risk	Main construction risk ⁽¹⁾	Temporary effect and significance
15-20	Former RAF Greatworth Wireless Transmission Station, now Greatworth Park Trading Estate and farmland	None to moderate/low	None to moderate/low	Negligible (not significant)

(1) 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.

8.4.15 Table 11 indicates that, based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination.

8.4.16 The main construction compound located in the study area will include the storage of hazardous substances, such as fuels and lubricating oils. 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.

Permanent effects

8.4.17 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.

8.4.18 Table 12 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 001-013.

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

Area ref	Area name	Main baseline risk	Main post-construction risk ⁽¹⁾	Post-construction effect and significance
15-1	Dismantled railway crossing the Proposed Scheme	Very low to moderate/low	Very low to moderate/low	Negligible (not significant)
15-4	Historical limestone quarry	Moderate/low	Moderate/low	Negligible (not significant)
15-6	Historical quarry	Very low	Very low	Negligible (not significant)
15-7	Historical limestone quarry	Very low	None	Minor beneficial effect (not significant)
15-8	Tanks at Blackgrounds Farm	Very low to moderate/low	None	Minor beneficial effect (not significant)
15-9	Historical quarry	Very low	Very low	Negligible (not significant)
15-10	Former RAF Chipping Warden Airfield	None to low	None to low	Negligible (not significant)
15-12	Sewage works	Very low to moderate	Very low to moderate	Negligible (not significant)

Area ref	Area name	Main baseline risk	Main post-construction risk ⁽¹⁾	Post-construction effect and significance
15-20	Former RAF Greatworth Wireless Transmission Station, now Greatworth Park Trading Estate and farmland	None to moderate/low	None to moderate/low	Negligible (not significant)

(1) 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.

8.4.19 The magnitude of the permanent effects and their significance have been determined by calculating the change in risk between the main baseline risk and the main post-construction risk. Therefore, where there is no change between the main baseline risk and the main post-construction risk, the permanent effect significance is deemed to be negligible even if the risk is 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 the construction boundary.

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

8.4.21 Table 12 indicates that, following remediation, there will be an overall negligible to minor beneficial effect, and none of the post-construction effects of land contamination impacts predicted are significant. For example, at the historical quarry near Trafford Bridge or the tanks at Blackgrounds Farm, the potential contaminants will be removed or remediated during construction by virtue of excavation or excavation and treatment of materials resulting in a beneficial effect.

Mining/mineral resources

8.4.22 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 severance⁵⁶ that may occur during the construction phase of the Proposed Scheme, possibly continuing through to the operation.

Temporary effects

8.4.23 There are no temporary effects on mining and mineral sites.

Permanent effects

8.4.24 There are four areas of sand and gravel resources in the study area that have been identified by Northamptonshire County Council as Mineral Safeguarding Areas. Northamptonshire Core Strategy Development Plan Document, 2010⁵⁷ in Policy CS10 makes it clear that any development of a significant nature within Minerals

⁵⁶ In this context, severance refers to the Proposed Scheme splitting an actual or proposed mining/mineral site into two or more areas, such that separate accesses would be required to work the whole site.

⁵⁷ Northamptonshire County Council (2010), *Minerals and Waste Development Framework Core Strategy Development Plan Document*.

Safeguarding Areas will have to demonstrate that the sterilisation of proven mineral resources of economic importance will not occur as a result of the development. Development will also have to demonstrate that the development will not pose a serious hindrance to future extraction in the vicinity. Only one of the areas underlies the route, and is located at the southern end of the study area, intersecting with the route over a distance of about 800m, and overlapping with the Newton Purcell to Brackley area (CFA14). If this resource is not exploited before construction, and hence sterilised, a slight adverse residual effect will occur. The area of land required to build the Proposed Scheme is located at the edge of the three remaining safeguarding areas and therefore any effect on these resources will be negligible.

- 8.4.25 If the resources are used for the construction phase or extracted prior to construction phase commencement then there will be no negative impact on the resource and no residual effects associated with mining and mineral resources in this area.
- 8.4.26 Table 13 presents a summary of the assessment of effects on the mining and mineral resources identified.

Table 13: Summary of effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area at the southern end of the study area, overlapping with CFA14 (Map LQ-01-35b, centred on grid reference C6)	Mineral Safeguarding Area	Mineral Safeguarding Area for sand and gravel	Medium	Moderate	Minor adverse (not significant)
Area of land east of Blackpits Farm (Map LQ-01-035b, centred on grid reference A4)	Mineral Safeguarding Area	Mineral Safeguarding Area for sand and gravel	Medium	Minor	Negligible (not significant)
Area to the north-west of Culworth (LQ-01-038, centred on grid reference E3)	Mineral Safeguarding Area	Mineral Safeguarding Area for sand and gravel	Medium	Minor	Negligible (not significant)
Area of land over Edgcote (LQ-01-038, centred on grid reference B8)	Mineral Safeguarding Area	Mineral Safeguarding Area for sand and gravel	Medium	Minor	Negligible (not significant)

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

Geo-conservation sites

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

Other mitigation measures

- 8.4.29 No additional mitigation measures are considered necessary to mitigate risks from land contamination during construction phase beyond those set out in the draft CoCP and instigated as part of required remediation strategies.

- 8.4.30 In addition to the excavation and treatment of contaminated soils, it may also be necessary to install ground (landfill) gas and leachate control systems within affected old backfilled sites, such as the historical quarries, 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.
- 8.4.31 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 track-bed, 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 NCC and any other interested parties to assist in achieving an effective management of minerals within the affected location of the MSA.

Summary of likely significant residual effects

- 8.4.32 No likely significant adverse effects are anticipated with the application of the mitigation measures detailed above.

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 There will be three auto-transformer stations within the study area, located: east of Greatworth; at Hill Farm, south-east of Edgcote; and west of Aston le Walls. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer station, in common with other modern substations, will use secondary containment appropriate to the level of risk.
- 8.5.4 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, such leakage or spillage is expected to be very small and unlikely to result in significant contamination.
- 8.5.5 It is unlikely that there will be any cumulative effects on land quality receptors due to the environmental controls that will be placed on operational procedures.

Other mitigation measures

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

Summary of likely significant residual effects

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

9 Landscape and visual assessment

9.1 Introduction

- 9.1.1 This section reports the assessment of the likely significant landscape and visual effects. It starts by summarising the baseline conditions found within and around the route of the Proposed Scheme and goes on to describe the significant effects that will arise during construction and operation on landscape character areas (LCAs) and visual receptors.
- 9.1.2 In this section, the operational assessment section refers not just to the running of the trains but also the presence of the new permanent infrastructure associated with the Proposed Scheme.
- 9.1.3 Principal landscape and visual issues in the area include:
- temporary effects to LCA and visual receptors during construction arising from the presence of construction plant, removal of existing vegetation and disruption to agricultural land This will be particularly apparent where associated with the most extensive areas of construction earthworks at Greatworth green tunnel, Chipping Warden green tunnel and south and west of Lower Boddington; and
 - permanent landscape and visual effects during operation arising from the presence of new engineered landforms cutting across the existing landscape, new viaducts, noise fence barriers, fencing, overbridges, highway infrastructure, overhead line equipment and the noise and visual effect of the regular passing of high speed trains. Permanent 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-001-015, which comprises the following:
- Part 1 Engagement with technical stakeholders;
 - Part 2 Environmental baseline report;
 - Part 3 Assessment matrices; and
 - Part 4 Schedule of non-significant effects.
- 9.1.5 The extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages has been discussed with Cherwell District Council, South Northamptonshire District Council, the River Nene Regional Park and Natural England. Summer field surveys, including photographic studies of LCAs and visual assessment of viewpoints, were undertaken from May to September 2012 and from May to June 2013. Winter surveys were undertaken from December 2012 to March 2013.

9.2 Scope, assumptions and limitations

- 9.2.1 The assessment scope, key assumptions and limitations for the cultural heritage assessment are set out in 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 Maps LV-07-056 to LV-07-063 and LV-08-056 to LV-08-063 (Volume 5, Landscape and Visual Assessment Map Book). The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-001-000/2), and is an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover will mean the actual visibility is substantially less than that shown in the ZTV. Tall construction plant (e.g. cranes and piling rigs) are excluded from the ZTV for the construction phase and overhead line equipment is excluded from the ZTV for the operational phase, but these are described and taken in to account in the assessment of effects on landscape character areas and visual receptors.
- 9.2.3 LCAs and visual receptors within approximately 1.5km of the Proposed Scheme have been assessed. Long distance views of up to 1.9km have been considered at locations such as Marston St Lawrence, Culworth, Upper Boddington and the more general network of rural roads and PRoW.

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 During the baseline survey there were some areas that 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. This was a notable constraint for PRoW between Thorpe Mandeville and Chipping Warden.

9.3 Environmental baseline

Existing baseline

Landscape baseline

- 9.3.1 The area is characterised by an undulating rural landscape of arable and pastoral farmland and scattered settlement. The landscape at the southern extent of the area around Greatworth is broadly undulating and drained by numerous shallow sloped valleys. The landform between Greatworth and Aston le Walls includes more intimate valley features at Trafford Bridge and Lower Thorpe. The northern extent of the area around Lower and Upper Boddington, is characterised by a contrast between a broad flat landscape to the west of Lower Boddington and a rolling, elevated landform on the eastern and western extents of the study area. Land use is typically agricultural

and comprises a mix of arable fields and pasture, bounded by hedgerows and woodland. Fields are generally medium to large scale, though smaller around villages. Settlements are typically small and widely dispersed. Large scale commercial development is limited to Greatworth Park in the south and the former airfield at Chipping Warden in the north.

- 9.3.2 Woodland cover is limited to small copses, shelterbelts, disused railway corridors and watercourses, which combine to give a wooded appearance to some areas of the landscape. Hedgerows are abundant throughout the area.
- 9.3.3 Numerous local roads and footpaths cross the study area, which provide important links between scattered properties and local villages and include the route of the A361 Byfield Road through Chipping Warden. A network of local PRow in the south includes the Jurassic Way, Battlefields Trail and Macmillan Way long distance trails. Dismantled railway lines cross the area at Greatworth, Lower Thorpe and Aston le Walls.
- 9.3.4 The landscape character areas have been determined with reference to the Natural England National Character Areas⁵⁸, Northamptonshire Landscape Character Assessment⁵⁹, Oxfordshire Wildlife and Landscape Character Study⁶⁰ and the Cherwell District Landscape Assessment⁶¹.
- 9.3.5 Descriptions of all LCAs are provided in Volume 5: Appendix LV-001-015 Part 2. For the purposes of this assessment the study area has been sub-divided into six discrete LCAs, five of which are most likely to be affected. A summary of these LCAs is provided below. The LCAs are shown in Maps LV-02-056 to LV-02-063 (Volume 5, Landscape and Visual Assessment Map Book).

The Tove Catchment Undulating Claylands LCA

- 9.3.6 The rural character of this LCA is influenced by the land cover that comprises predominantly arable fields and pasture bounded by tree lined hedgerows, partially maintained, but gappy in places. The overall condition of the landscape is good within the villages and fair within the wider landscape setting. Various local roads and farm tracks cross the area, most notably including the B4525 and Helmdon Road at Greatworth. Given the predominantly agricultural land use, the area is of medium tranquillity, aside from areas in proximity to overhead power lines, roads and villages where tranquillity is locally reduced. The area is valued at the borough level by local residents and users of the network of PRow. Therefore, this area has a medium sensitivity to change.

Middleton Cheney and Woodford Halse LCA

- 9.3.7 The area is defined by broad, sweeping undulations in the landform, and characterised by a combination of arable and pastoral farmland, with pasture predominating around settlements. Fields and roads are lined by well treed hedgerows, contributing to the

⁵¹ Natural England; The Character of England 1996; <http://www.naturalengland.org.uk/publications/nca/default.aspx>; Accessed October 2013.

⁵² Northamptonshire County Council (2006), *Current Landscape Character Assessment*.

⁵³ Oxfordshire County Council, Natural England and the Earth Trust (2004), *Oxfordshire Wildlife and Landscape Character Study*.

⁵⁴ Cherwell District Council (1995), *Cherwell District Landscape Assessment*.

appearance of a good landscape condition. A network of PRoW, predominantly in the centre and south of the LCA contributes to the area's local value. Given the predominantly agricultural land use, the area is of medium tranquillity, aside from areas in proximity to overhead line equipment power lines, roads and villages where tranquillity is locally reduced. Therefore, this area has a medium sensitivity to change.

Eydon Ironstone Hills LCA

- 9.3.8 A low, undulating, landform with broad caps of ironstone forms two distinct 'hills', between which flows the River Cherwell. Large to medium scale fields are interspersed with smaller fields of improved pasture which are in good condition. Vegetation consists of hedgerow boundaries with hedgerow trees and occasional deciduous woodland blocks. Settlement is limited to scattered farmsteads and the village of Eydon, within an area of distinctly rural character. The area has a high level of tranquillity, reduced locally in proximity to the A361 Byfield Road at the edge of the character area. The LCA is of local value in relation to the rural character setting afforded to local residents. Therefore, this area has a medium sensitivity to change.

Boddington Broad Unwooded Vale LCA

- 9.3.9 The broad, flat landscape is characterised by a combination of arable and pastoral land with fields of typically medium to large scale, including extensive areas of ridge and furrow. Woodland cover is limited, with occasional hedgerow trees and small scale woodland groups. The overall condition of the landscape is good within the villages and fair within the wider landscape setting. Given the predominantly agricultural land use, the area is of medium tranquillity, aside from areas in proximity to roads and villages where tranquillity is locally reduced. The LCA is of local value in relation to the rural character setting afforded to local residents. Therefore, this area has a medium sensitivity to change.

Boddington Low Pastoral Hills LCA

- 9.3.10 This LCA comprises the three main hills to the north, south and west of Upper Boddington. The elevated landscape affords panoramic views across the surrounding open countryside. The majority of the area is defined by the pattern of fields, including areas of ridge and furrow, with hedgerow boundaries, which are partially maintained with gaps in places. The overall condition of the landscape is good within the villages and fair within the wider landscape setting. Given the predominantly agricultural land use, the area is of medium tranquillity, aside from areas in proximity to roads and villages where tranquillity is locally reduced. The LCA is of local value in relation to the rural character setting afforded to local residents. Therefore, this area has a medium sensitivity to change.

Visual baseline

- 9.3.11 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-015 Part 2. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are numbered to identify their locations and are shown in Maps LV-03-056 to LV-03-063 and LV-04-056 to LV-04-063 (Volume 2, CFA15 Map Book).

- 9.3.12 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, 7: Active Sports.
- 9.3.13 No protected views have been identified within the study area.
- 9.3.14 Residential receptors have a high sensitivity to change and are concentrated within the villages of Halse, Greatworth, Marston St Lawrence, Thorpe Mandeville, Culworth, Chipping Warden, Aston le Walls, Lower Boddington and Upper Boddington, but also include grouped and individual properties located throughout the study area. Views are typically rural across arable and pastoral fields. The combination of flat and gently undulating topography with successive belts of mature vegetation bordering fields typically limits the extents of the views. Where topography is more elevated, such as within the Eydon Hills and Boddington Hills LCA, more extensive views are possible. Recreational receptors, also with a high sensitivity to change, are located on PRow throughout the study area, including the Battlefields Trail, Macmillan Way and the Jurassic Way. The viewpoints are typically located in rural, agricultural locations, with pasture defining the immediate setting and wooded skylines or planted field boundaries forming some degree of enclosure.
- 9.3.15 Views experienced by people travelling along the numerous 'scenic' rural roads within the study area have a medium sensitivity to change. People travelling on main roads, including the A361 Byfield Road at Chipping Warden, have a low sensitivity to change. Highway views are typically characterised by glimpsed views through roadside hedgerows across agricultural fields, with wooded backdrops and occasionally more elevated views across wider extents of countryside.
- 9.3.16 People at work and in educational institutions have a medium sensitivity to change and are located at Greatworth Park and Appleton Business Park. Views contain built form associated with the business parks but are typically across agricultural landscapes with hedgerow vegetation providing a degree of enclosure.
- 9.3.17 People engaged in formal sports have a low sensitivity to change and are located at Washbrook Farm Eventing Centre. Views here are characterised by an open landscape typically limited by hedgerows, small woodland blocks and gently rising topography.

Future baseline

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

Construction (2017)

- 9.3.19 The introduction of a photovoltaic park at Culworth Grounds Farm will have a localised influence within the agricultural landscape between Thorpe Mandeville and Culworth. The development will be most prominent in views from PRow AG7 that passes along the western boundary of the photovoltaic site on a route between Banbury Lane and the Thorpe Mandeville parish boundary, and will appear in more

distant views from Thorpe Mandeville. During construction therefore, there will be the potential for a combined visual influence of the Proposed Scheme and photovoltaic park in views from footpath AG7 and from the northern edge of Thorpe Mandeville. The photovoltaic park development will however be accompanied by a mitigation concession to bulk up the existing hedgerow on its western boundary to limit views of the photovoltaic panels from surrounding areas.

- 9.3.20 An extension of existing commercial buildings is proposed at the Appletree Industrial Estate at Chipping Warden. Based on the assumption that extension will be proportionate in scale, extent and character to that of existing buildings, there will be no additional cumulative associations with the Proposed Scheme.

Operation (year 1 – 2026)

- 9.3.21 By 2026, the growth of hedgerows associated with the boundaries of the photovoltaic park will contribute to screening of the development. It is anticipated that this will also limit the potential for views from the PRoW on the western boundary of the development towards the Proposed Scheme, thereby limiting the potential for direct cumulative views of the photovoltaic park and Proposed Scheme. There will however remain the potential for sequential views of the photovoltaic park and Proposed Scheme for footpath users travelling along the PRoW. The establishment of hedgerows around the development will contribute to the reduction of cumulative visual effects on views from the northern edge of Thorpe Mandeville.
- 9.3.22 There will be no additional cumulative associations with the Proposed Scheme, assuming that proposed extension to the existing commercial buildings at the Appletree Industrial Estate at Chipping Warden will be proportionate in scale, extent and character to that of existing buildings.

9.4 Temporary effects arising during construction

- 9.4.1 The construction works that have been taken into account in determining the effects on landscape and visual receptors include:
- mitigation earthworks between Halse Copse and Greatworth;
 - Greatworth green tunnel;
 - Lower Thorpe viaduct and adjacent earthworks;
 - Edgcote viaduct;
 - Chipping Warden green tunnel;
 - Highfurlong Brook viaduct;
 - mitigation earthworks west of Lower Boddington;
 - Claydon Road overbridge;
 - Banbury Road (Boddington) overbridge;

- construction sites with concentrations of buildings, vehicles and materials at Greatworth, Lower Thorpe, Edgcote, Chipping Warden, Lower Boddington and a small number of isolated clusters of buildings;
- construction traffic along the Proposed Scheme and along public roads joining the route from the minor road between Helmdon and Radstone, the B4525 towards Thorpe Mandeville, the A361 Byfield Road into Chipping Warden and Welsh Road between Lower Boddington and Edgcote;
- general earthworks along the Proposed Scheme requiring cut/fill, vegetation removal, modification of landform, disruption to agricultural land and the presence of construction plant; and
- temporary diversions to highways, PRoW and agricultural land property access.

Avoidance and mitigation measures

- 9.4.2 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible in many locations and will have the potential to give rise to significant temporary effects that cannot be practicably mitigated. Such effects vary over the construction period depending on the intensity and scale of the works at the time.
- 9.4.3 The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase, which is defined as the period during which the main civil engineering works will take place, including establishment of compounds, main earthworks and structure works. The effects associated with the peak construction phase in this area are considered to be long term given the construction programme (see Section 2.3).
- 9.4.4 Overall, civil engineering works in this area will be undertaken between the third quarter of 2017 and the middle of 2022. The Chipping Warden green tunnel main compound will be in place for approximately five years. Satellite compounds will be in place for between approximately two and five years. The civil engineering works at most individual sites along the route in this area would occur for a period of between approximately six months and two and a half years, with Greatworth and Chipping Warden green tunnels taking over four years. The duration of effects during other phases of works is likely to be less due to the intermittent and dispersed nature of activities during these phases.
- 9.4.5 Measures that have been incorporated into the draft CoCP to avoid or reduce landscape and visual effects during construction include the following (see Volume 5: Appendix CT-003-000/1):
- maximising the retention and protection of existing trees and vegetation where possible (draft CoCP, Section 12);
 - use of well-maintained hoardings and fencing (draft CoCP, Section 5);
 - designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses (draft CoCP, Section 5);

- methods to monitor and manage flood risk and other extreme weather events which may affect landscape and visual amenity resources during construction (draft CoCP, Section 5 and 16); and
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (draft CoCP, Section 12).

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

Assessment of temporary impacts and effects

9.4.7 The most perceptible changes to landscape character and viewpoints during construction will relate to the temporary presence of construction plant, the removal of existing landscape elements, such as trees, hedgerows and agricultural land and extensive landform earthworks. Changes will most affect the setting and outlook of the settlements of Greatworth, Thorpe Mandeville, Chipping Warden, Aston le Walls, Lower Boddington and Upper Boddington and affect the setting and views of the network of PRoW throughout the area. The height of the construction plant and viaducts and the close proximity of construction activities to viewpoints, coupled with the absence of intervening screening (apart from the site hoardings) will result in significant visual effects during construction. The topography in certain locations and the retention of intervening hedgerows and trees will partially screen low level construction activity.

Landscape assessment

9.4.8 The following section describes the likely significant effects on LCAs during construction. All LCAs within the study area considered to experience a not significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-015 Part 4.

The Tove Catchment Undulating Claylands LCA

9.4.9 The Proposed Scheme will pass through this LCA between the southern boundary of the CFA (north of Radstone) and Greatworth. Construction activities will include the removal of a small part of ancient woodland at Halse Copse and the removal of field boundary hedgerows where they intersect with the Proposed Scheme. The extent of excavation and earthworks generally between Greatworth and the southern boundary of the LCA will cut through the undulating landform and disrupt the existing continuity of field patterns. This will include the excavation and formation of a green tunnel north of Greatworth. Permanent 3m high landscape earthworks will be formed adjacent to the route, beyond the extent of the green tunnel. Soils and arising materials will also be stored in temporary material stockpiles up to 5m high. Loss and severance of agricultural land will occur throughout the LCA. Two buildings within Greatworth Park will also be demolished.

9.4.10 Construction will introduce vehicles and lighting, which is likely to reduce tranquillity particularly around the Greatworth green tunnel and the associated Greatworth green tunnel satellite compound.

- 9.4.11 Construction will result in disruption to and loss of trees, hedgerows and agricultural land, extensive earthworks operations and the introduction of construction plant into the rural landscape. However, impacts will diminish with distance from the Proposed Scheme and, overall, 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.

Middleton Cheney and Woodford Halse Undulating Hills and Valleys LCA

- 9.4.13 The Proposed Scheme will pass through this LCA between Greatworth and Aston le Walls. Construction will notably affect the valley landscapes at Lower Thorpe and Edgcote where the physical containment of the landform will accentuate the effects of construction works on tranquillity within the relative intimacy of the valley setting. Valley landform will also be notably altered by the engineered profile of cuttings and embankments. Construction of viaduct structures will result in concentrated construction activity in both locations and will require demolition of properties at Lower Thorpe, Blackgrounds Farm, The Bungalow and Stone House east of Chipping Warden. The excavation of cuttings and the formation of the green tunnel at Chipping Warden will result in disruption to existing land use. The construction of the Chipping Warden green tunnel northern portal will include excavation and re-grading of the profile of the scarp slope landform.
- 9.4.14 The construction compounds at Thorpe Mandeville cutting, Lower Thorpe viaduct, Danes Moor, Culworth cutting, Chipping Warden tunnel (south portal) and Chipping Warden (north portal) will be the focus of intense construction activity including materials handling and vehicle movements. The extent of excavation and earthworks generally along the length of the Proposed Scheme will result in disruption to existing landscape character components and setting, particularly at Thorpe Mandeville and Chipping Warden where earthworks grading will be extensive.
- 9.4.15 Construction activity will introduce vehicles and lighting, reducing tranquillity locally for the duration of the works.
- 9.4.16 Construction will result in disruption to valley and scarp slope landform features, removal of trees, hedgerows and agricultural land, extensive earthworks operations and the introduction of construction plant into the rural landscape. However, much of the character of the LCA will be largely unaffected. Taking the above into account, the magnitude of change is considered to be medium.
- 9.4.17 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Eydon Ironstone Hills LCA

- 9.4.18 The Proposed Scheme will not pass through this LCA. The key impact on the landscape character of the LCA will arise through the extensive inter-visibility of the route passing through the adjacent LCA. The excavation and formation of the green tunnel and cutting at Chipping Warden although located in the adjacent Middleton Cheney and Woodford Halse Undulating Hills and Valleys LCA, will have a notable indirect influence on the setting of the Eydon Ironstone Hills.

- 9.4.19 Construction activity within the adjacent LCA will introduce an indirect influence from vehicles and lighting, reducing tranquillity locally for the duration of the works.
- 9.4.20 Construction within the adjacent LCA will involve the limited loss of trees, hedges and agricultural land with an indirect influence on the character setting of the Eydon Ironstone Hills LCA. Taking the above into account, the magnitude of change is considered to be medium.
- 9.4.21 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Boddington Broad Unwooded Vale LCA

- 9.4.22 The Proposed Scheme will pass through this LCA between Aston le Walls and to the west of Lower Boddington. Impacts will arise from the extensive grading of earthworks associated with landscape mitigation bunding. The extent of grading will also result in the loss of extensive areas of ridge and furrow fields.
- 9.4.23 The construction of Claydon Road overbridge and the realigned Banbury Road overbridge, will introduce visible construction activity into the open, rural setting west of Lower Boddington. There will be a focus of activity, including the handling of materials and the movement of vehicles, at Claydon Road overbridge satellite compound and Banbury Road green overbridge satellite compound.
- 9.4.24 Construction activity will introduce vehicles and lighting, reducing tranquillity locally for the duration of the works. Construction will involve the loss of trees, hedgerows and agricultural land, extensive earthworks operations and the introduction of construction plant into the rural landscape. However, much of the character of the LCA will be largely unaffected. Taking the above into account, the magnitude of change is considered to be medium.
- 9.4.25 The medium magnitude of change assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Boddington Low Pastoral Hills LCA

- 9.4.26 The Proposed Scheme will pass through this LCA to the north of Upper Boddington. From higher ground there will be extensive inter-visibility with the route of the Proposed Scheme, ranging in distance from 3km beyond the LCA in the south to immediately within the LCA in the north. Construction activities within the LCA will include excavation of the maintenance loop cutting and realignment of the highway junction of Banbury Road and Stoneton Lane. Construction activities within the adjacent Boddington Broad Unwooded Vale LCA will include the grading of earthworks either side of the route to the west of Lower Boddington and the engineered earthworks associated with the maintenance loop. Construction activity will be uncharacteristic within the rural setting where associated with construction of road overbridges at Claydon Road (Upper and Lower Boddington).
- 9.4.27 Construction will introduce vehicles and lighting, reducing tranquillity from the south and west facing slopes of the LCA for the duration of the works.

- 9.4.28 Construction will involve the loss of trees, hedgerows and agricultural land, extensive earthworks operations and the introduction of construction plant into the rural landscape. However, much of the character of the LCA will be largely unaffected. Overall, the magnitude of change is considered to be medium.
- 9.4.29 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Visual assessment

- 9.4.30 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken during winter, in line with good 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, would be in leaf. Where residential receptors experience significant effects at night-time arising from additional lighting, these are also presented in this section. Representative viewpoints within the study area considered to experience a not significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-015 Part 4.
- 9.4.31 The number identifies the viewpoint locations which are shown in Maps LV-03-056 to LV-03-063, Volume 2, CFA15 Map Book.
- 9.4.32 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.
- 9.4.33 Where a viewpoint may represent multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity may be lower than those reported.

Viewpoint 189.3.001: View north-east from the PRow network south-east of Halse Copse (viewpoint located on PRow AN/24)

- 9.4.34 The Proposed Scheme will lie approximately 830m from this viewpoint, on rising ground. To the north-east there will be oblique views of the construction of a new footpath overbridge and of mitigation earthworks at approximately 650m from the viewpoint. However, the majority of existing intervening field boundary vegetation to the north-east of the viewpoint will be retained, partially screening views. Therefore, the magnitude of change is considered to be medium.
- 9.4.35 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 191.3.003: View east from the PRow network south of Halse Copse (viewpoint located on PRow AN/22)

- 9.4.36 The Proposed Scheme will cross this view around 400m from the viewpoint. The construction of the new Footpath AN22 accommodation overbridge (approximately 350m from the viewpoint) and the Proposed Scheme, will be visible in the middle ground. A temporary haul route will be visible to the east, on the west side of the Proposed Scheme. A temporary material stockpile area up to approximately 3m high

will be visible to the north-west and south-east on the west side of the Proposed Scheme. The majority of existing intervening vegetation to the west of the viewpoint will be removed during construction, including the southern edge of Halse Copse woodland, opening up views of construction. Construction operations will be highly visible and uncharacteristic within the direct frame middle ground extent of view. Therefore, the magnitude of change is considered to be high.

- 9.4.37 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in major adverse effects.

Viewpoint 192.3.001: View west from the PRow network south of Halse Copse (viewpoint located on PRow AN/22)

- 9.4.38 The Proposed Scheme will cross this view around 85m from the viewpoint. The construction of the new footpath AN22 accommodation overbridge (20m away), the Proposed Scheme and mitigation earthworks (150m away) to the west of the Proposed Scheme, will be visible in the foreground. The majority of intervening vegetation will be removed, including the southern edge of Halse Copse woodland to enable construction, resulting in open views of construction activities. A temporary haul route will be visible to the west of the viewpoint, on the west side of the Proposed Scheme. Temporary material stockpile areas up to approximately 3m high will be visible in open views to the west and south-west on the west side of the Proposed Scheme. Therefore, the magnitude of change is considered to be high.

- 9.4.39 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in major adverse effects.

- 9.4.40 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 192.3.002: View south-west from the PRow network south of B4525 road (viewpoint located on PRow AP/18)

- 9.4.41 The Proposed Scheme will lie approximately 900m from the viewpoint. Construction of the Proposed Scheme, including the new Bridleway AN37 accommodation overbridge (approximately 800m from the viewpoint), will be visible in the middle to background of the view. However, the majority of intervening field boundary vegetation to the south-west of the viewpoint along with Halse Copse, will be retained, screening and filtering views of construction. Therefore, the magnitude of change is considered to be medium.

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

Viewpoint 193.2.002: View east from Halse Copse Farm

- 9.4.43 The Proposed Scheme will lie approximately 400m from this viewpoint. Construction of the new Bridleway AN37 accommodation overbridge (approximately 260m from the viewpoint), the Proposed Scheme and mitigation earthworks to the west of the Proposed Scheme (approximately 180m from the viewpoint), will be visible in the middle ground. Although existing field boundary vegetation will be retained in the foreground, some will be removed to facilitate grading of mitigation earthworks

towards the middle ground of the view, resulting in views of construction being open in places. Construction operations will be highly visible and uncharacteristic within the direct frame middle ground extent of view. 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 major adverse effects.

9.4.45 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 193.3.001: View looking north, north-east from PRow north-west of Greatworth Fields (viewpoint located on PRow AN/14)

9.4.46 The Proposed Scheme will cross this view around 260m from the viewpoint. The majority of intervening vegetation will be removed to enable construction. There will be open views of a temporary material stockpile (approximately 20m away), the construction of the new Bridleway AN14 accommodation overbridge (approximately 200m away), the Greatworth green tunnel satellite compound (approximately 780m away), the Greatworth tunnel south portal, and the realignment of Helmdon Road (approximately 870m away) in the middle-ground to background of the view. Overall, the magnitude of change is considered to be high.

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

Viewpoints 193.3.002 and 195.3.001: Views west and north, north-east from the PRow network between Halse Copse and Greatworth (viewpoints located on PRow AN/18 and PRow AN/17 respectively)

9.4.48 The Proposed Scheme will cross these views around 800m from the viewpoints. There will be oblique views of the construction of the new Bridleway AN14 accommodation overbridge (around 750m from the viewpoints), the Greatworth green tunnel satellite compound, along with mitigation earthworks to the west of the Proposed Scheme (approximately 600m from the viewpoint) in the middle to background. The majority of existing intervening vegetation will be retained, resulting in the filtering and screening of views in places. Therefore, the magnitude of change is considered to be medium.

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

Viewpoints 194.2.001 and 196.2.001: Views looking south-west from residences (The Bungalow) to east of Greatworth Hall and Greatworth Hall

9.4.50 The Proposed Scheme will cross this view around 100m from the viewpoints. Construction activity, including the new Bridleway AN14 accommodation overbridge and mitigation earthworks to the west side of the Proposed Scheme will be highly visible in the immediate foreground of these views, as the majority of intervening vegetation will be removed. Therefore, the magnitude of change is considered to be high.

- 9.4.51 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in major adverse effects.
- 9.4.52 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 195.2.001 and 196.3.001: Views looking north-east from properties on eastern edge of Greatworth and south, south-west from PRoW north-east of Greatworth (viewpoint located on PRoW AN/13)

- 9.4.53 The Proposed Scheme will cross this view around 250m from the viewpoints. The majority of intervening vegetation will be lost to enable construction. There will be open views of the construction of the new Bridleway AN14 accommodation overbridge, the Greatworth green tunnel satellite compound, the Greatworth tunnel south portal and the realignment of Helmdon Road in the foreground and middle-ground. Overall, the magnitude of change is considered to be high.
- 9.4.54 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect.
- 9.4.55 Given the rural location of viewpoint 195.2.001, the night-time view will be affected by general construction lighting in relation to the Greatworth green tunnel satellite compound and the Greatworth tunnel south portal. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 196.4.001: View looking west from B4525, north of Greatworth

- 9.4.56 The Proposed Scheme will pass within 200m of this viewpoint. The construction of the Greatworth green tunnel and the associated Greatworth green tunnel satellite compound, the reinstatement of the B4525, the realignment of Helmdon Road and the reinstatement of footpath AN4 will be visible in the fore to middle ground. The demolition of two buildings within the Greatworth Park to enable the construction of the green tunnel will be visible in the middle ground approximately 320m away. Temporary material stockpiles to the east and west of the Proposed Scheme will result in the loss of intervening vegetation, opening up views of construction. Overall, there is considered to be a medium magnitude of change.
- 9.4.57 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 197.6.002: View looking north-east from Greatworth Park

- 9.4.58 The Proposed Scheme will pass within 100m of this viewpoint. The construction of the Greatworth green tunnel will be visible in the foreground, within 30m of the viewpoint. The Greatworth green tunnel satellite compound located to the east of the Proposed Scheme will be visible in the middle ground at approximately 580m away. The demolition of two buildings within Greatworth Park, along with the loss of existing vegetation surrounding the business park and associated with field boundaries will be visible, opening up views of construction. Overall, there is considered to be a high magnitude of change.

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

Viewpoint 197.3.002: View looking north-east from PRow east of Marston St Lawrence (viewpoint located on PRow AN/39)

- 9.4.60 The Proposed Scheme will pass within 150m of this viewpoint. Existing intervening field boundary vegetation will be removed, opening up views of construction. The construction elements visible at close-distance in the foreground will include the Greatworth green tunnel (within 20m of the viewpoint), the associated diversion of the B4525 in oblique views to the south-east (approximately 365m away) and the reinstatement of footpath AN39 (approximately 100m away). Overall, the magnitude of change is considered to be high.

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

Viewpoint 198.3.001: View looking west from PRow west of Sulgrave (viewpoint located on PRow AN/42)

- 9.4.62 The Proposed Scheme will pass within 335m of this viewpoint. Construction elements visible in the middle-distance will include the construction of the Greatworth green tunnel (within 130m of the viewpoint) and the reinstatement of footpath A39 over the green tunnel. Existing intervening vegetation in the foreground associated with field boundaries will be retained in proximity to the viewpoint, partially filtering views. Taking the above into account, the magnitude of change is considered to be medium.

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

Viewpoint 199.4.002: View looking east from Sulgrave Road, east of Thorpe Mandeville

- 9.4.64 The Proposed Scheme will pass within 210m of this viewpoint. Roadside and field boundary vegetation will be removed during construction, opening up views of construction. Construction elements visible in the middle-ground of this view will include the Greatworth green tunnel, the Greatworth green tunnel (north portal) satellite compound, Banbury Road overbridge and temporary material stockpiles to both sides of the Proposed Scheme. Overall, it is considered that the magnitude of change is high.

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

Viewpoint 200.3.001: View looking west from PRow west of Sulgrave (viewpoint located on PRow BB/3)

- 9.4.66 The Proposed Scheme will pass within 400m of this viewpoint. The majority of intervening vegetation will be removed through the process of construction, opening up views of construction. A roadhead to the east side of the Proposed Scheme (within 45m of the viewpoint) will be visible in the immediate foreground. The reinstatement of Sulgrave Road, the realignment of Banbury Road, the Thorpe Mandeville cutting

satellite compound, the Greatworth green tunnel (north portal) satellite compound and temporary material stockpiles to both sides of the Proposed Scheme will be visible in the near to middle-ground. Overall, the magnitude of change is considered to be high.

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

Viewpoints 201.2.001 and 201.2.002: Views looking north-east from Banbury Lane towards Lower Thorpe

- 9.4.68 The Proposed Scheme will pass within 220m and 450m respectively of these viewpoints. The majority of the intervening vegetation will be removed which along with the elevated nature of the viewpoints, will result in open views of construction activities. The construction of Lower Thorpe viaduct across the flood plain and the Lower Thorpe viaduct satellite compound will be visible in the near to middle-ground. Overall the magnitude of change is considered to be high.

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

- 9.4.70 Despite lighting being visible in the view from the nearby settlement of Thorpe Mandeville, construction lighting particularly from Lower Thorpe viaduct worksite will be intrusive. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 201.3.002: View looking north-east from the PRow network north of Thorpe Mandeville (viewpoint located on PRow BB/5)

- 9.4.71 The Proposed Scheme will pass within 625m of this viewpoint. The construction of the Lower Thorpe viaduct over the floodplain and the associated satellite compound, the Culworth Grounds accommodation overbridge, in combination with more general construction activities and earthworks, will be visible in the middle ground. A temporary haul route will be located to the east of the viewpoint, on the east and west sides of the Proposed Scheme. Existing intervening vegetation will be retained in the fore ground of the view and contribute to screening of the lower elements of the Proposed Scheme. However, vegetation in the middle ground will be removed through the process of construction, resulting in open views in places. Elements of construction will therefore remain visible and prominent. Overall, the magnitude of change is considered to be high.

- 9.4.72 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in major adverse effects.

Viewpoint 201.4.002: View looking east from Sulgrave Road, south of Thorpe Mandeville

- 9.4.73 Construction elements visible in the middle to background of this viewpoint will include the realignment of Banbury Road (approximately 185m from the viewpoint) and the Thorpe Mandeville cutting satellite compound (approximately 790m from the viewpoint). There will also be oblique views of the Greatworth green tunnel north portal to the south-east (approximately 935m from the viewpoint). Roadside

vegetation will be removed, particularly associated with construction of Banbury Road overbridge, opening up views of construction. Overall, the magnitude of change is considered to be medium.

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

Viewpoint 201.3.003: View looking north-east from the PRoW network south of Thorpe Mandeville (viewpoint located on PRoW BB/2)

- 9.4.75 The realignment of Banbury Road (approximately 850m from the viewpoint) and the Thorpe Mandeville cutting satellite compound (approximately 1.1km from the viewpoint), will be visible in the middle to background, in combination with more general construction activities and earthworks visible approximately 880m from this viewpoint. A temporary haul route will be located to the east of the viewpoint, on the east side of the Proposed Scheme. Existing intervening field boundary vegetation in the middle ground (at approximately 150 to 300m from the viewpoint) will contribute to screening views of construction activities. Overall, the magnitude of change is considered to be medium.

- 9.4.76 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in moderate adverse effects.

Viewpoints 202.3.001 and 202.3.002: Views looking south-west from PRoW north-east of Lower Thorpe (both viewpoints located on PRoW BB/11)

- 9.4.77 Existing intervening vegetation will be removed to enable construction, opening up views of the construction of the Lower Thorpe viaduct over the floodplain (approximately 385m and 800m respectively from viewpoints) and the Lower Thorpe viaduct satellite compound in the middle ground, approximately 560m and 1km respectively from these viewpoints. Overall, the magnitude of change is considered to be high.
- 9.4.78 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect.

Viewpoint 202.4.001: View looking south-west from Banbury Lane, east of Lower Thorpe

- 9.4.79 The construction of the Lower Thorpe viaduct over the floodplain, particularly tall construction plant such as cranes and the Lower Thorpe viaduct satellite compound will be visible in the middle ground, approximately 450m from this viewpoint, screened and filtered in places by intervening vegetation. There will also be oblique views of the realignment of Banbury Lane over the Proposed Scheme to the south of the viewpoint in long distance views (approximately 990m from the viewpoint). A temporary haul route will be visible to the west of the viewpoint, though largely filtered by intervening vegetation. Overall, the magnitude of change is considered to be medium.
- 9.4.80 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in moderate adverse effects.

Viewpoint 203.2.001: View looking east from Hill Farm, north-west of Thorpe Mandeville

- 9.4.81 Although the majority of intervening vegetation will be retained, views will be possible above the level of vegetation due to the elevated position of the viewpoint. The construction of Culworth Grounds accommodation overbridge to the north-east will be visible in the middle ground, approximately 800m from this viewpoint, along with Lower Thorpe viaduct and Lower Thorpe viaduct satellite compound in the background (approximately 940m and 770m away from the viewpoint, respectively). Taking the above into account, the magnitude of change is considered to be medium.
- 9.4.82 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.
- 9.4.83 Given the rural location of the viewpoint, the night-time view will be affected by construction lighting associated with the Lower Thorpe viaduct satellite compound, though filtered in places by intervening vegetation. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 203.3.003: View looking east from the PRoW north of Thorpe Mandeville (viewpoint located on PRoW AG/10)

- 9.4.84 The retention of existing intervening vegetation associated with field boundaries and the dismantled railway, along with the rising topography, will partially screen views of some construction activities. The construction of Culworth Grounds accommodation overbridge will be visible in open views in the foreground, approximately 35m from the viewpoint. There will be long distance views of the construction of Lower Thorpe viaduct (approximately 850m from the viewpoint), particularly tall construction plant such as cranes, and the Lower Thorpe viaduct satellite compound, along with general construction activities and earthworks. A temporary haul route will be located to the east of the viewpoint, on the east side of the Proposed Scheme, will be screened by intervening topography and vegetation. Overall, the magnitude of change is considered to be high.
- 9.4.85 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in major adverse effects.

Viewpoint 204.2.001: View looking west from Culworth Grounds Farm

- 9.4.86 The majority of intervening riparian vegetation associated with the stream in the middle ground of the view will be retained, partially screening views of construction. However, the slight elevation of the viewpoint will allow middle ground views of construction components including those associated with Lower Thorpe viaduct, the Lower Thorpe viaduct satellite compound and Culworth Grounds private accommodation overbridge, approximately 400m from the viewpoint. A temporary haul route will be located to the west of the viewpoint, on both the east and west sides of the Proposed Scheme, although views of the haul route will be filtered and screened by intervening vegetation. Overall, the magnitude of change is considered to be medium.

- 9.4.87 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in moderate adverse effects.
- 9.4.88 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 204.2.002 and 204.2.003: Views looking west from properties on western and southern edge of Culworth

- 9.4.89 Although the majority of intervening vegetation will be retained, views of construction will be possible given the elevation of the viewpoint. General construction activities and earthworks, along with the construction of the Culworth Grounds accommodation overbridge will be visible in the background, approximately 1.3km from this viewpoint. Overall, the magnitude of change is considered to be medium.
- 9.4.90 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect.
- 9.4.91 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 204.3.001: View looking east from PRow south-west of Culworth (viewpoint located on PRow AG/9)

- 9.4.92 Vegetation in the immediate foreground of the view will be retained, resulting in filtered views towards the construction of Bridleway AG9 overbridge, approximately 1.1km from the viewpoint. A temporary material stockpile on the east side of the Proposed Scheme, north of the Bridleway AG9 overbridge will be visible approximately 200m from the viewpoint. Taking the above into account, the magnitude of change is considered to be high.
- 9.4.93 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoints 205.2.001 and 207.2.002: Views looking east from Edgcote Lodge Farm and Trafford Bridge

- 9.4.94 The majority of intervening vegetation will be retained, screening and filtering views of the lower elements of construction activities. However, the elevated position of the viewpoint will allow views of tall construction plant such as cranes associated with Edgcote viaduct over the River Cherwell floodplain to the north-east, approximately 1.1km and 655m respectively away, along with the upper parts the Bridleway AG10 accommodation overbridge in the middle distance, approximately 875m and 995m respectively away from the viewpoint. Overall, the magnitude of change is considered to be high.
- 9.4.95 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect.
- 9.4.96 Given the rural location of the viewpoint, the night-time view will be affected by construction lighting, in relation to the Culworth cutting satellite compound. However, screening as a result of intervening vegetation will reduce these effects.

Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoints 206.3.001, 208.3.001 and 208.3.002: Views looking west from PRow east of Trafford Bridge (viewpoints located on PRow AE/7 and AG/12 respectively)

- 9.4.97 The Proposed Scheme will cross these middle to long distance views around 1km from the viewer. Visible middle ground construction elements will include two bridleway overbridges (AG9 and AG10), Culworth cutting satellite compound and the Danes Moor auto-transformer station satellite compound. Existing intervening field boundary and riparian stream vegetation will result in some screening of the lower elements of the construction works. However, upper elements will remain visible. Overall, it is considered there will be a medium magnitude of change.
- 9.4.98 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect.

Viewpoint 207.3.001: View looking west from PRow south of Edgcote (located on PRow AE/24)

- 9.4.99 The Proposed Scheme will cross this long distance view around 1.1km from the viewer. Visible middle ground construction elements from this viewpoint will include a bridleway accommodation overbridge (AG10), Culworth cutting satellite compound and Edgcote viaduct, along with a temporary material stockpile on the east side of the Proposed Scheme. Existing intervening field boundary and riparian stream vegetation will result in some screening of the lower elements of the construction works. However, upper elements, such as cranes and tall construction plant associated with the Edgcote viaduct, will remain visible. Overall, it is considered there will be a medium magnitude of change.
- 9.4.100 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 207.4.001: View looking south-west from Banbury Lane, east of Lower Thorpe

- 9.4.101 The Proposed Scheme will cross this near distance view around 135m from the viewer. Visible foreground construction elements from this viewpoint will include the Edgcote viaduct over the River Cherwell floodplain, with the Culworth cutting satellite compound visible in the middle ground (located approximately 625m from the viewpoint). The majority of intervening vegetation will be removed through the process of construction, resulting in open views. Overall, the magnitude of change is considered to be high.
- 9.4.102 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 208.2.001: View looking west from Culworth Mill at Trafford Bridge

- 9.4.103 The Proposed Scheme will cross this near-distance view around 135m from the viewer. Visible foreground construction elements will include the Edgcote viaduct over the River Cherwell floodplain, oblique views to the south of the Culworth cutting satellite compound (approximately 390m from the viewpoint) and a temporary material stockpile on the east side of the Proposed Scheme. Vegetation immediately adjacent to the viewpoint along the roadside will be retained, although the majority of intervening vegetation beyond the immediate extents of the view will be removed during construction. The viaduct and the road diversion will form a prominent elevated feature in the landscape. Overall, the magnitude of change is considered to be high.
- 9.4.104 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.
- 9.4.105 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 208.3.003: View looking west from the Battlefields Way PRoW, east of Trafford Bridge (viewpoint located on PRoW AG/10)

- 9.4.106 The Proposed Scheme will pass within 200m of this viewpoint. The majority of intervening vegetation will be lost, opening up views of the construction of the Edgcote viaduct over the River Cherwell floodplain. The Culworth cutting satellite compound (approximately 240m from the viewpoint) will be prominent in the near to middle-ground in oblique views to the south. A temporary haul route and soil stockpile will be located to the west of the viewpoint, on the east side of the Proposed Scheme, where open views will be possible due to removal of intervening vegetation through the process of construction. Overall, the magnitude of change is considered to be high.
- 9.4.107 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoints 208.4.001, 208.4.002 and 210.4.001: Views looking west from Welsh Road, in the vicinity of Trafford Bridge

- 9.4.108 The construction of the Edgcote viaduct over the River Cherwell floodplain and excavation of Edgcote cutting and the Culworth cutting satellite compound. Oblique views of the Bridleway AG10 accommodation overbridge over the Proposed Scheme will also be possible in the near to middle-ground. These activities will be approximately 100m from viewpoint 208.4.001, immediately in front of viewpoint 208.4.002 and 300m from viewpoint 210.4.001. The majority of intervening vegetation will be removed during construction, resulting in open views of construction operations. Overall, the magnitude of change is considered to be high.
- 9.4.109 The high magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in major adverse effects.

Viewpoint 209.2.003: View looking east from Edgcote House and Viewpoint 209.3.003: View looking east from Battlefields Trail PRow, north-east of Edgcote House (viewpoint located on PRow AE/5)

- 9.4.110 The construction of the Edgcote viaduct over the River Cherwell floodplain (990m and 325m from the viewpoints, respectively) will be visible in the middle to far distance. Part of the property at Blackgrounds Farm will be demolished to enable the formation of a cutting (785m and 145m distance from viewpoints, respectively). Vegetation in proximity to the Proposed Scheme will also be removed to enable construction. Some of the riparian vegetation along the River Cherwell will be retained, contributing to screening of construction activities, particularly in the view from 209.2.003. Overall, the magnitude of change is considered to be high.
- 9.4.111 The high magnitude of change, assessed alongside the high sensitivity of the receptors, will result in a major adverse effect.
- 9.4.112 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 210.3.003: View looking south-west from ProW south of Wardenhill Farm (viewpoint located on PRow AE/12)

- 9.4.113 The Proposed Scheme will be within 765m of this viewpoint. The formation of a cutting, the construction of the Chipping Warden green tunnel and the reinstatement of footpath AE17 over the Chipping Warden green tunnel (approximately 835m from the viewpoint) will be visible in the middle to far ground. Intervening vegetation will largely be retained, although the elevated position of the viewpoint will allow views over the vegetation across to the construction elements described above. Overall, the magnitude of change is considered to be high.
- 9.4.114 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 211.3.002: View looking north-east from Jurassic Way PRow, south of Chipping Warden (viewpoint located on PRow AE/4)

- 9.4.115 The formation of a cutting, Chipping Warden green tunnel, Chipping Warden green tunnel south portal satellite compound and a temporary material stockpile on the west side of the Proposed Scheme will be visible in the middle to background of the view, approximately 700m from this viewpoint. The majority of intervening field boundary vegetation and intervening woodland blocks will be retained during construction, providing some screening and filtering of views. Taking the above into account, the magnitude of change is considered to be medium.
- 9.4.116 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 211.4.002: View looking north-east from Culworth Road, east of Chipping Warden

- 9.4.117 The majority of vegetation in the foreground will be removed to enable construction, opening up views of construction activities. The construction of the Chipping Warden

green tunnel, the reinstatement of footpaths AE12, AE20 and AE21 over the green tunnel, along with the Chipping Warden tunnel (south portal) satellite compound will all be visible in the foreground, approximately 250m from this viewpoint. Overall, the magnitude of change is considered to be high.

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

Viewpoints 211.2.001 and 211.2.002: Views looking north-east from properties on northern edge of Chipping Warden

- 9.4.119 The Proposed Scheme will cross the middle ground, approximately 360m from the viewpoint. There will be open views of the construction of the Chipping Warden green tunnel and associated Chipping Warden green tunnel main compound, along with the temporary diversion and reinstatement of the A361 Byfield Road and roadhead, south of the A361. The majority of intervening vegetation in the foreground will be removed through the process of construction. Overall, the magnitude of change is considered to be high.
- 9.4.120 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect.
- 9.4.121 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 212.4.001: View looking south-west from road leading to West Farndon

- 9.4.122 There will be elevated and open views towards the Proposed Scheme, the construction of the Chipping Warden green tunnel and the associated Chipping Warden green tunnel main compound in long distance views from the viewpoint (approximately 1.1km). This will also include the reinstatement of the A361 Byfield Road (approximately 840m from the viewpoint), and the reinstatement of footpath AE17 (approximately 1km from the viewpoint). Overall, the magnitude of change is considered to be medium.
- 9.4.123 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 213.6.001: View looking north-east from Appleton Industrial Estate

- 9.4.124 Existing, intervening vegetation will partially screen views of the construction of the Chipping Warden green tunnel, the Appletree Lane reinstatement and the reinstatement of footpath AA8, approximately 500m from the viewpoint in the middle-distance. Overall, the magnitude of change is considered to be medium.
- 9.4.125 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoints 213.4.002 and 214.4.001: Views looking towards the Proposed Scheme from Appletree Lane south-west of Aston le Walls

- 9.4.126 The majority of intervening vegetation will be removed through the process of construction. This will open up views of the construction of the Chipping Warden green tunnel, the Appletree Lane reinstatement and the reinstatement of the footpath AA8, approximately 200m from the viewpoint in the near to middle distance. Overall, the magnitude of change is considered to be high.
- 9.4.127 The high magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in a major adverse effect.

Viewpoint 214.2.001: View looking south-west from properties on the south-western edge of Aston le Walls

- 9.4.128 There will be direct views of the construction of the Chipping Warden green tunnel and the reinstatement of Appletree Lane in middle distance views (approximately 550m from the viewpoint) and oblique views to the south-west of the Chipping Warden green tunnel main compound, approximately 520m from the viewpoint in the middle-ground. The majority of intervening field boundary, roadside vegetation and intervening woodland blocks will be retained during construction, screening views in places. However, views are possible of the Proposed Scheme where gaps in vegetation cover occur. Overall, the magnitude of change is considered to be high.
- 9.4.129 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.
- 9.4.130 Given the rural location of the viewpoint, the night-time view will be affected by construction lighting associated with the Chipping Warden green tunnel main compound. Intervening vegetation will provide some screening. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 214.4.002: View looking west from crossroads of the A361 Byfield Road and Welsh Road, south-east of Aston le Walls

- 9.4.131 Construction elements visible in the middle to background of the view, approximately 900m from the viewpoint, will include the Chipping Warden green tunnel, the Chipping Warden green tunnel main compound (approximately 540m from the viewpoint) and the reinstatement of the A361 Byfield Road (approximately 575m from the viewpoint), along with areas of temporary material stockpile to both sides of the Proposed Scheme (approximately 610m from the viewpoint). There will also be oblique views to the west of the reinstatement of Appletree Lane over the Chipping Warden green tunnel. Existing vegetation in the foreground will partially screen and filter the construction activities. Overall, the magnitude of change is considered to be medium.
- 9.4.132 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 215.2.001: View looking north-east from Hilltop Cottage and Field Farm, north-east of Appletree and Viewpoint 215.3.001: View looking north-east from Macmillan Way PRow south-west of Appletree

- 9.4.133 The majority of intervening vegetation including woodland blocks will be retained, partially screening and filtering views. There will be glimpsed views of the Proposed Scheme in cutting, the Chipping Warden green tunnel, the reinstatement of footpath AA8, and the viaduct over the Highfurlong Brook flood plain in the middle-ground, approximately 420m (viewpoint 215.2.001) and 1.5km (215.3.001) from the viewpoints. Overall, the magnitude of change is considered to be medium.
- 9.4.134 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect.
- 9.4.135 Given the rural location of viewpoint 215.2.001, the night-time view will be affected by construction lighting, particularly in relation to the Chipping Warden green tunnel north portal. Intervening vegetation will provide some screening. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 216.2.001: View looking west from properties on western edge of Aston le Walls

- 9.4.136 Visible elements of construction in the middle-ground, approximately 700m from the viewpoint, will include a section of Chipping Warden green tunnel, a length of cutting, a short section of embankment and oblique views of the viaduct over the Highfurlong Brook flood plain. The majority of the intervening vegetation will be retained during construction, contributing to the screening and filtering of construction activities. Overall, the magnitude of change is considered to be medium.
- 9.4.137 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.
- 9.4.138 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 216.7.001: View looking south-west from Washbrook Farm Eventing Centre

- 9.4.139 The construction of various parts of the Proposed Scheme will be visible in the middle ground and background of this view, approximately 500m from the viewpoint. This will include views of the construction of the viaduct over Highfurlong Brook floodplain to the north-east, Claydon Road overbridge (1km from the viewpoint) and the Claydon Road overbridge satellite compound (1.1km from the viewpoint), in combination with more general construction activity and earthworks. The vegetation in the foreground will be retained, screening the lower elements of construction in places. Overall, the magnitude of change is considered to be medium.
- 9.4.140 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 218.4.001: View looking south-west from Banbury Road, to the south of Lower Boddington

- 9.4.141 The construction of the Proposed Scheme will be visible in the middle-ground of the view, around 300m from the viewpoint. Elements of construction which will be visible include the viaduct over the Highfurlong Brook floodplain in oblique views to the south-east (approximately 750m from the viewpoint), Claydon Road overbridge (745m from the viewpoint) and Claydon Road overbridge satellite compound (approximately 780m from the viewpoint). Existing vegetation retained in the foreground and middle ground will partially filter the lower elements of construction. The overall magnitude of change is considered to be medium.
- 9.4.142 The medium magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in a moderate adverse effect.

Viewpoint 220.4.001: View looking south-west from Banbury Road, to the west of Lower Boddington and 217.4.001: View looking north-east from Claydon Road, south of Lower Boddington

- 9.4.143 The construction of the Proposed Scheme will be visible in the foreground and middle-ground of these views, around 200m from viewpoint 217.4.001 and including some elements of construction work immediately adjacent to viewpoint 220.4.001. Elements of construction which will be visible include the viaduct over the Highfurlong Brook floodplain in oblique views to the south-east, the Claydon Road overbridge and Claydon Road overbridge satellite compound. Vegetation retained in the foreground will partially filter the lower elements of construction. The overall magnitude of change is considered to be high.
- 9.4.144 The high magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in a major adverse effect.

Viewpoint 217.3.002: View looking north-west from the PRow network north-east of Springfield House (viewpoint located on PRow AC/1) and Viewpoint 218.2.001: View looking south-west from properties on the south-western edge of Lower Boddington

- 9.4.145 There will be open views across arable fields of the construction of cuttings and embankments, Claydon Road overbridge (approximately 200m from the viewpoints) and Claydon Road overbridge satellite compound in the foreground. Although the intervening landscape is generally open with limited vegetation, a well maintained roadside hedgerow in the foreground will screen views at ground level from viewpoint 218.2.001. Views will remain open from upper levels of properties at this viewpoint. Given the generally open intervening landscape, the construction works associated with the Proposed Scheme
- 9.4.146 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect.
- 9.4.147 Given the rural location of viewpoint 218.2.001, the night-time view will be affected by construction lighting associated with Claydon Road overbridge satellite compound.

Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 219.2.001: View looking north-east from Cedars Farm, west of Lower Boddington

- 9.4.148 The construction of the Proposed Scheme will be visible in the foreground of this view, approximately 200m from the viewpoint. Oblique views to the west will be possible of construction of the Cedars Farm access road. Existing roadside and field boundary vegetation will be removed during construction. Overall, the magnitude of change is considered to be high.
- 9.4.149 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.
- 9.4.150 The night-time effect of construction lighting will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 220.3.001: View looking south-west from PRow network on the southern edge of Upper Boddington (viewpoint located on PRow AC/11)

- 9.4.151 The majority of the intervening vegetation will be retained, providing a screening or filtering effect. The construction of Banbury Road overbridge, Banbury Road overbridge satellite compound and Claydon Road (also known as Boddington Road) diversion will be visible in long distance views, approximately 1.3km distant to the south-west and the Cedars Farm private access road to the west. Overall, the magnitude of change is considered to be high.
- 9.4.152 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 221.4.001: View looking north-east from Claydon Road, north of Three Shires Farm

- 9.4.153 The removal of intervening vegetation will result in open views of the construction of Banbury Road overbridge (Thorpe Mandeville), the Claydon Road (also known as Boddington Road) diversion and Banbury Road green overbridge satellite compound to the north-east in the middle-ground (approximately 600m from the viewpoint). The Cedars Farm access road is visible in the foreground (approximately 45m) in oblique views to the east. Overall, the magnitude of change is considered to be high.
- 9.4.154 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect.

Viewpoints 222.2.001 and 222.2.002: Views looking south-west from Hill Farm and Spella House, west of Lower Boddington

- 9.4.155 The removal of intervening vegetation will give rise to open views of construction elements in close proximity to the viewpoint (approximately 100m) including the formation of a cutting, the realignment of Claydon Road (also known as Boddington Road), the Banbury Road overbridge satellite compound and construction of Banbury Road overbridge. Overall, the magnitude of change is considered to be high.

- 9.4.156 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect.
- 9.4.157 Given the rural location of the viewpoint, the night-time view will be affected by construction lighting associated with the Banbury Road green overbridge satellite compound. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Cumulative effects

- 9.4.158 Section 2.1 and Appendix CT-004-015 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the construction of the Proposed Scheme. The consequential cumulative effect of these developments on LCAs and viewpoints is described below. These developments are shown in Map Series CT-10 (Volume 2, CFA15 Map Book).
- 9.4.159 Due to the combined presence of construction activity and plant at the Proposed Scheme and the photovoltaic park development at Culworth Grounds Farm, effects on the following receptors, which are significant when considering the construction of the Proposed Scheme on its own, would be exacerbated:
- Middleton Cheney and Woodford Halse Undulating Hills and Valleys LCA; and
- 9.4.160 Viewpoint 202.3.002: View looking south-west from PRoW north-east of Lower Thorpe.
- 9.4.161 The proposed extension to commercial buildings at the Appletree Industrial Estate (Chipping Warden) will not give rise to cumulative effects as it is assumed to be proportionate in scale, extent and character to the existing buildings.
- 9.4.162 There are no known instances where receptors, which will not be significantly affected by the construction of the Proposed Scheme on its own, will be significantly adversely affected by the combined presence of construction activity and plant from the surrounding developments.

Other mitigation measures

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

Summary of likely residual significant effects

- 9.4.164 The effects described above will be temporary and reversible in nature lasting only for the duration of the construction works. Any residual effects will generally arise from the widespread presence of construction activity and construction plant within the

landscape and viewed from surrounding residential receptors, and users of PRow and main roads within the study area.

9.5 Permanent effects arising during operation

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

- Greatworth green tunnel portals;
- Lower Thorpe viaduct and cuttings;
- Edgcote viaduct;
- Culworth Road realignment;
- Chipping Warden green tunnel portals;
- Highfurlong Brook viaduct;
- Claydon Road overbridge;
- Banbury Road overbridge;
- Proposed Scheme maintenance loops cutting;
- footpath and bridleway overbridges generally along the length of the Proposed Scheme;
- earthworks cuttings and embankments generally along the length of the Proposed Scheme; and
- change in land use due to severance of agricultural land (see Agriculture, forestry and soils, Section 3).

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 and this process will continue as the design develops further. Measures that have been incorporated into the design of the Proposed Scheme thus far include:

- embankment and cuttings, both for the route and highway realignments, have been shaped so as to integrate the Proposed Scheme into the character of the surrounding landscape. Planting will reflect tree and shrub species semi-native to the UK and characteristic of the local LCA;
- where it is considered that a noise fence barrier will create a visual impact on neighbouring residential properties, landscape planting or earthworks will be considered where reasonably practicable;
- balancing ponds will be integrated into the landscape to alleviate flooding and also provide opportunities for biodiversity; and

- planting, including semi-native broad-leaved woodland, shrub and hedgerows, and landscape earthworks will be implemented along various sections of the route 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. The selection of species will take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases.

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

Assessment of impacts and effects

9.5.4 The likely significant effects on the landscape character and viewpoints as a result of the operation of the Proposed Scheme will arise from new engineered landforms cutting across the existing landscape; the introduction of new viaducts up to 9m high⁶² with associated infrastructure; the introduction of noise fence barriers that will create a man-made linear feature; permanent severance of land; the introduction of highway infrastructure into the rural environment, including road bridges; the introduction of overhead line equipment; and the introduction of regular high speed trains. At a number of locations, views of the Proposed Scheme will be obscured by the rising landform, retention of intervening hedgerows and trees and the route within a cutting. Furthermore, effects will reduce over time as planting established as part of the Proposed Scheme matures.

Landscape assessment

9.5.5 This section describes the significant effects on LCAs during year 1, year 15 and year 60 of operation. Non-significant effects on LCAs are presented in Volume 5: Appendix LV-001-015 Part 4.

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

The Tove Catchment Undulating Claylands LCA

9.5.7 Between Halse Copse and Greatworth the Proposed Scheme will pass through an undulating profile of 5 – 10m deep cuttings, with associated 3m high false cuttings. False cuttings are artificially raised earth bunds implemented for the purpose of creating an additional height earthwork to contribute visual screening or acoustic containment benefits. A short length of 3m high embankment west of Greatworth Hall will then lead into a 4m deep cutting before entering the south portal of Greatworth green tunnel. Impacts on the landscape character of this LCA in year 1 of operation will include:

- engineered landforms with steep slopes cutting across the natural landform, which will be uncharacteristic in the context of the adjacent landscape;

⁶² Viaduct heights are given to rail level.

- overhead line equipment and moving trains which present a perceptible infrastructure influence within a largely rural context, particularly apparent within the landscape setting south-east of Greatworth;
- structures, including three pedestrian overbridges and tunnel portal structures at either end of Greatworth green tunnel, which will result in perceptible built form within a typically rural setting;
- restoration of landscape elements above the Greatworth green tunnel; and
- permanent severance of agricultural land in places, within a general presumption for farmland to be reinstated and returned to agricultural use.

9.5.8 There will be a reduction in tranquillity as a consequence of the movement and noise of trains in the predominantly rural context, particularly apparent in the vicinity of Halse Copse.

9.5.9 Overall, the presence of rail infrastructure, landform and bridges, along with the presence of high speed trains will have an apparent influence on parts of the LCA. However, much of the LCA will be unaffected. This will result in a medium magnitude of change to the character area in year 1 of operation.

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

9.5.11 By year 15 and beyond to year 60 of operation of operation, planting will have established sufficiently to contribute to greater landscape integration of the Proposed Scheme into the rural landscape, including through:

- softening the boundaries between engineered earthworks and natural landform and integrating infrastructure components, such as the Greatworth green tunnel portals, into the setting; and
- re-integration of fragmented landscape elements including hedgerows and tree cover, and in particular beginning to address the landscape character loss of ancient woodland at Halse Copse.

9.5.12 As an outcome of the integrating effect of mitigation planting, effects will be reduced to non-significant in year 15 and year 60 of operation.

9.5.13 However, these estimates may be altered by the impacts of extreme weather events and climate change. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Middleton Cheney and Woodford Halse Undulating Hills and Valleys LCA

9.5.14 The Proposed Scheme will emerge from Greatworth green tunnel into a 15m deep cutting, then grade through onto a 9m high embankment leading onto a 9m high viaduct at Lower Thorpe. The route will then pass through a series of cuttings and embankments (including the 25m deep cutting north of Lower Thorpe) before crossing a 9m high viaduct at Edgcote. The route will then pass through a 3 – 5m deep cutting before entering Chipping Warden green tunnel. Impacts on the landscape character of this LCA in year 1 of operation will include:

- engineered landforms with steep slopes cutting across the natural landform, which will be uncharacteristic in the context of the adjacent landscape and which will be particularly apparent at Lower Thorpe and Edgcote, where engineered landform contrasts with smaller scale, intimate natural valley landscapes;
- overhead line equipment and moving trains which will present a perceptible infrastructure influence within a largely rural context, particularly apparent within the landscape setting between Thorpe Mandeville and Edgcote;
- elevated structures, including viaducts at Lower Thorpe and Edgcote, highway and pedestrian overbridges and tunnel portal structures at either end of Chipping Warden green tunnel, which will result in perceptible built form within a typically rural setting;
- restoration of landscape elements above the Chipping Warden green tunnel;
- noise fence barriers at Lower Thorpe as a distinct linear feature, contrasting with the natural landscape; and
- permanent severance of agricultural land in places, within a general presumption for farmland to be reinstated and returned to agricultural use. There will be a reduction in tranquillity as a consequence of the movement and noise of trains in the predominantly rural context.

9.5.15 Overall, the presence of rail infrastructure, landform and bridges, along with the presence of high speed trains will have an apparent influence on parts of the LCA. However, much of the LCA will be unaffected. This will result in a medium magnitude of change to the character area in year 1 of operation.

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

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

- softening the boundaries between engineered earthworks and natural landform and integrating infrastructure components, such as Lower Thorpe and Edgcote viaducts, into the setting; and
- partially screening overhead line equipment and trains on embankment, re-integration of fragmented landscape elements including hedgerows and tree cover, and in particular addressing the re-definition of vegetation patterns associated with the more intimate valley landscapes at Lower Thorpe and Trafford Bridge.

9.5.18 As an outcome of the integrating effect of mitigation planting, effects will be reduced to non-significant in year 15 and year 60 of operation.

9.5.19 However, these estimates may be altered by the impacts of extreme weather events and climate change. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Eydon Ironstone Hills LCA

- 9.5.20 The Proposed Scheme will not pass through this LCA, therefore landscape elements will not be directly impacted upon during operation. The Chipping Warden green tunnel will contribute notably to reducing indirect landscape impacts on the LCA by concealing the route. However a section of the Proposed Scheme between Thorpe Mandeville and Lower Boddington will indirectly influence the setting of the LCA. Indirect setting impact on the landscape character of this LCA in year 1 of operation will include:
- engineered landforms with steep slopes cutting across the natural landform, which will be uncharacteristic in the context of the adjacent topography and which will be particularly apparent between the southern portal of Chipping Warden green tunnel and Edgcote where the earthwork cuts a notable line across the general landform profile;
 - overhead line equipment and moving trains which will present a perceptible infrastructure influence within a largely rural context, and which will be particularly apparent within the landscape setting south of Chipping Warden;
 - elevated structures, including a viaduct at Edgcote, highway and pedestrian overbridges and the southern tunnel portal structure of Chipping Warden green tunnel, which will result in perceptible built form within a typically rural setting; and
 - restoration of landscape elements above Chipping Warden green tunnel.
- 9.5.21 The tranquillity of this LCA will be affected by the presence of new infrastructure and high speed trains within the predominantly rural context.
- 9.5.22 Overall, the indirect influence of rail infrastructure, landform and bridges, along with the presence of high speed trains will have an apparent influence on parts of the LCA. However, much of the LCA will be unaffected. This will result in a medium magnitude of change to the character area in year 1 of operation.
- 9.5.23 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in an indirect moderate adverse effect in year 1 of operation.
- 9.5.24 By year 15 of operation, planting will have established sufficiently to contribute to greater landscape integration of the Proposed Scheme into the adjacent LCA rural landscape, including through:
- softening the boundaries between engineered earthworks and natural landform and integrating infrastructure components, such as Edgcote viaduct, into the setting; and
 - re-integration of fragmented landscape elements including hedgerows and tree cover, and in particular addressing the re-definition of vegetation patterns associated with the more intimate valley landscape at Trafford Bridge.
- 9.5.25 As an outcome of the integrating effect of mitigation planting, effects will be reduced to non-significant in year 15 and year 60 of operation.

9.5.26 However, these estimates may be altered by the impacts of extreme weather events and climate change. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Boddington Broad Unwooded Vale LCA

9.5.27 The Proposed Scheme will exit the Chipping Warden green tunnel before crossing a 9m high embankment leading onto Highfurlong Brook viaduct. The route will then pass through an extensive area of 4-6m high false cuttings before entering a cutting up to 15m deep coincident with a maintenance loop. Effects on the landscape character of this LCA in year 1 of operation will include:

- engineered landforms with steep slopes associated with the maintenance loop to the north-west of Lower Boddington, which will be uncharacteristic in the context of the adjacent topography;
- extensive false cutting earthworks up to 5m above the adjacent track level extending across the landscape west of Lower Boddington;
- overhead line equipment and moving trains, which will present a perceptible infrastructure influence within a largely rural context;
- noise fence barriers adjacent to the north portal of Chipping Warden green tunnel as a distinct linear feature, contrasting with the natural landscape;
- permanent severance of agricultural land in places, within a general presumption for farmland to be reinstated and returned to agricultural use; and
- elevated structures, including a viaduct across Highfurlong Brook and highway overbridges, which will result in perceptible built form within a typically rural setting.

9.5.28 The tranquillity of this LCA will be affected by the presence of new infrastructure and high speed trains within the predominantly rural context.

9.5.29 Overall, the presence of rail infrastructure, landform and bridges, along with the presence of high speed trains will have an apparent influence on parts of the LCA. However, much of the LCA will be unaffected. This will result in a medium magnitude of change to the character area in year 1 of operation.

9.5.30 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.

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

- softening the boundaries between engineered earthworks and natural landform and integrating infrastructure components, such as the maintenance loop to the north-west of Lower Boddington, into the setting; and

- re-integration of fragmented landscape elements including hedgerows and tree cover, and in particular addressing the re-definition of field patterns severed by the route of the Proposed Scheme.

9.5.32 As an outcome of the integrating effect of mitigation planting, effects will be reduced to non-significant in year 15 and year 60 of operation.

9.5.33 However, these estimates may be altered by the impacts of extreme weather events and climate change. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Boddington Low Pastoral Hills LCA

9.5.34 The Proposed Scheme will pass through this LCA to the north of Upper Boddington within a cutting up to 15m deep. The majority of influence on this LCA will, however, result from indirect impacts on the setting of the adjacent Boddington Broad Unwooded Vale LCA. Direct effects on the character of this LCA in year 1 of operation will include:

- engineered landforms with steep slopes cutting across the natural landform, which will be uncharacteristic in the context of the adjacent landscape; and
- permanent severance of agricultural land in places, within a general presumption for farmland to be reinstated and returned to agricultural use.

9.5.35 Indirect effects on the character of this LCA in year 1 of operation will include:

- extensive false cutting earthworks up to 6m above the adjacent track level extending across the landscape west of Lower Boddington;
- overhead line equipment and moving trains which will present a perceptible infrastructure influence within a largely rural context; and
- elevated structures, including a viaduct across Highfurlong Brook and highway overbridges, which will result in perceptible built form within a typically rural setting.

9.5.36 The tranquillity of this LCA will be affected by the presence of new infrastructure and high speed trains within the predominantly rural context.

9.5.37 Overall, the direct and indirect influence of rail infrastructure, landform and bridges, along with the movement and noise of trains, will result in a medium magnitude of change to the character area in year 1 of operation.

9.5.38 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.

9.5.39 By year 15 of operation, planting will have established sufficiently to contribute to greater landscape integration of the Proposed Scheme into the immediate and adjacent LCA rural landscape, including through:

- softening the boundaries between engineered earthworks and natural landform and integrating infrastructure components, such as the maintenance loop to the north-west of Lower Boddington, into the setting; and

- re-integration of fragmented landscape elements including hedgerows and tree cover, and in particular addressing the re-definition of field patterns severed by the route of the Proposed Scheme.

9.5.40 As an outcome of the integrating effect of mitigation planting, effects will be reduced to non-significant in year 15 and year 60 of operation.

9.5.41 However, these estimates may be altered by the impacts of extreme weather events and climate change. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Visual assessment

9.5.42 This section describes the significant effects on visual receptors during year 1, year 15 and year 60 of operation. Effects on visual receptors that are not significant are presented in Volume 5: Appendix LV-001-015 Part 4.

9.5.43 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.

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

9.5.45 The number identifies the viewpoint locations which are shown in Maps LV-04-056 to LV-04-063, Volume 2, CFA15 Map Book. 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.

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

Viewpoint 189.3.001: View looking north-east from the PRow network south-east of Halse (viewpoint located on PRow AN/24)

9.5.47 The upper elements of the Proposed Scheme (including the trains and overhead line equipment) will be visible towards the middle to background of the view (900m). The depth of cutting and height of embankment will vary between approximately 5.5m depth and 2.5m height, with additional landscape earthworks up to 5m high on the west side of the Proposed Scheme, and intermittently present on the east side. The footpath overbridge (Footpath AN22) will be visible in the background, in oblique views to the north. Retained field boundary vegetation will screen the lower elements of the Proposed Scheme such as the tracks and track-bed. Hedgerow mitigation planting will be located along the top of the bunds to the east and west of the Proposed Scheme. However at year 1 will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

- 9.5.48 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in moderate adverse effects in the winter of year 1 operation.
- 9.5.49 In the summer of year 1 operation, vegetation will provide enhanced screening, although it will not be sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in a moderate adverse effect.
- 9.5.50 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme, although the upper elements, such as the overhead line equipment, will remain visible. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 191.3.003: View east from the PRow network south of Halse Cope South

- 9.5.51 The Proposed Scheme will cross the middle-ground extent of view around 400m from the viewpoint. The Bridleway AX18 accommodation overbridge will be visible in the foreground, in direct views to the north-east. Greatworth south cutting to the north-east of the viewpoint will result in the screening of the lower elements of the Proposed Scheme. Landscape earthworks to the west of the Proposed Scheme will contribute further to screening of lower elements. Mitigation hedgerow planting will be located along the top of the earthwork, although at year 1 it will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is assessed as medium.
- 9.5.52 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in moderate adverse effects in the winter of year 1 of operation.
- 9.5.53 In summer of year 1 of operation, there will be little enhanced screening effect from intervening vegetation. Therefore, effects will be unchanged.
- 9.5.54 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme. This will reduce effects to non-significant. These are reported in Volume 5: Appendix 15.4.

Viewpoint 192.3.001: View west from the PRow network south of Halse Cope South (viewpoint located on PRow AN/22)

- 9.5.55 To the west of the viewpoint, the majority of the Proposed Scheme (including the tracks, trains and overhead line equipment) will be visible towards the middle to background of the viewpoint (200m from the viewpoint). The depth of cutting and height of embankment will vary between approximately 7m depth and 2.5m height, with additional 3m high landscape earthworks providing screening on the west side of the Proposed Scheme, and intermittently present on the east side. The footpath overbridge (Footpath AN22) will be visible in open direct views in the foreground and introduce a new element into views. Retained vegetation associated with Halse Cope to the north will partially screen oblique views of the Proposed Scheme to the north-west. Landscape mitigation planting will be located to the sides of the footpath

overbridge. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is assessed as high.

9.5.56 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in the winter of year 1 of operation.

9.5.57 In summer of year 1 of operation, there will be little enhanced screening effect from intervening vegetation. Therefore, effects will be unchanged.

9.5.58 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 193.2.002: View looking east, north-east from Halse Copse Farm

9.5.59 The upper elements of the Proposed Scheme (including the trains and overhead line equipment) will be visible towards the middle ground, along with the bridleway accommodation overbridges AN37 and AN14 (600m from the viewpoint). The depth of cutting at this point will vary between approximately 2.5m and 8.5m depth, with additional 3m high landscape earthworks providing screening on both sides of the Proposed Scheme. Any retained field boundary vegetation will partially screen views of the lower elements of the Proposed Scheme such as the tracks and track-bed. Mitigation hedgerow planting will be located along the top of the landscape earthworks on both sides of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Taking the above into account, 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 the winter of year 1 of operation.

9.5.61 In summer of year 1 of operation, vegetation will provide additional screening. However, this will not be sufficient to result in any change in magnitude of effect. Therefore, the magnitude of effect is considered to remain medium and as such will also result in a moderate adverse effect.

9.5.62 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

9.5.63 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 192.3.002: View south-west from the PRow network south of B4525 road (viewpoint located on PRow AP/18)

9.5.64 The upper elements of the Proposed Scheme (including the trains and overhead line equipment), along with footpath overbridges (footpaths AN19, AN28, AN37 and Bridleway AN14) will be visible towards the middle ground to back ground of the view (900m from the viewpoint). The depth of cutting at this point will vary in depth up to 8.5m, with additional 3m high landscape earthworks providing screening on both

sides of the Proposed Scheme resulting in lower elements of the Proposed Scheme being screened. Retained vegetation associated with the field boundaries will contribute to partially screening the lower elements of the Proposed Scheme such as the tracks and track-bed. An area of woodland habitat creation will be located to the east side of the Proposed Scheme along with hedgerow planting along the top of the landscape earthworks on both sides of the track. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

- 9.5.65 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.66 In summer of year 1 operation, vegetation will provide enhanced screening, although it will not be sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in a moderate adverse effect.
- 9.5.67 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 193.3.002 and 195.3.001: Views west from the PRow network between Halse Copse North and Greatworth (viewpoint located on PRow AN/18 and PRow AN/17 respectively)

- 9.5.68 The upper elements of the Proposed Scheme (including the trains and overhead line equipment), along with Bridleway AN14 accommodation overbridge will be visible towards the middle ground (approximately 800m from the viewpoint). The depth of cutting and height of embankment at this point will vary between approximately 10m depth and 2.5m height, with additional 3m high landscape earthworks providing screening on both sides of the Proposed Scheme. Any retained vegetation associated with the field boundaries will partially screen the lower elements of the Proposed Scheme such as the tracks and track-bed. Mitigation hedgerow planting will be located along the top of the landscape earthworks on both sides of the track. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.69 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.70 In summer of year 1 of operation, vegetation will enhance screening, although not sufficiently to change the view noticeably. Therefore, the magnitude of change is considered to remain medium and as such will also result in a moderate adverse effect.
- 9.5.71 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme, although the overhead line equipment will remain visible. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 194.2.001 and 196.2.001: Views looking south-west from property (The Bungalow) to east of Greatworth Hall and Greatworth Hall

- 9.5.72 The majority of the Proposed Scheme (including the trains, overhead line equipment and noise fence barriers) will be visible in the foreground of the view, along with the realignment of Helmdon Road over Greatworth green tunnel (100m from the viewpoint). The depth of cutting at this point will vary between approximately 2.5m and 10m depth, with additional landscape earthworks providing screening on both sides of the Proposed Scheme up to a 6m high. In addition, noise fence barriers will be located on the west side of the Proposed Scheme, adjacent to viewpoint 196.2.001. This will contribute to a shortening of views, reducing openness and screening the lower elements of the Proposed Scheme. Existing vegetation will provide limited screening, aside from retained vegetation within the garden of The Bungalow. Mitigation hedgerow planting will be located to both sides of the Proposed Scheme and landscape mitigation planting will be located in the vicinity of Greatworth Hall. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.73 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.74 In summer of year 1 of operation, as there is limited intervening vegetation, there will be no change in the view. Taking the above in account the magnitude of effect is considered to remain medium and will also result in moderate adverse effects.
- 9.5.75 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.76 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment from Greatworth Hall (viewpoint 196.2.001). This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4. There is limited mitigation planting in the view from The Bungalow (194.2.001), therefore there will be little change in the view in year 15 or 60 aside from maturation of grassland habitat. Therefore, the magnitude of effect is considered to be medium, resulting in moderate adverse effects.

Viewpoints 193.3.001 and 195.2.001: Views looking north, north-east from PRow north-west of property at Greatworth Fields (viewpoint located on PRow AN/14) and north-east from properties on eastern edge of Greatworth

- 9.5.77 The upper elements of the Proposed Scheme (including the trains, overhead line equipment and noise fence barriers), along with the top of Greatworth green tunnel south portal and Helmdon Road realignment (approximately 300m from the viewpoint) will be visible in generally open views towards the middle ground. The depth of cutting and height of embankment will vary between approximately 10m depth and 2.5m height, with additional 3m high landscape earthworks providing screening on both sides of the Proposed Scheme. Any retained field boundary vegetation will partially screen the lower elements of the Proposed Scheme such as

the tracks and track-bed. Noise fence barriers will be visible on the west side of the tracks, adjacent to Greatworth Hall, further restricting views in this direction. Mitigation planting will be located to both sides of the Proposed Scheme in the vicinity of Greatworth Hall and along the north side of the Helmdon Road realignment. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be high.

- 9.5.78 The view of the Proposed Scheme from viewpoint 195.2.001 in the winter of year 1 of operation is illustrated on the photomontage shown in Map LV-01-097 (Volume 2, CFA15 Map Book).
- 9.5.79 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect in the winter of year 1 of operation.
- 9.5.80 In summer of year 1 of operation, existing vegetation will not change the view noticeably. Therefore, the magnitude of change is considered to remain high and as such will also result in a major adverse effect.
- 9.5.81 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.82 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, partially screening the Proposed Scheme. Therefore, the magnitude of change is considered to reduce to medium, resulting in moderate adverse effects.

Viewpoint 196.3.001: View looking south, south-west from PRow north-east of Greatworth (viewpoint located on PRow AN/13)

- 9.5.83 The upper elements of the Proposed Scheme (including the trains, overhead line equipment and noise fence barriers), will be visible in generally open views towards the middle ground (300m from the viewpoint). The depth of cutting and height of embankment will vary between approximately 10m depth and 2.5m height, with additional 3m high landscape earthworks providing screening on both sides of the Proposed Scheme. Any retained field boundary vegetation will partially screen the lower elements of the Proposed Scheme such as the tracks and track-bed. Noise fence barriers will be visible on the west side of the tracks, adjacent to Greatworth Hall, shortening views in this direction. Mitigation planting will be located to both sides of the Proposed Scheme in the vicinity of Greatworth Hall and along the north side of the Helmdon Road realignment. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.84 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.85 In summer of year 1 of operation, existing vegetation will not change the view noticeably. Therefore, the magnitude of change is considered to remain medium and as such will also result in a moderate adverse effect.

- 9.5.86 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, partially screening the Proposed Scheme. The potential for localised elements of the tunnel portal to remain visible will, however, result in a medium magnitude of change, and moderate adverse effects.

Viewpoint 197.6.002: View looking north-east from Greatworth Park

- 9.5.87 Greatworth green tunnel will be visible in near distance views from this viewpoint (100m from the viewpoint). The majority of intervening field boundary vegetation and vegetation associated with Greatworth Park will be removed, although a proportion of the vegetation around the perimeter of Greatworth Park will be retained, filtering views of the Proposed Scheme in places. The engineered slopes of Greatworth green tunnel will be visible in views from Greatworth Park and although filtered in places by existing perimeter vegetation, open views will be possible. Therefore, the magnitude of change is considered to be high.
- 9.5.88 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.89 In summer year 1 of operation, existing vegetation will provide limited additional screening. Therefore, the magnitude of change is considered to remain high and as such will also result in moderate adverse effects.
- 9.5.90 By year 15 and beyond to year 60 of operation, the reinstatement of landscape components will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 197.3.002: View looking north-east from PRow east of Marston St Lawrence (viewpoint located on PRow AN/39)

- 9.5.91 Greatworth green tunnel will be visible in near to middle distance views from this viewpoint (100m from the viewpoint). The reinstatement of two footpaths (AN39 and AN10) will be visible from the viewpoint, along with the B4525 Welsh Road reinstatement over Greatworth green tunnel (140m from the viewpoint). Hedgerow planting along existing field boundaries will be undertaken as part of the mitigation approach. This will help filter views of the engineered slopes of Greatworth green tunnel, although effects will be limited at year 1 due to the young age and limited height of the planting. Therefore, the magnitude of change is considered to be medium.
- 9.5.92 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.93 In summer year 1 of operation, vegetation will provide further screening, although this will not be sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.
- 9.5.94 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely filtering views and softening the appearance of the Proposed Scheme. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 199.4.002: View looking east from Sulgrave Road, east of Thorpe Mandeville

- 9.5.95 Greatworth green tunnel and Greatworth green tunnel north portal will be visible in near distance views (150m from the viewpoint) to the east and south-east of this viewpoint. To the north-east of the view, an area of mitigation planting will be visible, associated with north portal of Greatworth green tunnel and the beginning of Thorpe Mandeville cutting. However, due to the young age of the planting, it will have limited screening effects at year 1. Therefore, the magnitude of change is considered to be medium.
- 9.5.96 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.97 In summer year 1 of operation, vegetation will provide further screening, although this will not be sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.
- 9.5.98 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 200.3.001: View looking west from PRow west of Sulgrave (viewpoint located on PRow BB/3)

- 9.5.99 Lower Thorpe viaduct, Banbury Road realignment and Culworth Grounds accommodation overbridge will be visible in middle distance views from this viewpoint (400m from the viewpoint). Intervening vegetation and topography will partially screen the Proposed Scheme in places. To the north-east, the height of viaduct and depth of cutting will vary between approximately 7m height and 1.5m depth, which will allow upper elements of the Proposed Scheme (such as the trains and overhead line equipment) to be visible in places. Mitigation planting will be located to both sides of the Proposed Scheme at the north portal of Greatworth green tunnel. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.100 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.101 In summer year 1 of operation, vegetation will provide a degree of enhanced screening. The magnitude of effect is however considered to remain medium and as such will result in a moderate adverse effect.
- 9.5.102 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 201.2.001 and 201.2.002: Views looking north-east from Banbury Lane towards Lower Thorpe

- 9.5.103 The upper elements of the Proposed Scheme (including trains, noise fence barriers and overhead line equipment) will be intermittently visible in the middle ground of this viewpoint. Lower Thorpe viaduct will be visible in direct views and the Banbury Road realignment in oblique views (400m from the viewpoint). The depth of cutting and height of the viaduct at this point will vary between approximately 0.5m depth and 7m height. Noise fence barriers will be located on the west side of the tracks, east of Thorpe Mandeville, resulting in a permanent visual feature, which will provide some screening of moving trains. Mitigation planting will be located to both sides of the Proposed Scheme at the north portal of Greatworth green tunnel and to the north of Thorpe Mandeville. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be high.
- 9.5.104 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.
- 9.5.105 The view of the Proposed Scheme from viewpoint 201.2.002 in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-098 (Volume 2, CFA15 Map Book).
- 9.5.106 In summer of year 1 of operation, there will be no additional screening effect. Therefore, the magnitude of change will remain high, resulting in major adverse effects.
- 9.5.107 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.108 By year 15 and beyond to year 60 of operation, there will be little change in the view from viewpoint 201.2.001, due to the limited mitigation planting in the vicinity of the viewpoint. Major adverse effects are considered to remain. Views from viewpoint 201.2.002 will be screened and filtered to the east due to maturing mitigation planting north of Thorpe Mandeville, therefore moderate adverse effects are reported.

Viewpoints 201.3.002 and 203.3.003: Views looking north-east to east from the PRow network north of Thorpe Mandeville (viewpoints located on PRow BB/5 and AG/10 respectively)

- 9.5.109 Lower Thorpe viaduct, Banbury Road realignment and Culworth Grounds accommodation overbridge will be visible from these viewpoints approximately 700m away. Intervening vegetation and topography will screen the Proposed Scheme in places. To the north-east, the height of viaduct and depth of cutting will vary between approximately 7m height and 1.5m depth, which will allow upper elements of the Proposed Scheme such as the trains and overhead line equipment to be visible in places. Mitigation planting will be located to both sides of the Proposed Scheme at the north portal of Greatworth green tunnel and in the vicinity of Lower Thorpe. However, at year 1 the vegetation will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

- 9.5.110 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.111 In summer year 1 of operation, vegetation will provide enhanced screening. The magnitude of effect is however considered to remain medium and as such will result in a moderate adverse effect.
- 9.5.112 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment from viewpoint 203.3.003. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4. Due to its elevated outlook, viewpoint 201.3.002 will however include views of the trains in the landscape and therefore retain a medium magnitude of change and moderate adverse effect.

Viewpoint 201.4.002: View looking east from Sulgrave Road, south of Thorpe Mandeville

- 9.5.113 The upper slopes of Thorpe Mandeville cutting and Banbury Road overbridge will be visible 400m east of the viewpoint. Intervening existing vegetation and topography will partially obscure views and the 8 to 15m deep landform of Thorpe Mandeville cutting will largely contain potential views of trains and overhead line equipment. Landscape mitigation planting will be located along the length of the Proposed Scheme, on both sides. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore the magnitude of change is considered to be medium.
- 9.5.114 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.115 In summer year 1 of operation and beyond to year 15 and year 60, intervening existing and mitigation vegetation will screen views of the Proposed Scheme, reducing effects to not significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 202.3.001: View looking south-west from PRow north-east of Lower Thorpe (located on PRow BB/11)

- 9.5.116 Upper elements of the Proposed Scheme will be visible such as the trains and overhead line equipment, along with Lower Thorpe viaduct, Banbury Road overbridge and Culworth Grounds accommodation overbridge (200m from the viewpoint). Therefore, the magnitude of change is considered to be high.
- 9.5.117 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect in the winter of year 1 of operation.
- 9.5.118 In summer year 1 of operation, existing vegetation to the south of the viewpoint will provide enhanced screening, although it will not be sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain high and as such will also result in major adverse effects.

- 9.5.119 By year 15 and beyond to year 60 of operation, there will be little change in the view due to maturing mitigation planting. Open views will be possible towards Lower Thorpe viaduct, therefore this will result in major adverse effects.

Viewpoint 202.3.002: View looking south-west from PRow north-east of Lower Thorpe (located on PRow BB/11)

- 9.5.120 Upper elements of the Proposed Scheme will be visible such as the trains and overhead line equipment, along with Lower Thorpe viaduct and Banbury Road overbridge. Landscape mitigation planting will be located to both sides of the Proposed Scheme, although at year 1 it will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be high.
- 9.5.121 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect in the winter of year 1 of operation.
- 9.5.122 In summer year 1 of operation, existing vegetation to the south of the viewpoint will provide enhanced screening. Therefore, the magnitude of change is considered to reduce to medium and as such will result in a moderate adverse effect.
- 9.5.123 By year 15 and beyond to year 60 of operation, maturing mitigation planting will further screen views and result in non-significant effects. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 202.4.001: View looking south-west from Banbury Lane, east of Lower Thorpe and Viewpoint 204.2.001: View looking west from Culworth Grounds Farm

- 9.5.124 The upper elements, such as the trains and overhead line equipment, will be visible in places, particularly where Lower Thorpe viaduct is located (500m from the viewpoint). The height of the viaduct at this point will be approximately 7m in height. A combination of cutting and embankment will be present in the vicinity of this viewpoint, varying in height from 7m high to 15m depth in cutting. Intervening topography and vegetation will screen the majority of other views of the Proposed Scheme. Mitigation planting will be located to both sides of the Proposed Scheme in the vicinity of Lower Thorpe. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.125 The medium magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.126 In summer year 1 of operation, screening provided by any roadside and field boundary vegetation retained following construction will contribute to an additional screening effect of the Proposed Scheme. Taking the above into account, the effect is considered to be non-significant.
- 9.5.127 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, contributing further to screening the Proposed

Scheme and resulting in non-significant effects. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 203.2.001: View looking east from Hill Farm, north-west of Thorpe Mandeville

- 9.5.128 The upper elements of the Proposed Scheme (trains, noise fence barriers and overhead line equipment) will be intermittently visible in the middle ground of this viewpoint, along with an overbridge (800m from the viewpoint) (Culworth Grounds accommodation overbridge). The depth of cutting and height of embankment at this point will vary between approximately 25.5m depth and 7m height. The depth of cutting will result in the majority of the Proposed Scheme being screened at that point. A planted strip of land will be located to the west of the Proposed Scheme, approximately 50m from the railway alignment. However, at year 1 the vegetation will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.129 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.130 In summer of year 1 of operation, there will be some enhanced screening associated with intervening field boundary vegetation, although given the elevated position of the viewpoint, there will be no significant change in the view. Taking the above in account, the magnitude of effect is considered to remain medium, resulting in moderate adverse effects.
- 9.5.131 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4
- 9.5.132 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 204.2.002 and 204.2.003: Views looking west from properties on western edge of Culworth

- 9.5.133 The upper elements of the Proposed Scheme (including trains and overhead line equipment) will be visible in places along the route, along with Culworth Grounds accommodation overbridge (approximately 1.25km from the viewpoint). A combination of cutting and embankment will be present in views from this location, varying in height from approximately 7m high to 26m depth of cutting, resulting in the Proposed Scheme being fully screened at the deepest point of cutting. In addition, intervening riparian vegetation and vegetation along the dismantled railway will further screen lower elements of the route. However, upper elements will be visible in places as new elements in the landscape. Landscape mitigation planting will be located to both sides of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

- 9.5.134 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.135 The view of the Proposed Scheme from viewpoint 204.2.003 in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-101 (Volume 2, CFA15 Map Book).
- 9.5.136 In summer year 1 of operation, intervening vegetation will limit visibility to upper elements of the Proposed Scheme. Taking the above in account, the magnitude of change is considered to be non-significant.
- 9.5.137 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.138 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, contributing further to screening of the Proposed Scheme and resulting in non-significant effects. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 204.3.001: View looking east from PRow south-west of Culworth (viewpoint located on PRow AG/9)

- 9.5.139 Intervening vegetation will screen the lower elements of the Proposed Scheme such as the tracks and track-bed, although upper elements such as the trains, overhead line equipment and bridleway accommodation overbridges (AG10 and AG9) will be visible over the extents of intervening vegetation (180m from the viewpoint). The height and depth of embankment and cutting will vary from approximately 5m height to 4m depth, screening lower elements of the Proposed Scheme in places. Landscape mitigation planting will be located along both sides of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be high.
- 9.5.140 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.
- 9.5.141 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain high and as such will also result in major adverse effects.
- 9.5.142 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to moderate adverse.

Viewpoints 205.2.001 and 207.2.002: Views looking east from Edgcote Lodge Farm and Trafford Bridge Farm

- 9.5.143 The upper elements of the Proposed Scheme including trains, noise fence barriers and overhead line equipment, Edgcote viaduct over the River Cherwell floodplain and the Danes Moor auto-transformer station will be visible from this viewpoint (940m from the viewpoint). The viaduct will vary from 1m to 8.5m in height. Areas of landscape mitigation earthworks will be located to the east and west of the Proposed Scheme.

The viaduct, auto-transformer station and the visible elements of the Proposed Scheme will form prominent elements in the landscape. Mitigation planting will be located to both sides of the Proposed Scheme in the vicinity of Edgcote. However, at year 1 the vegetation will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be high.

- 9.5.144 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect in the winter of year 1 of operation.
- 9.5.145 In summer year 1 of operation, the intervening vegetation will provide some enhanced screening, although the elements described previously will remain visible. Taking the above into account, the magnitude of change is considered to remain high, resulting in major adverse effects.
- 9.5.146 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.147 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, screening the Proposed Scheme in places. This will result in a reduction in effects to moderate adverse from viewpoint 205.2.001 and a reduction in effects to non-significant from viewpoint 207.2.002. Non-significant effects are reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 206.3.001, 208.3.001 and 208.3.002: Views looking west from PRoW east of Trafford Bridge (viewpoints located on PRoW AE/7 and AG/12 respectively)

- 9.5.148 Intervening vegetation will screen the lower elements of the Proposed Scheme such as the tracks and track-bed, although upper elements such as the trains, overhead line equipment and Bridleway AG10 accommodation overbridge and Bridleway AG9 overbridge will be visible over the extents of intervening vegetation (1km from the viewpoint). The embankment and cutting will vary from approximately 5m in height to 4m in depth, screening lower elements of the Proposed Scheme in places. Mitigation planting will be located on both sides of the Proposed Scheme in the vicinity of Trafford Bridge, with hedgerow planting to both sides of the Proposed Scheme south of Wadground Barn. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.149 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.150 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.
- 9.5.151 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 207.3.001: View looking west from ProW south of Edgcote (located on PRow AE/24)

- 9.5.152 The upper elements of the Proposed Scheme including trains, noise fence barriers and overhead line equipment and Edgcote viaduct over the River Cherwell floodplain will be visible from this viewpoint (1.1km from the viewpoint). The viaduct will vary from 1m to 8.5m in height. Areas of landscape mitigation earthworks will be located to the east and west of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. The viaduct and the visible elements of the Proposed Scheme will form prominent elements in the landscape. Therefore, the magnitude of change is considered to be medium.
- 9.5.153 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.154 In summer year 1 of operation, the intervening vegetation will provide some enhanced screening, although the elements described previously will remain visible. Taking the above in account, the magnitude of change is considered to be medium, resulting in moderate adverse effects.
- 9.5.155 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 207.4.001: View looking south-east from Warrington Road/Mill Lane, west of Trafford Bridge

- 9.5.156 The upper elements of the Proposed Scheme such as the trains and overhead line equipment, along with Edgcote viaduct over the River Cherwell, will all be visible from the viewpoint (100m from the viewpoint). The lower elements of the Proposed Scheme such as the tracks and track-beds will be screened by intervening topography. The viaduct will be approximately 8.5m in height at its highest point. Roadside and field boundary vegetation in the immediate foreground will provide a level of screening; however the upper elements of the Proposed Scheme will remain visible. Mitigation planting areas will be located to both the east and west of the Proposed Scheme in the vicinity of Trafford Bridge. However at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.157 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.158 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.
- 9.5.159 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering the Proposed Scheme, although the magnitude of change will remain medium with a moderate adverse effect.

Viewpoint 208.3.003: View looking west from the Battlefields Way PRoW, east of Trafford Bridge (located on PRoW AG/10)

- 9.5.160 The upper elements of the Proposed Scheme including trains and overhead line equipment and Edgcote viaduct over the River Cherwell floodplain will be visible in the middle ground of the viewpoint (200m from the viewpoint). The height of the viaduct at its highest point will be approximately 8.5m. These will form prominent, elevated features in the landscape. Landscape mitigation areas will be located on both the east and west sides of the Proposed Scheme in the vicinity of Trafford Bridge. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be high.
- 9.5.161 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.
- 9.5.162 In summer year 1 of operation, vegetation will provide enhanced screening. Therefore, the magnitude of change is considered to be medium and as such will result in moderate adverse effects.
- 9.5.163 By year 15 and beyond to year 60 of operation, there will be little additional screening due to mitigation planting, therefore the effects are assessed to remain as moderate adverse effects.

Viewpoint 208.2.001: View looking west from Culworth Mill at Trafford Bridge

- 9.5.164 The upper elements of the Proposed Scheme including trains and overhead line equipment and Edgcote viaduct over the River Cherwell floodplain will be visible in the middle ground of the viewpoint (300m from the viewpoint). The height of the viaduct at its highest point will be approximately 8.5m. Areas of mitigation planting will be located to the east and west of the Proposed Scheme in the vicinity of Trafford Bridge. However, at year 1 the planting will not yet have matured and will contribute little to screening. Although there are high levels of intervening vegetation, the prominent elevated elements of the Proposed Scheme such as the viaduct will be partially filtered by intervening vegetation, resulting in a medium magnitude of change.
- 9.5.165 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.166 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-103 (Volume 2, CFA15 Map Book).
- 9.5.167 In summer year 1 of operation, the intervening vegetation will provide enhanced screening, although the upper elements of the Proposed Scheme and the viaduct will remain visible. Taking the above into account, the magnitude of change is considered to remain medium, resulting in moderate adverse effects.
- 9.5.168 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

9.5.169 The view of the Proposed Scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-244 (Volume 2, CFA15 Map Book).

9.5.170 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme, although views of the viaduct will remain possible. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 208.4.001: View looking west from Welsh Road, north of Trafford Bridge

9.5.171 The upper elements of the Proposed Scheme such as the trains and overhead line equipment, along with Edgcote viaduct over the River Cherwell floodplain (108-L1), will be visible from the viewpoint (300m from the viewpoint). The height of the viaduct will be approximately 8.5m at its highest point. Roadside and field boundary vegetation in the immediate foreground will provide a high level of screening; however the upper elements of the Proposed Scheme will remain visible. Mitigation planting areas will be located to both the east and west of the Proposed Scheme in the vicinity of Trafford Bridge. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

9.5.172 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in moderate adverse effects.

9.5.173 In summer year 1 of operation, vegetation will provide enhanced screening. Therefore, the magnitude of change is considered to be medium and as such will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.174 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme. However, the viaduct will remain visible, therefore the effects are considered to remain as moderate adverse.

Viewpoints 208.4.002 and 210.04.001: Views looking west from Welsh Road, in the vicinity of Trafford Bridge

9.5.175 The upper elements of the Proposed Scheme such as the trains and overhead line equipment, along with Edgcote viaduct over the River Cherwell floodplain, will be visible from the viewpoint (300m from the viewpoint). The height of the viaduct will be approximately 8.5m at its highest point. Roadside and field boundary vegetation in the immediate foreground will provide a high level of screening. However, the upper elements of the Proposed Scheme will remain visible. Mitigation planting areas will be located to both the east and west of the Proposed Scheme in the vicinity of Trafford Bridge. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

9.5.176 The medium magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.

- 9.5.177 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to be medium and as such will result in moderate adverse effects.
- 9.5.178 By year 15 and beyond to year 60 of operation, the relative openness of view from viewpoint 210.04.001 onto a localised at-grade section of the Proposed Scheme with trains and overhead line equipment visible means that the view will not change noticeably from year 1 of operation. Therefore, the effects are considered to remain as moderate adverse. Views from viewpoint 208.4.002 will however largely be obscured by maturing mitigation vegetation in the vicinity of Bridleway AG10 accommodation overbridge and will reduce effects to be non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 209.2.003: View looking east from Edgcote House

- 9.5.179 The upper elements of the Proposed Scheme will be visible to the east of the viewpoint including trains and overhead line equipment (800m from the viewpoint). The depth of cutting at this point will vary between approximately 0.5m and 12.5 m depth, screening lower elements and gradually screening all elements of the Proposed Scheme as the route continues to the north-west and the cutting gradually increases in depth. Mitigation planting will be located to both sides of the Proposed Scheme in the vicinity of Trafford Bridge. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.180 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.181 In summer year 1 of operation, there will be some enhanced screening, although not sufficient to result in a change to the magnitude of change assessment for winter. Therefore, the magnitude of change will remain medium, resulting in moderate adverse effects.
- 9.5.182 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.183 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme and reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 209.3.003: View looking east from Battlefields Trail PRoW, north-east of Edgcote House (viewpoint located on PRoW AE/5)

- 9.5.184 The upper elements of the Proposed Scheme will be seen from this viewpoint, both when on viaduct and when in cutting (100m from the viewpoint). The height of the viaduct at this point will vary between approximately 7m and 5.4m high, while the depth of cutting will vary between approximately 0.5m and 8.5m depth. Mitigation planting is located to the east and west of the Proposed Scheme in the vicinity of Trafford Bridge. However, at year 1 the planting will not yet have matured and will

contribute little to screening. Therefore, the magnitude of change is considered to be high.

- 9.5.185 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.
- 9.5.186 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain high and as such will also result in major adverse effects.
- 9.5.187 By year 15 and beyond to year 60 of operation, there will be limited changes in the view due to limited mitigation planting in the vicinity of the viewpoint. Therefore, the effects are considered to remain as major adverse effects.

Viewpoint 210.2.001: View looking south-west from property on Culworth Road, east of Chipping Warden

- 9.5.188 The upper elements of the Proposed Scheme will be visible to the south-west of the viewpoint including trains and overhead line equipment (100m from the viewpoint). The height of the viaduct at this point will vary between approximately 7m and 5.4m high, while the depth of cutting at this point will vary between approximately 0.5m and 12.5 m depth, screening lower elements and gradually screening all elements of the Proposed Scheme as the route continues to the north-west and the cutting gradually increases in depth. Therefore, the magnitude of change is considered to be high.
- 9.5.189 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect in the winter of year 1 of operation.
- 9.5.190 In summer year 1 of operation, there will be some enhanced screening, although not sufficient to result in a change to the magnitude of change assessment for winter. Therefore, the magnitude of change will remain high, resulting in major adverse effects.
- 9.5.191 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.192 By year 15 and beyond to year 60 of operation, there will be limited changes in the view due to limited mitigation planting in the vicinity of the viewpoint. Therefore, the effects are considered to remain as major adverse effects.

Viewpoint 210.3.003: View looking south-west from PRow south of Wardenhill Farm (located on PRow AE/12)

- 9.5.193 The majority of elements associated with the Proposed Scheme such as the tracks, trains and overhead line equipment will be screened by the extents of cutting and the Chipping Warden green tunnel approximately 900m away. Mitigation planting will be located to both sides of the Proposed Scheme, particularly in the vicinity of the Chipping Warden green tunnel south portal. However at year 1 the planting will not yet have matured and will contribute little to screening. Vegetation removed during the course of construction will still be apparent, particularly where mitigation planting

has yet to mature, emphasising the alignment of the green tunnel. This will form a noticeable feature in the landscape, although some screening will be provided by intervening woodland blocks and field boundary vegetation. Therefore, the magnitude of change is considered to be medium.

- 9.5.194 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.195 In summer year 1 of operation, the numerous blocks of woodland and field boundary vegetation throughout the landscape will result in enhanced screening of the road diversion, and softening of the engineered appearance of the green tunnel. Taking the above into account the effect will not be significant.
- 9.5.196 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 211.4.002: View looking north-east from Culworth Road, east of Chipping Warden

- 9.5.197 The Chipping Warden green tunnel will be visible in near to middle distance views to the north and east of this viewpoint, along with the deep cutting approximately 10.5m depth to the north-west of the viewpoint and the footpath AE20 overbridge (200m from the viewpoint). Mitigation planting will be located to both sides of the Proposed Scheme, particularly in the vicinity of the Chipping Warden green tunnel south portal. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.198 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.199 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.
- 9.5.200 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, screening the Proposed Scheme in places. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 215.2.001: View looking north-east from Hilltop Cottage and Field Farm, along with PRoW AA/8, north-east of Appletree

- 9.5.201 The route of the Proposed Scheme will be visible extending from the north portal of Chipping Warden green tunnel and on past Claydon Road overbridge towards Lower Boddington. The elevated outlook of the viewpoint will afford views of trains moving through the landscape. Highfurlong Brook viaduct will be visible to the north-west of the viewpoint. Mitigation planting will be located to both sides of the Proposed Scheme, particularly in the vicinity of the Chipping Warden green tunnel north portal.

However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

- 9.5.202 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.203 In summer year 1 of operation, there will be an enhanced screening effect from existing intervening vegetation, although the elevated outlook of the viewpoint will continue to afford views along the line of the Proposed Scheme. Taking the above into account, the assessment of magnitude of change will remain medium, resulting in moderate adverse effects.
- 9.5.204 By year 15 and beyond to year 60 of operation, intervening existing and mitigation vegetation will screen views of the Proposed Scheme, reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 215.3.001: View looking north-east from Macmillan Way PRow. South-west of Appletree

- 9.5.205 The Chipping Warden green tunnel will be visible in middle distance views to the north-east of this viewpoint. Visible elements will include a shallow length of cutting, and a viaduct over Highfurlong Brook floodplain (500m from the viewpoint). The majority of intervening vegetation will be retained following construction, resulting in some screening of elements of the Proposed Scheme. However, views will be possible, particularly of the viaduct. Mitigation planting will be located to both sides of the Proposed Scheme, particularly in the vicinity of the Chipping Warden green tunnel north portal. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.
- 9.5.206 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.207 In summer year 1 of operation, there will be enhanced screening due to the intervening field boundary vegetation and blocks of woodland. Taking the above into account, the magnitude of change is considered to be non-significant.
- 9.5.208 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, contributing further to screening the Proposed Scheme and resulting in non-significant effects. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 216.2.001: View looking west from properties on western edge of Aston le Walls

- 9.5.209 The Chipping Warden green tunnel will be visible in middle distance views to the southwest of this viewpoint (800m from the viewpoint). As the route continues north, the upper elements of the scheme will become visible such as the trains and overhead line equipment. The height of embankment and then the viaduct over Highfurlong Brook floodplain will be approximately 6m at its highest point, resulting in visibility of all elements of the Proposed Scheme including the track, trains and overhead line equipment. However, high levels of screening provided by intervening vegetation will

result in the majority of views being filtered towards the Proposed Scheme. Mitigation planting will be located to the west of the viewpoint, on the east side of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

- 9.5.210 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.211 In summer year 1 of operation, there will be enhanced screening. However, the viaduct is likely to remain visible. Taking the above into account, the assessment of magnitude of change will remain medium, resulting in moderate adverse effects.
- 9.5.212 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.213 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. This will reduce effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 216.07.001: View looking south-west from Washbrook Farm Eventing Centre

- 9.5.214 Visible middle to background construction elements will include views of the viaduct over Highfurlong Brook floodplain to the north-east and Claydon Road diversion over the Proposed Scheme, in combination with more general construction activity and earthworks (500m from the viewpoint). Intervening vegetation will provide screening of lower elements of the Proposed Scheme, such as the track and track-bed, in places. Mitigation planting will be located on both sides of the Proposed Scheme to the south-west of the viewpoint. However, at year 1 the planting will not yet have matured and will contribute little to screening. Overall, the magnitude of change is considered to be medium.
- 9.5.215 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.216 During summer, although existing vegetation will provide enhanced effect, the elevation of the viewpoint will allow views towards the Proposed Scheme. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.
- 9.5.217 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme. However, the Highfurlong Brook viaduct will remain visible; therefore the effects are considered to remain as moderate adverse effects.

Viewpoint 217.3.002: View looking north-west from PRow network north-east of Springfield House (located on PRow AC/1)

- 9.5.218 All elements associated with the Proposed Scheme including tracks, track-beds, trains, noise fence barriers and overhead line equipment, will be visible, including Claydon Road overbridge over the Proposed Scheme (360m from the viewpoint). The

lack of any intervening vegetation will result in open views from this viewpoint. The diversion of Claydon Road will result in the loss of any intervening roadside vegetation and will also be a prominent visible feature. Landscape earthworks up to 7m high will be located on both the east and west of the Proposed Scheme to provide screening. Mitigation planting will be located to the west side of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

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

9.5.220 In summer year 1 of operation, vegetation will provide enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain medium and as such will also result in moderate adverse effects.

9.5.221 By year 15 and beyond to year 60 of operation, there will be limited additional screening as a result of mitigation planting. Therefore, the effects are considered to remain as moderate adverse effects.

Viewpoint 218.2.001: View looking south-west from properties on the south-western edge of Lower Boddington

9.5.222 To the south of the viewpoint, the upper elements of the Proposed Scheme will be visible (including trains, noise fence barriers and overhead line equipment), along with Claydon Road overbridge (600m from the viewpoint). The Proposed Scheme will pass from cutting to embankment within the extent of view, ranging from approximately 1m depth to 4m high. Landscape earthworks up to 7m high to the east of the Proposed Scheme will screen views of the lower elements of the Proposed Scheme such as the tracks and track-beds. In addition, effective screening provided by intervening vegetation will result in the majority of views being filtered towards the Proposed Scheme. Mitigation planting will be located to the west side of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Therefore, the magnitude of change is considered to be medium.

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

9.5.224 In summer year 1 of operation, there will be enhanced screening. However, Claydon Road overbridge and upper elements of the Proposed Scheme will remain visible. Taking the above into account, the assessment of magnitude of change will remain medium, resulting in moderate adverse effects.

9.5.225 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

9.5.226 By year 15 and beyond to year 60 of operation, mitigation planting will have matured, screening views of the Proposed Scheme and reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoints 218.4.001 and 220.4.001: Views looking south-west from Banbury Road, to the south and west of Lower Boddington

- 9.5.227 The lower elements of the Proposed Scheme such as the tracks and track-bed will be screened by intervening field boundary vegetation and the landscape earthworks up to 7m high that will be located to the east of the Proposed Scheme (300m from the viewpoint). The Banbury Road diversion over the Proposed Scheme will be visible in oblique views to the south-east. Therefore, the magnitude of change is considered to be medium.
- 9.5.228 The medium magnitude of change, assessed alongside the medium sensitivity of these receptors, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.229 In summer year 1 of operation, there will be some enhanced screening by intervening vegetation, specifically roadside vegetation. However, this will not affect views of the upper elements of the Proposed Scheme. Taking the above into account, the magnitude of change experienced from viewpoint 220.4.001 is considered to remain medium, resulting in moderate adverse effects. The effect on the view from viewpoint 218.4.001 will however reduce to non-significant.
- 9.5.230 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, largely screening the Proposed Scheme including the overhead line equipment. Effects from both viewpoints will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

Viewpoint 219.2.001: View looking north-east from Cedars Farm, west of Lower Boddington

- 9.5.231 To the north of the viewpoint, the Proposed Scheme will be visible including trains, noise fence barriers and overhead line equipment, along with the Cedars Farm access track to the west of the viewpoint (200m from the viewpoint). The route will be visible on embankment, ranging from 3m to 4m high. Landscape earthworks up to 7m high located to the east and west of the Proposed Scheme will combine with intervening vegetation to filter views of lower elements of the Proposed Scheme such as tracks and track-bed. Upper elements of the Proposed Scheme will however remain visible. Therefore, the magnitude of change is considered to be high.
- 9.5.232 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.
- 9.5.233 In summer year 1 of operation, there will be enhanced screening. However, the access road diversion and upper elements of the Proposed Scheme will remain visible. Taking the above into account, the assessment of magnitude of change will remain high, resulting in major adverse effects.
- 9.5.234 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.
- 9.5.235 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme. However, views will be possible of the upper elements of the Proposed Scheme such

as the overhead line equipment in places. Therefore, the effects are considered to be moderate adverse.

Viewpoint 220.3.001: View looking south-west from PRow network on the southern edge of Upper Boddington (viewpoint located on PRow AC/11)

- 9.5.236 The Proposed Scheme will be screened in places by intervening field boundary vegetation and small woodland blocks (1.1km from the viewpoint). Banbury Road overbridge over the Proposed Scheme will be visible in oblique views to the west and south-west. Mitigation hedgerow planting will be located to the east side of the Proposed Scheme, although at year 1 it will not yet have matured and will contribute little to screening. Given the intervening roadside and field boundary vegetation, the magnitude of change is considered to be medium.
- 9.5.237 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.238 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-106 (Volume 2, CFA15 Map Book).
- 9.5.239 In summer year 1 of operation, there will be some enhanced screening by intervening vegetation, specifically field boundary vegetation and small blocks of woodland. However, views of Banbury Road overbridge will be possible. Taking the above into account, the magnitude of change is considered to be medium, resulting in moderate adverse effects.
- 9.5.240 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme. However, this will not be sufficient to amend the effect and this will remain as a moderate adverse effect.

Viewpoint 221.4.001: View looking north-east from Claydon Road, north of Three Shires Farm

- 9.5.241 The Proposed Scheme will be visible from the viewpoint. Banbury Road green overbridge over the Proposed Scheme will be visible in views to the north-west, although an intervening linear woodland block will screen direct views of the Proposed Scheme from the viewpoint (200m from the viewpoint). Mitigation planting will be located to both sides of the Proposed Scheme. However, at year 1 the planting will not yet have matured and will contribute little to screening. Overall, the magnitude of change is considered to be medium.
- 9.5.242 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.243 In summer year 1 of operation, there will be some enhanced screening by intervening vegetation, specifically roadside vegetation. However, this will not affect views of the upper elements of the Proposed Scheme. Taking the above into account, the magnitude of change is considered to remain medium, resulting in moderate adverse effects.

9.5.244 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering the Proposed Scheme. However, views will remain possible of Banbury Road overbridge and the upper elements of the Proposed Scheme such as the overhead line equipment. The effects are considered to remain as moderate adverse.

Viewpoints 222.2.001 and 222.2.002: Views looking south-west from Hill Farm and Spella House, west of Lower Boddington

9.5.245 To the south-west of the viewpoint, the upper elements of the Proposed Scheme will be visible including trains and overhead line equipment (100m from the viewpoint). The route will be in cutting within the extent of view, with a maximum depth of approximately 12m in oblique views to the north-west of the viewpoint. Landscape earthworks 3m high will be located on both the east and west sides of the Proposed Scheme to provide screening. Although the lower elements of the Proposed Scheme such as the tracks and track-bed will be screened by cutting and earth mounding, the upper elements of the Proposed Scheme will remain visible. Mitigation planting will be located to the both sides of the Proposed Scheme in the vicinity of the Claydon Road (also known as Boddington Road) diversion. However, at year 1 the planting will not yet have matured and will contribute little to screening. Overall, the magnitude of change is considered to be high.

9.5.246 The high magnitude of change, assessed alongside the high sensitivity of these receptors, will result in a major adverse effect in the winter of year 1 of operation.

9.5.247 In summer year 1 of operation, vegetation will provide an enhanced screening, although not sufficient to change the view noticeably from that in winter. Therefore, the magnitude of change is considered to remain high and as such will also result in a major adverse effect.

9.5.248 The night-time effect of lighting during year 1 of operation will not be significant. This is reported in Volume 5: Appendix LV-001-015 Part 4.

9.5.249 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, filtering views of the Proposed Scheme. This will reduce effects to moderate adverse.

Cumulative effects

9.5.250 Section 2.1 and Appendix CT-004-015 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 have been included as 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. These developments are shown in Map Series CT-13 (Volume 5, Cross Topic Appendix 1 Map Book).

9.5.251 Due to the combined presence of the Proposed Scheme and the photovoltaic park development at Culworth Grounds Farm, effects on the following receptors, which are significant when considering the operation of the Proposed Scheme on its own, would be increased:

- Middle Cheney and Woodford Halse Undulating Hills and Valleys LCA; and
- Viewpoint 202.3.002: View looking south-west from PRow north-east of Lower Thorpe.

9.5.252 There are no known instances where receptors, which will not be significantly affected by the operation of the Proposed Scheme on its own, will be significantly adversely affected by the combined operation of the surrounding developments.

Other mitigation measures

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

Summary of likely residual significant effects

9.5.254 In most cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following residual effects will remain following year 15 of operation:

- adverse effects on views from residences on the eastern edge of Greatworth (receptor 195.2.001) and views from PRow (receptors 193.3.001 and 194.2.001) and minor roads east of Greatworth (receptor 196.3.001) arising from visibility of the tunnel portal area and general views of trains and rail infrastructure;
- adverse effects on views from residences on the eastern edge of Thorpe Mandeville (receptors 201.2.001 and 201.2.002) and PRow to the east and north of Thorpe Mandeville (receptors 201.3.001, 202.3.002 and 204.3.001) arising from visibility of Lower Thorpe viaduct and the general extents of the Proposed Scheme and trains in cutting and on embankment;
- adverse effects on views from scattered properties (receptors 205.2.001 and 210.2.001), PRow (receptors 208.3.003 and 209.3.003) and minor roads (receptors 207.4.001, 208.4.001 and 210.4.001) in the vicinity of Edgcote and Trafford Bridge, including effects on the setting of Trafford Bridge, due to the appearance of engineered landform, the visual presence of Edgcote viaduct and the appearance of moving trains;
- adverse effects on views from scattered properties (receptors 216.7.001, 219.2.001, 222.2.001 and 222.2.002), PRow (receptors 217.3.002 and 220.3.001) and minor roads (receptor 221.4.001) between Aston le Walls and the northern extents of CFA15 where glimpses of trains and overhead line equipment, or the foreshortening of views by mitigation landform, will have a perceptible influence on the view;

- adverse effects on views from residents of Upper Boddington (220.3.001), arising from elevated views of the Proposed Scheme Banbury Road overbridge and Lower Boddington maintenance loop; and
- adverse effects on users of PRoW across parts of the study area, including the Battlefields Way, Jurassic way and Macmillan Way long distance trails, arising from the visibility of different elements of the Proposed Scheme including trains, noise fence barriers and overhead line equipment.

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 area.

Construction

10.1.4 The proposed construction works will have relevance in terms of socio-economics in relation to:

- premises demolished with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme;
- effects on the amenity (e.g. air quality and construction dust, noise and vibration, construction traffic and visual impacts) of an area which could affect business operations. Any resulting effects on employment are reported at a route-wide level (Volume 3); and
- potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

10.1.5 The proposed operation of the route will have relevance in terms of socio-economics in relation to potential employment opportunities created by new business opportunities.

10.2 Scope, assumptions and limitations

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

10.2.2 There have been no variations to the socio-economic assessment methodology 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 Greatworth to Lower Boddington area, which includes data of specific relevance to socio-economics notably demographic and employment data. The following provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the area⁶³.
- 10.3.2 The Greatworth to Lower Boddington area is located entirely within the district of South Northamptonshire.
- 10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)⁶⁴ to provide a profile of local communities. Map SE-02-016 (Volume 5, Socio-economics Map Book) shows the location of the DCA. The area contains Greatworth, Thorpe Mandeville, Culworth, Aston le Walls, Lower and Upper Boddington, and Edgcote and Chipping Warden DCA.

Business and labour market

- 10.3.4 Within South Northamptonshire the professional, scientific and technical services sector accounts for the largest proportion of businesses (18%), with the construction (13%) and agriculture, forestry and fishing (10%) sectors also accounting for large proportions of businesses within the borough⁶⁵. This is shown in Figure 6⁶⁶. For comparison within the East Midlands region the professional, scientific and technical services sector also accounts for the largest number of businesses (11%), with construction (11%), retail (11%) and production⁶⁷ (8%) sectors also accounting for relatively large numbers of businesses within the region.

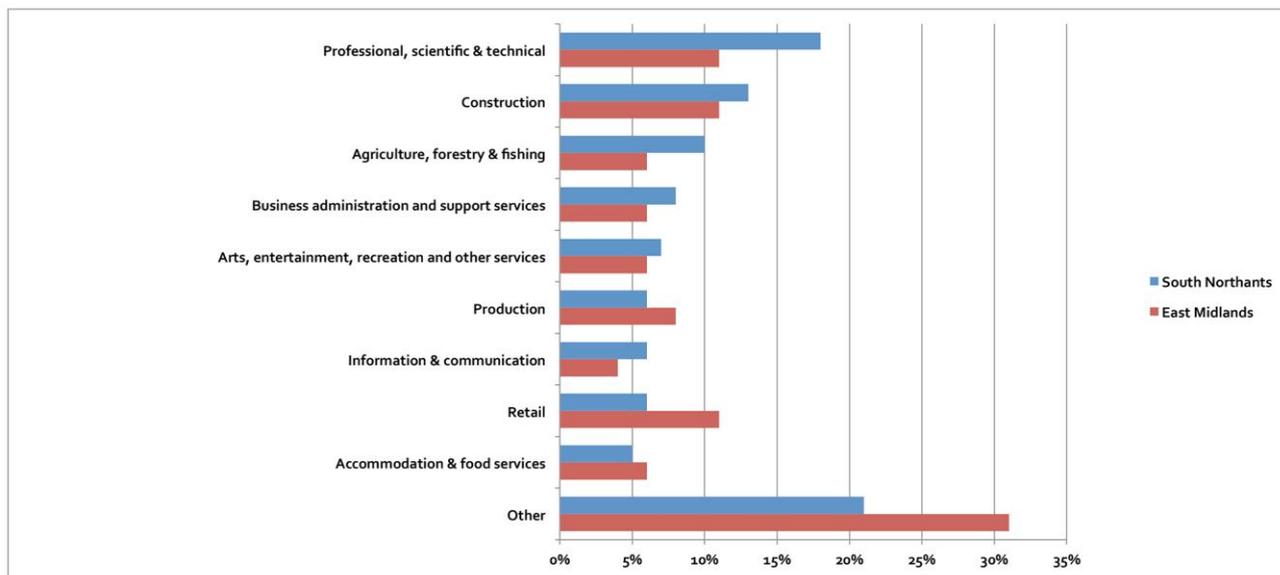
⁶³ Further information on the socio-economics baseline with regard to business and labour market profile within the Greatworth to Lower Boddington area is contained in Volume 5: Appendix SE-001-000.

⁶⁴ 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).

⁶⁵ Office for National Statistics (ONS) (2012), *UK Business: Activity, Size and Location 2011*, ONS, London. Please note 2011 data has been presented to provide an appropriate comparison with 2011 Census data.

⁶⁶ The Figure presents the proportion of businesses within each business sector in the district but not the proportion of employment by sector.

⁶⁷ Production, as per ONS grouping, includes manufacturing and mining, quarrying, manufacturing and utilities.

Figure 6: Business sector composition in South Northamptonshire and the East Midlands⁶⁸

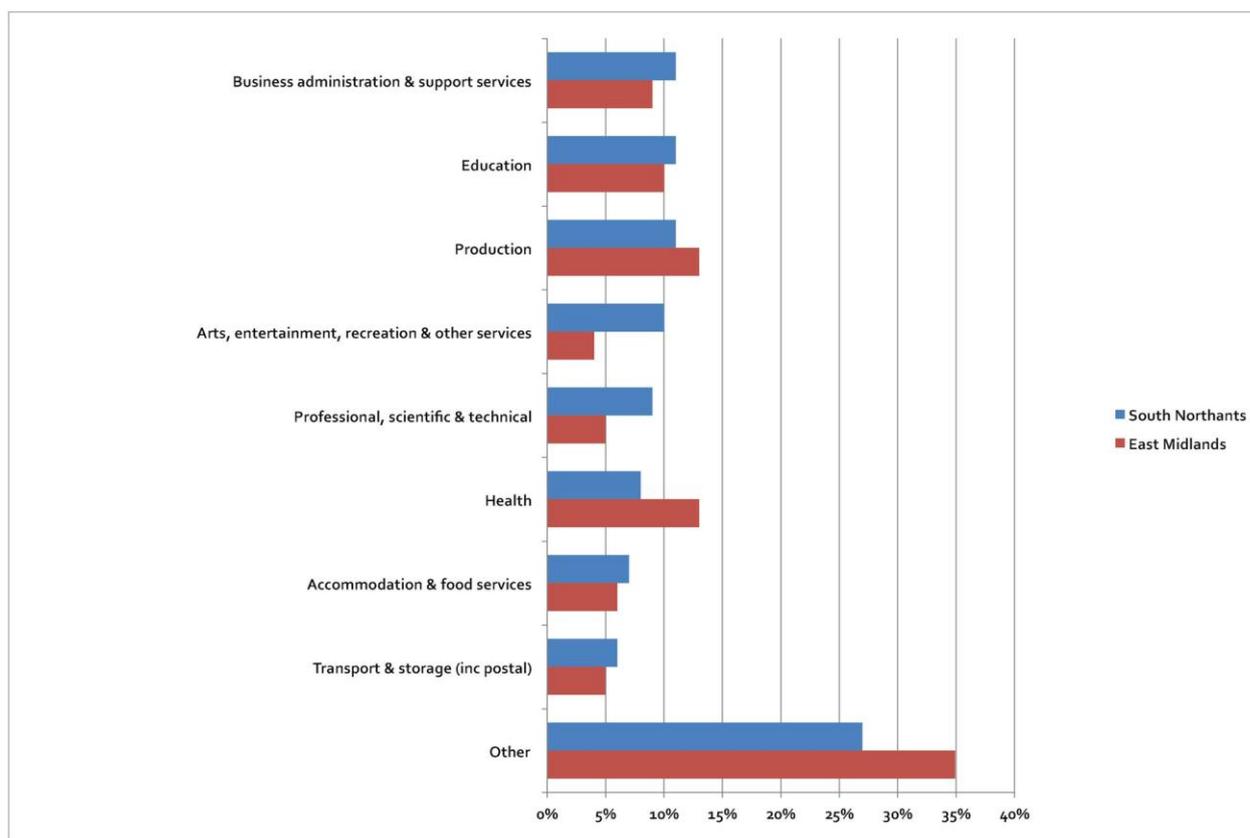
- 10.3.5 Approximately 30,000 people⁶⁹ worked in South Northamptonshire while 200 people worked within the Greatworth DCA, 100 within Culworth DCA, 200 within Aston le Walls DCA, 400 within Lower and Upper Boddington DCA and 300 within the Edgcote and Chipping Warden DCA. No jobs were recorded as being located within Thorpe Mandeville DCA⁷⁰.
- 10.3.6 According to the ONS Business Register and Employment Survey 2011, the sectors with the highest proportion of employment in South Northamptonshire are business, administration and support services (11%), production (11%) and education (11%). The proportion of employees working in arts, entertainment, recreation and other services in South Northamptonshire (10%) is higher compared to both the East Midlands (4%) and England (5%). The health sector accounts for 8% of employment in the district, which is lower than the regional and national levels (13% and 12% respectively). This is shown in Figure 7.
- 10.3.7 Key sectors in terms of employment, for Greatworth DCA are construction (17%), arts, entertainment, recreation and other services (14%), wholesale (13%) and professional, scientific and technical (13%). In Thorpe Mandeville DCA and Culworth DCA these are health (28%) and arts, entertainment, recreation and other services (15%) respectively. Key sectors in Aston le Walls DCA and Lower and Upper Boddington DCA are transport and storage (including postal) (53%) and business administration and support services (13%) respectively. In Edgcote and Chipping Warden DCA, the key sector is transport and storage, including postal, (35%).

⁶⁸ 'Other' includes; motor trades; transport and storage; finance and insurance; public administration and defence; health; and education sectors.

⁶⁹ Office for National Statistics (2012), *Business Register and Employment Survey 2011*, ONS, London

⁷⁰ Where the number of jobs is less than 100, the Business Register and Employment Survey is not able to provide a number owing to ONS data disclosure provisions.

Figure 7: Employment by industrial sector in South Northamptonshire and the East Midlands⁷¹



- 10.3.8 According to the 2011 Census⁷², the employment rate⁷³ within South Northamptonshire in 2011 was 73% (which represents 46,000 people), markedly higher than those recorded for both the East Midlands (64%) and England (65%). The employment rate in Greatworth, Thorpe Mandeville and Aston le Walls DCAs was 72%, 74% in Culworth, 68% in Lower and Upper Boddington DCA and 69% in Edgcote and Chipping Warden DCA.
- 10.3.9 The unemployment rate for South Northamptonshire in 2011 stood at 4% which was below the England average of 7%. The unemployment rate recorded for Greatworth, Culworth and Aston le Walls DCA was 3%, 1% in Thorpe Mandeville DCA, and 2% in Lower and Upper Boddington DCA, and 4% in Edgcote and Chipping Warden DCA.
- 10.3.10 According to the 2011 Census, 31% of South Northamptonshire residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4), compared to 24% in the East Midlands and 27% in England, while 17% had no qualifications, which was lower than that recorded both for the East Midlands (25%) and England (23%). In 2011, 32% of Greatworth DCA residents aged 16 and over were qualified to NVQ4 level, compared to 38% in Thorpe Mandeville DCA, 35% in Culworth DCA, 31% in Aston le Walls DCA, 44% in Lower and Upper Boddington DCA, 30% in Edgcote and Chipping Warden DCA.

⁷¹ 'Other' includes retail, construction, wholesale, information and communication, motor trades, public administration and defence, property, financial and insurance, agriculture, forestry and fishing sectors.

⁷² Office for National Statistics (ONS) (2012), Population Census 2011.

⁷³ The proportion of working age (16-74 years) residents in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.

- 10.3.11 The proportion of residents with no qualifications was 15% in Greatworth DCA, 14% in Thorpe Mandeville DCA, 19% in Culworth DCA, 14% in Aston le Walls DCA, 13% in Lower and Upper Boddington and 21% in Edgcote and Chipping Warden DCA.
- 10.3.12 Greatworth DCA, Thorpe Mandeville DCA, Culworth DCA, Aston le Walls DCA, Lower and Upper Boddington DCA and Edgcote and Chipping Warden DCA are each predominantly residential areas, set within a predominately rural area. All have high rates of employment and comparatively high levels of qualification attainment compared to regional and national averages.

Property

- 10.3.13 Total stock of industrial/warehousing floorspace within South Northamptonshire as estimated by the Valuation Office Agency (VOA) in 2012, stood at 518,000 square metres⁷⁴.
- 10.3.14 Vacancy for industrial property in South Northamptonshire in July 2013 has been assessed as 11% based on marketed space against known stock⁷⁵. Overall this suggests there is adequate availability of alternative accommodation.

Future baseline

Construction (2017)

- 10.3.15 Volume 5: Appendix CT-004-000/1 provides details of the developments which are assumed to have been implemented by 2017. There are no consents or allocations in this local area which are expected to accommodate significant additional employment by 2017.

Operation (2026)

- 10.3.16 Volume 5: Appendix CT-004-000/2 provides details of the developments that are assumed to have been implemented by 2026. There are no consents or allocations in this local area that are expected to accommodate significant additional employment between 2017-2026.

10.4 Effects arising during construction

Avoidance and mitigation measures

- 10.4.1 In order to avoid or reduce the adverse 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:

⁷⁴ Valuation Office Agency; *Business Floorspace (Experimental Statistics)*; http://www.voa.gov.uk/corporate/statisticalReleases/120517_CRLFloorspace.html; Accessed October 2013.

⁷⁵ Vacant space is based on marketed space identified from Estates Gazette data (EGi); stock data is taken from information supplied by the Valuation Office (VOA).

- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (draft CoCP Section 5);
- reducing nuisance through sensitive layout of construction sites (draft CoCP Section 5);
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (draft CoCP Section 13);
- requiring contractors to monitor and manage flood risk and other extreme weather events which may affect socioeconomic resources during construction (draft CoCP, Sections 5 and 16); and
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP Section 14).

Assessment of impacts and effects

Temporary effects

Change in business amenity value

- 10.4.3 Businesses within the area may experience air quality, noise and vibration, visual or construction traffic impacts as a result of construction of the Proposed Scheme. Taken in combination, the residual effects from these other topic assessments may amount to a significant change in amenity, which leads to a possible loss of trade for the affected businesses. Any resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3).
- 10.4.4 The Carpenters Arms public house on Claydon Road will experience significant visual effects as a result of the construction activities associated with the proposed Claydon Road overbridge. In addition, Claydon Road and Banbury Road (at the junction of which the business lies) are identified as roads along which there are expected to be significant effects arising from HGV construction traffic. Construction activity associated with the proposed Claydon Road overbridge will last approximately three years, commencing in 2017. The sensitivity of the establishment is deemed to be high as users are considered to be susceptible to changes in amenity and the construction works may discourage customers, which may include passing trade, from this establishment. Given these in combination effects and the high level of sensitivity, the Proposed Scheme is assessed to have a significant amenity effect on this business.
- 10.4.5 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3).

Isolation

- 10.4.6 No non-agricultural businesses⁷⁶ have been identified within the area which are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

- 10.4.7 A number of construction compounds for the Proposed Scheme will be located within the Greatworth to Lower Boddington area, and will include Chipping Warden green tunnel main compound. These locations are set out in Section 2.3 of this report.
- 10.4.8 The use of these sites will result in the creation of up to 2,700 person years of construction employment⁷⁷ opportunities or approximately 270 full time equivalent jobs⁷⁸, that, depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of direct construction employment creation has been assessed as part of the route-wide assessment (see Volume 3).
- 10.4.9 Direct construction employment created by the Proposed Scheme will also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of the indirect construction employment creation has been assessed as part of the route-wide assessment (see Volume 3).

Cumulative effects

- 10.4.10 No committed (inter-project) developments have been identified that are considered to interact with the Proposed Scheme.
- 10.4.11 Cumulative effects arise in relation to the accumulation of individual resource based job displacement and losses on a local labour market. These effects are assessed as part of the route-wide assessment (see Volume 3).
- 10.4.12 In-combination effects arise where business establishments are affected by other environmental effects (from noise, vibration, air quality, visual and construction traffic) such that their ability to trade is disadvantaged thereby potentially prejudicing jobs in business establishments affected. These effects are identified in this section and assessed in the route-wide assessment (see Volume 3).

Permanent effects

Businesses

- 10.4.13 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.

⁷⁶ Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.

⁷⁷ 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

⁷⁸ Based on the convention that 10 employment years is equivalent to one full time equivalent job.

10.4.14 In all, two business accommodation units⁷⁹ within the area will be directly impacted upon by the Proposed Scheme: two motorsport engineering businesses within the northern building at Greatworth Park trading estate (Triple Eight Race Engineering and David Appleby Engineering Ltd (main base of operations)). These form one defined resource which will be subject to likely significant effects on business activities and employment. The resource is presented in Table 14.

Table 14: Resources with potentially significant direct effects

Resource	Description of business activity
Two motorsport engineering businesses at Greatworth Park trading estate (northern building).	Industrial premises occupied by motorsport engineering businesses.

Impact magnitude

10.4.15 The magnitude of impact focuses on the number of jobs that are affected (either through displacement or possible loss) by the Proposed Scheme. It also considers the implications of this impact in relation to the scale of economic activity and opportunity in the area.

Sensitivity

10.4.16 The following was taken into account when considering the sensitivity of resources:

- availability of alternative, suitable premises;
- size of the local labour market;
- skill levels and qualifications of local people; and
- levels of unemployment.

Significance of effect

10.4.17 Taking account of the sensitivity of the resource and the magnitude of impact, the significance of the resultant effects is set out in Table 15.

Table 15: Significant effect on resources

Resource	Impact magnitude	Sensitivity	Significance of effect
Two motorsport engineering businesses at Greatworth Park trading estate (northern building).	Medium	Medium	Moderate adverse significant effect

10.4.18 Construction of the Proposed Scheme will require the demolition of industrial premises occupied by two motorsport engineering businesses at Greatworth Park trading estate (northern building). Given the specialist nature of the activities taking place at these businesses there are likely to be abnormal and specific locational,

⁷⁹ Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level. Direct effects arising at equestrian business and orchards are assessed in Section 3: Agriculture, forestry and soils.

design and skill requirements associated with this business which may make their relocation difficult. The effect on these resources and their employees is assessed to be moderate adverse and will therefore be significant.

- 10.4.19 It is estimated that the Proposed Scheme will result in the displacement or possible loss of a total of 40 jobs⁸⁰ within this area. Taking into account total employment within the area the impact on the local economy from the displacement or possible loss of jobs is considered to be relatively modest compared to the scale of economic activity and opportunity in the area.

Cumulative effects

- 10.4.20 No committed (inter-project) developments have been identified that are considered to interact with the Proposed Scheme.
- 10.4.21 Cumulative effects also arise in relation to the accumulation of individual resource based job displacement and losses on a local labour market. These effects are dealt with as part of the route-wide assessment (see Volume 3).

Other mitigation measures

- 10.4.22 The above assessment has concluded that there are significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.
- 10.4.23 Businesses displaced by the Proposed Scheme will be fully compensated within the provisions of the Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to new premises and will therefore provide additional support over and above statutory requirements to facilitate this process.
- 10.4.24 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

- 10.4.25 Likely significant residual effects are shown on Maps SE-01-045 to SE-01-051a (Volume 5, Socio-economics Map Book).
- 10.4.26 The Proposed Scheme will require the demolition of industrial premises at Greatworth Park trading estate leading to the need to relocate two businesses. During construction, customers may be discouraged from using The Carpenters Arms public house on the Claydon Road for a three year period as it is expected to be affected by construction works and passing lorries related to building the Claydon Road overbridge.

⁸⁰ Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) *Employment Densities Guide 2nd Edition* (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

10.5 Effects arising during operation

Avoidance and mitigation measures

10.5.1 No mitigation measures are required during operation within this area.

Assessment of impacts and effects

Resources with direct effects

10.5.2 There are no resources considered likely to experience significant direct effects during the operational phase of the Proposed Scheme within this area.

Change in business amenity

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

Operational employment

10.5.4 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots, which are considered unlikely to be accessed by residents within the area.

10.5.5 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the Proposed Scheme or benefiting from expenditure of directly employed workers on goods and services. Some of these employment opportunities will be accessible to residents in the locality.

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 this section of the route will be either negligible or beneficial and therefore mitigation is not relevant.

Summary of likely residual significant effects

10.5.9 There are no significant effects identified in this assessment that will arise during operation.

11 Sound, noise and vibration

11.1 Introduction

11.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the Proposed Scheme for the Greatworth to Lower Boddington 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 areas⁸¹; 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'⁸².

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).

⁸¹ '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.

⁸² Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity (further information is provided in Volume 5: Appendix SV-001-000).

11.1.7 More detailed information and mapping regarding the sound, noise and vibration assessment for Greatworth to Lower Boddington is available in the relevant appendices in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-015);
- sound, noise and vibration construction assessment (Appendix SV-003-015);
- sound, noise and vibration operation assessment (Appendix SV-004-015); 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 varies significantly with location.

11.2.2 In the north eastern part of Greatworth the main sound source is local traffic on Helmdon Road giving rise to daytime levels of around 45 to 50dB⁸³. Sound levels reduce into the village at locations further away from this road. During lulls in local traffic, more distant intermittent traffic on the B4525 can be heard. Other sounds in the area include activity at residential properties and natural sources. Night-time sound levels⁸⁴ are typically 35 to 45dB due to reduced traffic volumes.

11.2.3 The sound environment in Thorpe Mandeville is shaped by relatively constant distant road traffic and intermittent traffic on local roads, giving rise to typical daytime levels of around 45dB, and sometimes lower at locations without direct sight of the roads. Other sources of sound include occasional overflying aircraft and agricultural activities. Sound levels at night are typically around 5dB lower than in the day.

11.2.4 In Chipping Warden and nearby areas, the dominant sound source is traffic using the A361 Byfield Road. In the village, properties situated close to this road are exposed to relatively high daytime sound levels of around 65 to 70dB. Further back from the A361 Byfield Road, sound levels reduce to around 50dB. Other sound sources in the area include occasional overflying aircraft, intermittent local road traffic and birdsong. Sound levels are lower at night as traffic reduces, typically 60dB close to the A361 Byfield Road and 40 to 45dB at locations screened from the main traffic sound sources.

11.2.5 The sound environment in Aston le Walls reflects the rural location of the village and daytime sound levels are typically around 45dB. The sound of distant road traffic on the A361 Byfield Road to the south-east of the village is interspersed with occasional sound of traffic on the local roads. Birds and other natural sources also contribute to

⁸³ Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.

⁸⁴ Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr}$.

the sound environment, as do occasional aircraft over-flights. Sound levels are lower at night as traffic reduces – typically around 40dB.

- 11.2.6 Vehicles on Banbury Road provide the dominant sound source for Lower Boddington, resulting in daytime sound levels of typically approaching 60dB near to the road, and 45dB further afield. Other sound sources in the area include intermittent local road traffic, occasional aircraft, farm activities, birdsong and local community activities. Sound levels are 5 to 10dB lower at night as traffic volumes reduce.
- 11.2.7 The sound environment at the more remote properties in the area tends to be characterised by lower overall sound levels compared to the settlements, and is usually influenced by the proximity to nearby roads and the amount of traffic on those roads. Most locations in the area are subject to the occasional sound of aircraft over flight and each property is subject to specific local sounds that may include agricultural activities, natural sources, light-industrial or commercial activities depending on the locality.
- 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-002-015.
- 11.2.9 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration⁸⁵. 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 roads⁸⁶, 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.

⁸⁵ Further information is available in the Volume 5: Appendix SV-001-000, the SMR and its Addendum.

⁸⁶ Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

Operation (2026)

- 11.2.12 The assessment is based upon the predicted change in sound levels that result from the Proposed Scheme. The assessment initially considered a worst case (that would overestimate the change in levels) by assuming that sound levels would not change from the existing baseline year of 2012/2013. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2026 to coincide with the proposed start of passenger services. The future baseline is for the sound environment that would exist in 2026 without the Proposed Scheme.

11.3 Effects arising during construction

Local assumptions and limitations

Local assumptions

- 11.3.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3 of this report.
- 11.3.2 Although it is anticipated that there may be occasional short term night-time working during road possession periods, it is expected that the noise effects would be limited in duration and would hence not be considered significant. The management and control processes in the draft CoCP would reduce any adverse noise effects.
- 11.3.3 The assessment takes account of people’s perception of noise throughout the day. More stringent criteria are applied during evening and night-time periods, when people are more sensitive to noise, compared to the busier and more active daytime period.
- 11.3.4 Local limitations
- 11.3.5 In this area, there are a number of locations where the land or property owners did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient information has been obtained to undertake the assessment. Further information is provided in Volume 5: Appendix SV-002-015.

Avoidance and mitigation measures

- 11.3.6 The assessment assumes the implementation of the principles and management processes set out in Section 13 of 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 warnings⁸⁷; 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 noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration including confirmation of noise insulation/ temporary re-housing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and
- contractors will be required to comply with the terms of the CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.7 In addition to this mitigation, taller screening as described in the draft CoCP⁸⁸ has been assumed along the edge of the construction site boundary adjacent to the residential communities at Greatworth (including Greatworth Park); Thorpe Mandeville; Chipping Warden; Aston le Walls; and Lower Boddington.

11.3.8 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP noise insulation and temporary re-housing policy. Noise insulation or ultimately temporary re-housing will avoid residents being significantly affected⁸⁹ by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for such measures.

11.3.9 Qualification for noise insulation and temporary re-housing will be identified as part of seeking prior consent from the local authorities under Section 61 of the CoPA. Qualifying buildings will be identified early enough so that noise insulation can be installed, or temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria. Noise insulation, where required, will be installed as early as possible to reduce internal sound levels from construction activities and also when the Proposed Scheme comes into operation.

⁸⁷ Warning signals that consist of bursts of noise.

⁸⁸ 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.

⁸⁹ Information is provided in the emerging National Planning Practice Guidance; Noise; <http://planningguidance.planningportal.gov.uk>. Accessed: October 2013. e.g. the Table presenting the noise exposure hierarchy.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

- 11.3.10 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, two residential buildings (the dwellings at The Old Dairy and Greatworth Hall, Greatworth) are forecast to experience noise levels higher than the noise insulation trigger levels as defined in the draft CoCP. For daytime construction the trigger level is 75dB⁹⁰ measured outdoors.
- 11.3.11 The mitigation measures, including noise insulation, will reduce noise inside all dwellings, including those at The Old Dairy and Greatworth Hall, such that it does not reach a level where it would significantly affect residents.

Residential receptors: direct effects – communities

- 11.3.12 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.
- 11.3.13 In locations with lower existing sound levels⁹¹, 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 non-significant.

Residential receptors: indirect effects

- 11.3.14 Construction traffic is likely to cause adverse noise effects on residential receptors along Banbury Lane where it passes through Thorpe Mandeville (CSV15-Co1). Approximately 40 dwellings located immediately adjacent to the lane are forecast to experience an increase in outdoor noise levels of around 7dB during the peak months (further information on traffic flows is provided in Section 12).
- 11.3.15 These adverse effects would be a change in the acoustic character of the area such that there is a perceived change in the quality of life and are considered significant when assessed on a community basis taking account of the local context⁹².

Non-residential receptors: direct effects

- 11.3.16 Significant construction noise effects have been identified on a reasonable worst case basis on the following non-residential receptors:
- commercial properties located in Greatworth Park (CSV15-No1) and Greatworth Hall (CSV15-No2). Significant noise effects⁹³ have been identified during the daytime with noise levels rising at times to around 75dB⁹⁴ during the construction of the Greatworth green tunnel; and

⁹⁰ L_{pAeq,0800-1800} measured at the façade.

⁹¹ Further information is provided in Volume 5: Appendix SV-001-000.

⁹² Further information is provided in Volume 5: Appendices SV-001-000 and SV-003-015.

⁹³ Activity disturbance, especially for activities that require good conditions for verbal communication.

⁹⁴ Equivalent continuous sound level at the facade, L_{pAeq,0700-1900}.

- Chipping Warden Primary School (CSV15-No3). A significant noise effect has been identified due to daytime construction noise associated with the elements of the Byfield Road realignment that are closest to the school. The forecast noise levels at the school are at times around 55dB⁹⁵.

Non-residential receptors: indirect effects

- 11.3.17 On a worst case basis, construction traffic along Banbury Road is likely to cause significant indirect noise effects at the Church of St John the Baptist (CSV15-No4), Thorpe Mandeville Village Hall (CSV15-No5) and The Three Conies public house (CSV15-No6). This is associated with a forecast increase in noise levels of around 7dB in the peak months (further information on traffic flows is provided in Section 12).

Cumulative effects from the Proposed Scheme and other committed development

- 11.3.18 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments⁹⁶. In this area, no committed developments are due 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 effects.

Summary of likely residual significant effects

- 11.3.19 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it does not reach a level where it would significantly affect residents.
- 11.3.20 The measures also reduce the effect of outdoor construction noise on the acoustic character around the local residential communities such that the adverse effects are not considered to be significant.
- 11.3.21 On a reasonable worst case basis, noise from specific construction activities has been identified as resulting in significant residual temporary effects on commercial properties (primarily office accommodation) located in Greatworth Park and Greatworth Hall⁹⁷ and Chipping Warden Primary School.
- 11.3.22 Construction traffic on Banbury Lane is likely to cause significant noise effects on adjacent residential and non-residential receptors where it passes through Thorpe Mandeville.
- 11.3.23 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.

⁹⁵ Equivalent continuous sound level at the facade, $L_{pAeq, 0700-1900}$

⁹⁶ Refer to Volume 5: Appendix CT-004-000

⁹⁷ Conference facilities are provided at Greatworth Hall.

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 1⁹⁸. 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

Local assumptions – tunnelled sections

- 11.4.3 Tunnel portals are likely to include mechanical ventilation equipment. It is likely that this equipment will only operate for limited testing periods during the daytime⁹⁹, or in the event of an emergency.

Avoidance and mitigation measures

- 11.4.4 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities and low in the ground. These avoidance measures have protected many communities from likely significant noise or vibration effects.

Airborne noise

- 11.4.5 HS2 trains will be quieter than the relevant current European Union specifications. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 300kph (186mph) with current pantograph designs, drawing on

⁹⁸ The change in noise and vibration effects between the different passenger services is assessed in Volume 1.

⁹⁹ For example, HS1 vent shaft fans are tested monthly.

proven technology in use in East Asia. The track will be specified to reduce noise, as will the maintenance regime. Overall these measures would reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train operating on the new track. Further information is provided in Volume 5: Appendix SV-001-000.

- 11.4.6 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise barriers in the form of landscape earthworks, noise fence barriers and/or 'low-level' barriers on viaducts. Noise barrier locations are shown on Map Series SV-05 (Volume 2, CFA15 Map Book).
- 11.4.7 Generally, the assessment has been based on noise barriers having a noise reduction performance equivalent to a noise fence barrier with a top level 3m above the top of the rail, which is acoustically absorbent on the railway side, and which is located 5m to the side of the outer rail. In practice, barriers may differ from this description, but will provide the same acoustic performance. For example, where noise barriers are in the form of landscape earthworks they will need to be higher above rail level to achieve similar noise attenuation to a 3m barrier because the crest of the earthwork will be further than 5m from the outer rail.
- 11.4.8 The Proposed Scheme incorporates 'low-level' barriers into the design of viaducts. Where needed to avoid or reduce significant airborne noise effects, these barriers are designed to provide noise reduction that is equivalent to a 2m high absorptive noise barrier located on the parapet of the viaduct. Locating these 'low-level' barriers close to the rail also reduces visual impact and limits the mass of the viaduct itself.
- 11.4.9 Noise effects are reduced in other locations along the line by landscape earthworks provided to avoid or reduce significant visual effects and engineering structures such as cuttings and safety fences on viaducts (where noise barriers are not required). The location of these barriers is shown on Volume 5: Map Book – Sound, noise and vibration, Map Series SV-05 (Volume 2, CFA15 Map Book).
- 11.4.10 The Proposed Scheme also includes green tunnels that reduce noise effects in and around Greatworth, Chipping Warden and Aston le Walls. Tunnel portals will be designed to avoid any significant airborne noise effects caused by the trains entering the tunnel.
- 11.4.11 Significant noise effects from the operational static sources such as mechanical ventilation at tunnel portals and line-side equipment will be avoided through their design and the specification of noise emission requirements (for further information please see Volume 5: Appendix SV-001-000).
- 11.4.12 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996¹⁰⁰ (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations. Qualification for noise

¹⁰⁰ *The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996*, London. Her Majesty's Stationery Office.

insulation under the Regulations will be identified and noise insulation offered at the time that the Proposed Scheme becomes operational.

11.4.13 Where required, as well as improvements to noise insulation of windows facing the railway, ventilation will be provided so that windows can be kept closed to protect internal sound levels.

11.4.14 Following Government’s emerging National Planning Practice Guidance¹⁰¹, where the noise from the use of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the WHO Night Noise Guidelines for Europe¹⁰², residents are considered to be significantly affected by the resulting noise inside their dwelling. The effect on people at night due to the maximum sound level as each train passes has also been assessed¹⁰³. The Interim Target is a lower level of noise exposure than the Regulations trigger threshold for night noise. In these particular circumstances, where night-time noise levels for the use of new or additional railways authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55dB¹⁰⁴, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion, noise insulation will be offered for these additional buildings.

Ground-borne noise and vibration

11.4.15 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

Surface sections of route; airborne noise and ground-borne vibration

11.4.16 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified a number of residential buildings close to the Proposed Scheme where the daytime forecast noise level does not exceed the threshold set in the Regulations but the forecast night-time noise level would exceed the World Health Organization’s Interim Target of 55dB or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion. It is therefore estimated that these buildings will be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are indicated on Map Series SV-05 (Volume 2, CFA15 Map Book):

- The Dairy, Granary Barn, The Threshing Barn and The Forge on Culworth Road near Chipping Warden; and

¹⁰¹ National Planning Practice Guidance; Noise; <http://planningguidance.planningportal.gov.uk>; Accessed: October 2013.

¹⁰² World Health Organization (2010), *Night-time Noise Guidelines for Europe*.

¹⁰³ During the night (23:00-07:00) a significant effect is also identified where the Proposed Scheme results in a maximum sound level at the façade of a building at or above: 85dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80dB L_{pAFmax} (where the number of train pass-bys exceeding this value is greater than 20).

¹⁰⁴ Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings.

- The Old Dairy and the dwelling at Greatworth Hall, Greatworth. These dwellings are also identified as being likely to qualify for noise insulation as a consequence of construction noise as described earlier in this section.

11.4.17 The mitigation measures including noise insulation will reduce noise inside all dwellings such that it will not reach a level where it would significantly affect residents.

Residential receptors: direct effects – communities

11.4.18 The mitigation measures in this area will avoid airborne noise adverse effects on the majority of receptors, and at the following communities:

- Greatworth;
- Chipping Warden;
- Aston le Walls; and
- Lower Boddington.

11.4.19 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2, CFA15 Map book) shows the long term 40dB¹⁰⁵ night-time sound level contour from the operation of trains on the Proposed Scheme. The extent of the 40dB night-time sound level contour is equivalent to, or slightly larger than, the 50dB daytime contour¹⁰⁶. In general, below these levels adverse effects are not expected.

11.4.20 Above 40dB during the night and 50dB during the day the effect of noise is dependent on the baseline sound levels in that area and the change in sound level (magnitude of effect) brought about by the Proposed Scheme. The airborne noise impacts and effects forecast for the operation of the scheme are presented on Map Series SV-05 (Volume 2, CFA15 Map Book).

11.4.21 The changes in noise levels are likely to affect the acoustic character of the area such that there is a perceived change in the quality of life and are considered to be significant when assessed on a community basis taking account of the local context¹⁰⁷, as identified in Table 17.

Table 17: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number (see Map Series SV-05, Volume 2, CFA15 Map Book)	Source of significant effect	Time of day	Location and details
OSV15-C01	Airborne noise increase from new train services	Daytime and night-time	Thorpe Mandeville. Approximately 10 dwellings in the vicinity of Banbury Lane. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the closest properties.

¹⁰⁵ Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$

¹⁰⁶ 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 $L_{pAeq,day}$) from the Proposed Scheme would be approximately 10dB higher than the night-time sound level. The 40dB contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 50dB.

¹⁰⁷ Further information is provided in Volume 5: Appendices SV-001-000 and SV-004-015.

Significant effect number (see Map Series SV-05, Volume 2, CFA15 Map Book)	Source of significant effect	Time of day	Location and details
			The effect on the acoustic character of residential areas that are located further from the railway would be a either moderate or minor. There are no shared open spaces identified as being affected in this community area.

Residential receptors: indirect effects

11.4.22 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

11.4.23 The assessment of operational noise and vibration indicates that significant effects are likely on the non-residential receptors identified in Table 18.

11.4.24 The assessment of effects on non-residential receptors has been undertaken on a reasonable worst case basis taking account of public available information about each receptor. Further information can be found in Volume 5: Appendix SV-004-015.

Table 18: Likely significant noise or vibration effects on non-residential receptors arising from operation of the Proposed Scheme

Significant effect number (see Map Series SV-05, Volume 2, CFA15 Map Book)	Type of significant effect and source	Time of day	Location and details
OSV15-No1	Major airborne noise effect on the acoustic character around the offices and a risk of disturbing activities inside the offices buildings due to the operation of train services.	Daytime	Offices at Greatworth Hall located closest to the route (may include conference facilities)
OSV15-No2	Major airborne noise effect on the acoustic character around the property and a risk of disturbing activities inside the office buildings due to the operation of train services.	Daytime	General commercial property at Spella Barn, Lower Boddington.

Non-residential receptors: indirect effects

11.4.25 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

Summary of likely significant residual effects

11.4.26 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect residents.

- 11.4.27 The avoidance and mitigation measures in this area will avoid noise and vibration adverse effects on the majority of receptors and communities including their shared open areas.
- 11.4.28 Taking account of the avoidance and mitigation measures and the local context, the residual permanent noise adverse effects on the acoustic character of the community close to Banbury Lane on the eastern edge of Thorpe Mandeville are considered significant.
- 11.4.29 On a reasonable worst case basis a significant noise effect has been identified on the offices at Greatworth Hall that are located closest to the route and general commercial property at Spella Barn, Lower Boddington. HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so, HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures. The outcome of these activities will be reflected in the Environmental Minimum Requirements.

12 Traffic and transport

12.1 Introduction

- 12.1.1 This section describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction and operation of the Proposed Scheme through the Greatworth to Lower Boddington area.
- 12.1.2 With regard to traffic and transport, the main issues as a result of implementation of the Proposed Scheme are traffic generated during construction and the closure of both roads and other PRoW, either temporarily or in some cases permanently, with associated diversions.
- 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: TR-001-000 Transport Assessment.
- 12.1.5 Figure 2 shows the key transport infrastructure in this area.
- 12.1.6 Engagement has been undertaken with the key transport authorities including Northamptonshire County Council (NCC) and Oxfordshire County Council (OCC).

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 A422 (M40 to B4525 Banbury Lane), A361 Williamscot Hill/Banbury Road/Byfield Road/Badby Road West (M40 to A45 Stefen Way), B4525 Banbury Lane (A422 to A43) and local roads that either cross the Proposed Scheme or are in close proximity to it.
- 12.2.3 The A423 Southam Road north of Banbury and the A422 Hennef Way in Banbury between the A423 Southam Road and the M40, junction 11 are reported in this report and in the neighbouring Ladbroke and Southam study area (CFA16). This is because the impacts on these roads are due to the construction vehicles that originate in the Ladbroke and Southam area. For the same reason, any effects of the Proposed Scheme on these roads within this study area are reported both in this CFA report and in the neighbouring Ladbroke & Southam study area (see CFA 16 report).
- 12.2.4 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 forecast road traffic growth in the area. The assessment covers the morning (08:00-09:00 hours) and evening (17:00-18:00 hours) peak periods for an average weekday.

- 12.2.5 It has been assumed that bus services for the future years of assessment will be the same as those currently operating, since it is not possible to forecast how commercial services may change in the future.
- 12.2.6 Future year traffic flows with and without the Proposed Scheme are based on an approach that does not take account of wider effects, such as redistribution and reassignment of traffic, modal shift and peak spreading. As a consequence, adverse transport effects may be over-stated.

12.3 Environmental baseline

Existing baseline

- 12.3.1 Existing conditions in the Greatworth to Lower Boddington area have been determined through site visits, specially commissioned transport surveys, and liaison with relevant transport authorities and stakeholders to source traffic data, information on public transport, PRow and accident data.
- 12.3.2 Traffic surveys of all roads crossing or potentially affected by the route were undertaken in June and September 2012 and February 2013 comprising automatic traffic counts, junction turning counts and queue surveys. This was supplemented by traffic and transport data obtained from other sources where available, including from the NCC and OCC.
- 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 all PRow and roads that will cross the route of the Proposed Scheme, and any additional PRow that will be affected by the Proposed Scheme. The surveys indicated that the majority of the roads, footpaths, bridleways and cycleways crossing the route are used by no more than 10 people per day with the exception of Appletree Lane and Culworth Road which were all used by no more than 30 people per day, PRow AC1 which was used by no more than 60 people per day, and Claydon Road (also known as Hill Road) which was used by no more than 150 people per day. The Proposed Scheme will affect 42 PRow within the Greatworth to Lower Boddington area and crosses 36 of these. In addition to the 36 PRow the Proposed Scheme crosses 11 roads with potential for use by non-motorised users.
- 12.3.4 The main strategic roads and local roads affected by the Proposed Scheme are A422 Hennef Way (M40 to A423), A423 Southam Road (A422 to Southam), A422 (M40 to B4525 Banbury Lane), A361 Williamscot Hill/Banbury Road/Byfield Road/Badby Road West (M40 to A45 Stefen Way), B4525 Banbury Lane (A422 to A43), Radstone Road (Radstone), Helmdon Road (Greatworth), Marston Road (Greatworth to B4525), Sulgrave Road (South of Banbury Road), Banbury Road (B4525 to Sulgrave Road), Banbury Lane (Banbury Road to Culworth), Wardington Road, Culworth Road (Chipping Warden), Appletree Road (Chipping Warden), Welsh Road (Trafford Bridge to Banbury Road), Banbury Road (Lower Boddington), Claydon Road (also known as Hill Road), and Claydon Road (also known as Boddington Road).
- 12.3.5 Relevant accident data for the road network subject to assessment has been obtained from NCC and OCC for the three year period from 2009 to 2011. This has been

assessed and any identified clusters have been examined. No significant accident clusters have been identified in the area.

12.3.6 The following seven public bus services operate along roads that were subject to traffic and transport assessment:

- Route 508 – connecting Brackley to Bodicote and serving Greatworth, Helmdon, Culworth, Thorpe Mandeville, Banbury and Calthorpe;
- Route 200 – connecting Banbury to Daventry and serving Wardington, Chipping Warden, Byfield, and Badby;
- Route C88 – a demand responsive service covering Brackley, Middleton Cheney and Towcester areas;
- Route B500 and C500 – demand responsive services covering the Northamptonshire and Oxfordshire areas; and
- Route 503 – Bishops Itchington and Southam to Banbury.

12.3.7 Route 508 operates along the B4525 Welsh Lane, Banbury Lane, and Helmdon Road on a one service a week basis. Route 200 operates along the A361 Williamscot Hill/Banbury Road/Byfield Road/Badby Road West at a peak frequency of one bus an hour. The demand responsive services Route B500 and Route C500 operate along Banbury Road, Banbury Lane, Marston Road, Welsh Road, and Culworth Road as required, with a potential maximum combined peak frequency of two buses an hour. The Route B500 also operates along the A361 Williamscot Hill/Banbury Road/Byfield Road/Badby Road West and Appletree Lane as required at a potential frequency of one bus an hour, and the Route C500 also operates along the B4525 Banbury Lane/Welsh Road and Helmdon Road as required at a potential frequency of one bus an hour. In addition to these, the demand responsive Route C88 operates along the B4525 Welsh Road. Route 503 operates along A423 Southam Road and A422 Hennef Way at a peak frequency of one bus a day.

12.3.8 There are no rail services that are affected by the Proposed Scheme in this area and consequently this topic is not considered further in this assessment.

12.3.9 The only waterway frequently used by waterborne craft in this area is the Oxford Canal, which is not crossed or affected by the Proposed Scheme. Consequently it is not considered further in this assessment.

Future baseline

12.3.10 Future baseline traffic volumes have been calculated by applying growth factors derived from TEMPRO for the years of 2021, 2026 and extrapolated to 2041. The factors have been derived for the individual road types and relevant wards. No other changes to the traffic and transport baseline are anticipated in this area.

Construction

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 between around 12% and 15% by 2021 compared to 2012, depending on road type.

Operation (2026)

12.3.12 Future baseline traffic volumes in the peak hours are forecast to grow by between around 20% and 25% by 2026 compared to 2012, depending on road type.

Operation (2041)

12.3.13 Future baseline traffic volumes in the peak hours are forecast to grow by between around 36% and 50% by 2041 compared to 2012, depending on road type.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as described in Section 2) have been included as part of the engineering design of the Proposed Scheme and will avoid or reduce adverse effects on transport users:

- transporting construction materials and equipment along haul roads within and adjacent to the route of the Proposed Scheme, 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 reduced diversions of traffic onto alternative routes;
- provision of temporary alternative routes and/or building structures early to maintain connectivity for PRow closed during construction to reduce loss of amenity;
- HGV routing as far as reasonably practicable, along the strategic road network and using designated routes for access as shown on Maps TR-03-060 and TR-03-061 (Volume 5, Traffic and Transport Map Book);
- excavated material will be reused where reasonably practicable along the alignment of the Proposed Scheme which will reduce the effects of construction vehicles on the public highway; and
- providing on-site accommodation and welfare facilities to reduce daily travel by site workers.

12.4.2 The draft CoCP (see Volume 5: Appendix CT-003-000/1) includes measures which seek to reduce the impacts and effects of deliveries of construction materials and equipment, including reducing construction lorry trips during peak background traffic periods. The draft CoCP includes HGV management and control measures.

12.4.3 Where reasonably practicable, the number of private car trips to and from the site (both workforce and visitors) will be reduced by encouraging alternative modes of transport or vehicle sharing. This will be supported through an over-arching

framework travel plan¹⁰⁸ that will require travel plans to be used, along with a range of potential measures, to mitigate the adverse impacts of traffic and transport movements associated with construction of the Proposed Scheme. As part of this, a construction workforce travel plan will be put into operation with the aim of reducing workforce commuting by private car, especially sole occupancy car travel. Where practicable this will encourage the use of sustainable modes of transport or vehicle sharing.

- 12.4.4 The measures in the draft CoCP (Section 14) 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 management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads, bridleways, footpaths and other PRow affected by the Proposed Scheme as necessary.
- 12.4.5 Specific measures will include core site operating hours will be 08:00-18:00 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 the 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).

Assessment of impacts and effects

Temporary effects

- 12.4.6 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.
- 12.4.7 The temporary traffic and transport impacts within this area will be:
- construction vehicle movements to and from the construction compounds;
 - road closures and associated diversions;
 - bus diversions; and
 - PRow closures and associated diversion.
- 12.4.8 Construction vehicle movements required to construct the Proposed Scheme 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. The duration of when there will be busy transport activity at each site is shown in Table 19. This represents the periods when the construction traffic flows will be greater than 50% of peak construction flows. Also shown is the estimated number of daily vehicle trips during

¹⁰⁸ Construction and operational travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

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 shows the average during the peak month.

Table 19: Typical vehicle trip generation for construction 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	Greatworth green tunnel	B4525 and A43 from the east, and B4525 and A422 from the west	2017	Six years and six months	54 months	140-200	80-120
Main	Chipping Warden green tunnel	A361 Byfield Road	2017	Five years	26 months	190-200	890-1,300
Satellite	Thorpe Mandeville cutting	Banbury Road, Banbury Lane, B4525, and A422	2017	Two years	Two months	20-30	1060-1230
Satellite	Greatworth green tunnel (north portal) (rail systems)	Sulgrave Road, B4525 and A422	2022	One year and six months	Nine months	<10	0
Satellite	Lower Thorpe viaduct	Banbury Lane and either B4525 Banbury Lane and A422 or B4525 and A43	2017	Two years	13 months	150-220	20-30
Satellite	Culworth cutting	Welsh Road via A361 Byfield Road	2018	Two years	15 months	160-230	20-30
Satellite	Danes Moor auto-transformer station (rail systems)		2022	One year and six months			
Satellite	Chipping Warden green tunnel south portal (rail systems)	Culworth Road via A361 Byfield Road	2022	One year and nine months	Nine months	20-30	10-20
Satellite	Chipping Warden tunnel north portal (rail systems)	Appletree Lane, Welsh Road, A361 Byfield Road	2022	Two years	13 months	80-100	10-20

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	Claydon Road overbridge	Claydon Road (also known as Hill Road) via Banbury Road, Welsh Road, A361 Byfield Road	2017	Two years and nine months	15 months	130-160	10-30
Satellite	Banbury Road green overbridge and Boddington auto-transformer station	Banbury Road via Welsh Road, A361 Byfield Road, A45 Stefen Way	2022	Five years and nine months	14 months	70-100	20-30

- 12.4.10 Information on the indicative construction programme and methodology is provided in Section 2 which illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 19. Consequently the peak traffic movements will not generally occur at the same time, although in some instances there may be some overlap.
- 12.4.11 Where construction routes serve more than one construction compound, the combined vehicle movements have been assessed.
- 12.4.12 Construction of the Proposed Scheme is expected to result in changes in traffic flows and delays to vehicle users due to increased traffic flows from workers and construction vehicles accessing compounds and also temporary road closures and diversions.
- 12.4.13 These changes in traffic flows will lead to significant increases in delays to vehicle users and congestion¹⁰⁹ at the following junctions:
- A422 with A361 (M40 j11) (moderate adverse effect);

¹⁰⁹ 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 close to capacity and the increases in traffic due to the Proposed Scheme will be such as to substantially increase queues and delays on a routine basis. 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 cause occasional queues and delays or small increases in existing delays.

- A422 with the B4525 Banbury Lane (minor adverse effect);
- A361 Banbury Road with Welsh Road (moderate adverse effect);
- B4525 Banbury Lane/Welsh Lane with Banbury Lane (moderate adverse effect);
- A361 Badby Road West with B4037 Badby Road (minor adverse effect);
- A45 Stefen Way/A361 Badby Road West (minor adverse effect); and
- B4525 Welsh Lane with Radstone Road (minor adverse effect).

12.4.14 Changes in traffic flows will also lead to a significant increase in delay and congestion to vehicle users in the following locations between the M40 and the A423, due to impacts on these roads originating in the neighbouring Ladbroke and Southam area (CFA16):

- M40 slip roads/A422 Hennef Way/A361 Willamscot Hill junction (major adverse effect);
- A422 Hennef Way/Ruscote Avenue/A423 Southam Road junction (minor adverse effect);
- A422 Hennef Way/Concord Avenue junction (moderate adverse effect); and
- A422 Hennef Way/Ermont Way junction (major adverse effect).

12.4.15 Road closures and associated diversions will result in the following effects for traffic due to increased travel distance and time:

- temporary closure of Claydon Road (also known as Hill Road) requiring a traffic diversion for up to approximately one year and six months of approximately 7.4km via Claydon Road (also known as Boddington Road) and Banbury Road resulting in a moderate adverse effect;
- temporary closure of Appletree Lane requiring a traffic diversion for up to approximately four years and six months of approximately 6km via Appletree Road, A361 and Welsh Road resulting in a moderate adverse effect;
- temporary closure of Wardington Road requiring a traffic diversion for up to approximately two years of approximately 5.3km via Culworth Road resulting in a moderate adverse effect;
- temporary closure of Banbury Lane, Thorpe Mandeville, requiring a traffic diversion for up to approximately two years of approximately 6.5km via Banbury Road resulting in a moderate adverse effect; and
- temporary closure of Helmdon Road requiring a traffic diversion for up to approximately one year six months of approximately 3.9km via Welsh Road, Marston Road and the B4525 resulting in a moderate adverse effect.

12.4.16 There will also be effects due to permanent closures as follows and these are reported in Section 12.5. These will include permanent closure of Claydon Road (also known as

Boddington Road) that will require a traffic diversion of approximately 1.5km via Banbury Road; and the permanent closure of Culworth Road.

12.4.17 Construction of the Proposed Scheme will result in substantial increases in daily traffic flow (i.e. more than 30% for HGV or all vehicles) and these will cause a significant increase in traffic related severance¹¹⁰ for non-motorised users seeking to cross the road in the following locations:

- Claydon Road (also known as Boddington Road), between Banbury Road and Claydon (moderate adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Claydon Road (also known as Hill Road), between the Proposed Scheme and Lower Boddington (moderate adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Welsh Road/Banbury Road, between A361 Byfield Road and Banbury Road Green overbridge satellite compound (moderate adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Appletree Lane, between the Proposed Scheme and Welsh Road (minor adverse effect) due to an increase in all traffic flow;
- A361 Byfield Road, between Welsh Road and A45 Stefen Way (moderate adverse effect) due to an increase in HGV flow;
- A361 Byfield Road, between Welsh Road and A422/M40 (major adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Welsh Road, between A361 Byfield Road and Culworth cutting satellite compound (moderate adverse effect) due to an increase in HGV flow as well as all traffic flow;
- B4525 Banbury Lane, between A422 and junction with Banbury Lane (south of Thorpe Mandeville) (major adverse effect) due to an increase in HGV flow;
- Banbury Lane, between B4525 Banbury Lane and junction with Banbury Road at Thorpe Mandeville (major adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Banbury Lane (near Thorpe Mandeville) between the Proposed Scheme and Banbury Road (moderate adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Banbury Road, Thorpe Mandeville, between the Proposed Scheme and Banbury Lane (major adverse effect) due to an increase in HGV flow as well as all traffic flow;

¹¹⁰ In the context of this Traffic and transport section, severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

- Marston Road, between Helmdon Road and B4525 Welsh Lane (moderate adverse effect) due to an increase in HGV flow as well as all traffic flow;
- Radstone Road, between Proposed Scheme and B4525 Welsh Lane (major adverse effect) due to an increase in HGV flow; and
- A423 Southam Road, north of A422 Hennef Way in Banbury (moderate adverse effect due to increase in HGV traffic).

- 12.4.18 Unless separately identified, these traffic flow increases will not result in significant increases in congestion.
- 12.4.19 Utilities works, including diversions, have been assessed in detail where they are major and where the traffic and transport impacts from the works separately, or in combination with other works, is greater than other construction activities arising within the area. More minor utilities works and associated traffic management measures will have only localised impacts and are expected to short-term in duration. Utilities works are not expected to result in significant additional adverse effects.
- 12.4.20 No significant effects on parking or loading have been identified during construction in this area.
- 12.4.21 The effect on accident and safety risks will not be significant as there are no locations where there are both existing clusters of accidents and where there are substantial increases in traffic during construction.
- 12.4.22 It is expected that the construction of the Proposed Scheme will require a number of bus route diversions and these will result in additional travel time for public transport users as follows:
- moderate adverse effects due to the temporary closure of Appletree Lane and the associated temporary diversion for four years and six months of the demand responsive Route B500 bus service of approximately 4km;
 - minor adverse effects due to the temporary closure of Helmdon Road for one year and six months and the associated temporary diversion of the Route 508 bus service of approximately 1.7km; and
 - the permanent closure of Culworth Road requiring a diversion of the demand responsive Route B500 and Route C500 bus services (effect is reported in Section 12.5).
- 12.4.23 Apart from general congestion, there will be no additional effects on other bus services.
- 12.4.24 There will be minor adverse effects on non-motorised users due to increased travel distance from 11 ProW and eight road diversions, at Banbury Road, Claydon Road (also known as Boddington Road) and AC1 (footpath), AA8 (footpath), Appletree Lane, A361 Byfield Road, AE12 Jurassic Way, AE21 (footpath), AE20 Macmillan Way, Banbury Lane, Sulgrave Road, AN40 (footpath), AN42 (footpath), B4525 Welsh Road, AN4 (footpath), Helmdon Road, AN14 (bridleway), AN19 (footpath), AN22 (footpath) and AG10 (bridleway). These diversions are between 100 and 300m in length, apart

from the diversions at Appletree Lane and AA8 (footpath) being approximately 400m, AN40 (footpath) approximately 500m, Banbury Lane 600m and AN42 (footpath) 1.4km.

- 12.4.25 There will also be moderate adverse severance effects for non-motorised users due to temporary diversions at Wardington Road by approximately 1.6km and AN39 (footpath) by approximately 1.7km.

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 takes into account traffic and transport impacts of works being undertaken in neighbouring study areas. From the study area adjacent to the south, the Newton Purcell to Brackley area (CFA14), the cumulative average construction traffic flows of approximately 290 cars/LGV per day (two way) and 12 HGV per day (two way) have been included in the assessment for this area.
- 12.4.28 An element of the construction traffic associated with activities in the Ladbroke to Southam area (CFA16), approximately 900 cars/LGV per day (two way) and 280 HGV per day (two way) has been incorporated within in the assessment for this area.

Permanent effects

- 12.4.29 Any permanent effects of construction have been considered in the operations phase assessments for traffic and transport in Section 12.5. This is because the impacts and effects of the forecast increases in travel demand and the wider impacts and effects of the operations phase need to be considered together.

Other mitigation measures

- 12.4.30 The implementation of the draft CoCP (see Volume 5: Appendix CT-003-000/1) in combination with the framework travel plan and the construction workforce travel plan will, to some degree, mitigate the transport related effects during construction of the Proposed Scheme. The reductions in effects arising from the travel plan measures have not been included in the assessment, which will mean that the adverse effects may be over-stated.
- 12.4.31 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

- 12.4.32 Increased traffic during the most intensive periods of construction will affect non-motorised users crossing and using Claydon Road (also known as Boddington Road), between Banbury Road and Claydon; Claydon Road (also known as Hill Road), between the Proposed Scheme and Lower Boddington; Welsh Road/Banbury Road, between A361 Byfield Road and Banbury Road green overbridge satellite compound; Appletree Lane, between the Proposed Scheme and Welsh Road; A361 Byfield Road, between Welsh Road and A45 Stefen Way; A361 Byfield Road, between Welsh Road and A422/M40; Welsh Road, between A361 Byfield Road and Culworth cutting

satellite compound; B4525 Banbury Lane, between A422 and junction with Banbury Lane (south of Thorpe Mandeville); Banbury Lane, between B4525 Banbury Lane and junction with Banbury Road at Thorpe Mandeville; Banbury Lane (near Thorpe Mandeville) between the Proposed Scheme and Banbury Road; Banbury Road, Thorpe Mandeville, between the Proposed Scheme and Banbury Lane; Marston Road, between Helmdon Road and B4525 Welsh Lane; and Radstone Road, between Proposed Scheme and B4525 Welsh Lane.

- 12.4.33 Increased traffic during the most intensive periods of construction will also cause additional traffic congestion and delay at the junctions at A422 with A361 (M40 junction 11); A422 with the B4525 Banbury Lane; A361 Banbury Road with Welsh Road; B4525 Banbury Lane/Welsh Lane with Banbury Lane; A361 Badby Road West with B4037 Badby Road; A45 Stefen Way/A361 Badby Road West; and B4525 Welsh Lane with Radstone Road.
- 12.4.34 Temporary closure of Claydon Road (also known as Hill Road); Appletree Lane; Wardington Road; Banbury Lane; and Helmdon Road during construction will cause some additional delay for users of these roads due to the additional travel distance required by the associated diversions.
- 12.4.35 The temporary closure of Appletree Lane, Helmdon Road and Culworth Road will also cause some additional delay for bus users, due to the diversion of Route 508 and the demand responsive Route B500 and Route C500 bus services.
- 12.4.36 Temporary closure and associated diversion of 12 PRow and nine roads (Banbury Road, Claydon Road (also known as Boddington Road) and AC1 (footpath), AA8 (footpath), Appletree Lane, A361 Byfield Road, AE12 Jurassic Way, AE21 (footpath), AE20 Macmillan Way, Banbury Lane, Sulgrave Road, AN40 (footpath), AN42 (footpath), B4525 Welsh Road, AN4 (footpath), Helmdon Road, AN14 (bridleway), AN19 (footpath) and AN22 (footpath), Wardington Road, AN39 (footpath) and AG10 (bridleway), during construction will affect non-motorised users due to the increased travel distances required by associated diversions.
- 12.4.37 Traffic generated by construction of the Proposed Scheme in the neighbouring Ladbroke and Southam area (CFA16) also results in effects on A423 Southern Road north of Banbury and A422 Hennef Way between A423 Southam Road and M40. These are reported in the Ladbroke and Southam area (CFA16). Additional traffic will cause congestion and delay at the junctions at M40 slip roads with A422 Hennef Way and A361 Willamscot Hill, A422 Hennef Way with A423 Southam Road and Ruscote Avenue, A422 Hennef Way with Concord Avenue, and A422 Hennef Way with Ermont Way. Non-motorised users crossing and using A423 Southam Road north of A422 Hennef Way junction will also be affected during the most intensive periods of construction.
- 12.4.38 The significant effects that result from construction of the Proposed Scheme are shown on Map TR-03-060 and TR-03-061 (Volume 5, Traffic and Transport Map Book).

12.5 Effects arising from operation

Avoidance and mitigation measures

12.5.1 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users:

- retaining the majority of roads crossing the Proposed Scheme in their current location, or very close to their current location resulting in no substantial diversions of traffic onto alternative routes; and
- retaining PRoW crossing the Proposed Scheme, with any localised realignments or diversions reduced to a reasonably practicable minimum length.

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 area will be:

- realignment and stopping up of roads;
- diversion of bus services; and
- PRoW realignments.

12.5.4 Occasional traffic may access areas of the Proposed Scheme for maintenance purposes. However, these infrequent vehicle movements are anticipated to be very low and will therefore not have a significant effect.

12.5.5 The following effects on road users of increased travel distance and time will arise from diversions:

- realignment of Claydon Road (also known as Boddington Road) will require a traffic diversion of approximately 1.5km via Banbury Road, resulting in a minor adverse effect; and
- stopping up of Culworth Road will require a traffic diversion of up to 5km via A361 Byfield Road and Welsh Road, resulting in a minor adverse effect.

12.5.6 The stopping up of Culworth Road will also result in an increase in all traffic on Welsh Road, between Culworth Road and A361 Byfield Road, having a moderate adverse effect on traffic-related severance for non-motorised users.

12.5.7 The effect on accident and safety risks will not be significant as there are no substantial increases in traffic during operation.

12.5.8 No significant effects on parking or loading have been identified resulting from the operation of the Proposed Scheme in this area.

- 12.5.9 The stopping up of Culworth Road will result in a minor adverse effect on travel time for users of the demand responsive B500 and C500 bus services, due to the permanent diversion of up to 2.5km via A361 Byfield Road.
- 12.5.10 There will be minor adverse effects on non-motorised road users as a result of severance from increased travel distance due to the permanent realignment of five PRow and two roads at Banbury Road, AC2 (footpath), Culworth Road, AE5 (footpath), AN13 (footpath), AN28 (footpath) and AN37 (footpath). The majority of realignments are between approximately 200 and 250m in length, apart from AN28 (footpath) and Culworth Road at approximately 400m and AC2 (footpath) at approximately 500m.
- 12.5.11 There also will be a moderate adverse effect due to the permanent realignment at Claydon Road (also known as Boddington Road) by approximately 1.6km.
- 12.5.12 The impacts and consequential effects of the operation of the Proposed Scheme in 2041 will be the same as described for 2026, having taken account of increased background traffic growth.

Cumulative effects

- 12.5.13 The assessment includes cumulative effects of planned development during operation, by taking into account background traffic growth.
- 12.5.14 There will be no additional traffic in this area resulting from the operation of the Proposed Scheme in neighbouring areas.

Other mitigation measures

- 12.5.15 No other mitigation measures during operation of the Proposed Scheme are considered necessary based on the outcome of this assessment.

Summary of likely significant residual effects

- 12.5.16 The stopping up of Culworth Road will result in an increase in all traffic on Welsh Road, between Culworth Road and A361 Byfield Road that will have an adverse effect on non-motorised users crossing and using this road.
- 12.5.17 The realignment of Claydon Road (also known as Boddington Road) and stopping up of Culworth Road will cause some additional delay for users of these roads due to the additional travel distance required.
- 12.5.18 The stopping up of Culworth Road will also cause some additional delay for bus users, due to the diversion of Route 508 and the demand responsive Route B500 and Route C500 bus services.
- 12.5.19 Permanent realignment of five PRow and three roads (Banbury Road, AC2 (footpath), Culworth Road, AE5 (footpath), AN13 (footpath), AN28 (footpath) and AN37 (footpath), and Claydon Road (also known as Boddington Road)) will affect non-motorised users due to increased travel distances.
- 12.5.20 The significant effects that result from the Proposed Scheme in 2026 and 2041 are shown on Map TR-04-070 (Volume 5, Traffic and Transport Map Book).

13 Water resources and flood risk assessment

13.1 Introduction

13.1.1 This section provides a description of the current baseline for water resources including surface water, groundwater and the baseline conditions for flood risk. It then reports on the likely impacts and significant effects on these aspects as a result of the construction and operation of the Proposed Scheme.

13.1.2 The main environmental features of relevance to water resources and flood risk include:

- the River Cherwell (main river from just upstream of Trafford Bridge on the Culworth Brook tributary), Highfurlong Brook (main river) and Boddington Feeder Channel (which feeds the Oxford Canal) and their tributaries;
- the Blisworth Limestone Formation and the Taynton Limestone Formation, which are classified as Principal aquifers;
- a number of Secondary aquifers;
- numerous minor springs present, particularly in the Greatworth and Lower Thorpe area; and
- a number of private groundwater abstractions.

13.1.3 Key environmental issues relating to water resources and flood risk include:

- the need for culvert crossings of watercourses;
- the need for channel realignments on the River Cherwell, Highfurlong Brook and Boddington Feeder Channel;
- the potential impact on groundwater flow to springs in the area of Greatworth, Thorpe Mandeville and Chipping Warden;
- potential impacts on groundwater flow to private abstractions; and
- potential impact on flood risk from works in the floodplains of the River Cherwell, Highfurlong Brook and the Boddington Feeder Channel and their tributaries.

13.1.4 Volume 5: Appendix WR-001-000 contains a report on the route-wide effects including:

- generic assessments on a route-wide basis;
- stakeholder engagement;
- in combination effects;
- a draft operation and maintenance plan for water resources and flood risk;

- a Water Framework Directive¹¹¹ (WFD) compliance assessment; and
- a route-wide Flood Risk Assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within the study area are also contained in the Volume 5 appendices. These include:

- Appendix WR-002-015: Water Resources Assessment report;
- Appendix WR-003-015: Flood Risk Assessment;
- Appendix WR-004-006: Hydraulic Modelling Report for the Culworth Brook at Lower Thorpe;
- Appendix WR-004-007: Hydraulic Modelling Report for the River Cherwell at Edgcote; and
- Appendix WR-004-008: Hydraulic Modelling Report for the Highfurlong Brook.

13.1.6 Map Series WR-01 to WR-03 and WR-05 to WR-06 (Volume 5, Water Resources and Flood Risk Assessment Map Book) show some of the details, environmental baseline and design features referred to in this report.

13.1.7 Discussions have been held with the Environment Agency and the Canal & River Trust (formerly British Waterways). Holders of private licences were sent information and a questionnaire about their abstraction.

13.2 Scope, assumptions and limitations

13.2.1 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1 and in the SMR and its addendum presented in Volume 5: Appendix CT-001-000/1 and Appendix CT-001-000/2. This report follows the standard assessment methodology.

13.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the Proposed Scheme, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, the distances above were measured from the limit of the land required for the construction of the Proposed Scheme taking account of constraints imposed by lack of hydraulic connectivity where appropriate. For the purposes of this assessment this is defined as the study area.

13.2.3 Site visits have been carried out for the following locations along the route:

- Lower Thorpe to visit the proposed crossing of the tributary of the River Cherwell and associated tributary streams and water bodies where access was granted in September 2012; and

¹¹¹ 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 (Water Framework Directive), Strasbourg, European Parliament and European Council.

- various groundwater springs and issues within the vicinity of Greatworth and Culworth in May/June 2013.

- 13.2.4 The assessment is based on data and information from the Environment Agency and other sources and therefore no water quality surveys were carried out specifically for the assessment.
- 13.2.5 WFD classification data have been made available by the Environment Agency. For water bodies that do not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), the status class for those watercourses has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant RBMP, these are referred to as 'not assessed by the Environment Agency'.
- 13.2.6 There are limited water quality data available from private abstractions. The available data have been incorporated into the baseline.
- 13.2.7 The assessment uses existing data with regard to groundwater levels. No monitoring of groundwater levels has been undertaken as part of this assessment. It is assumed that the elevation of springs and issues on Ordnance Survey maps reflects the minimum groundwater level within a particular hillside.
- 13.2.8 Existing hydraulic modelling made available from the Environment Agency or others has been used for the assessment of flood risk. Three new site-specific models have been constructed for Culworth Brook at Lower Thorpe, for the River Cherwell at Edgcote and the Highfurlong Brook. The limitations associated with flood risk within this study area are described in detail in Volume 5: Appendix WR-003-015 and the modelling reports in Volume 5: Appendices WR-004-006 to WR-004-008.

13.3 Environmental baseline

Existing baseline – surface water resources

Surface water features

- 13.3.1 Most water bodies in the study area fall within the Cherwell sub-catchment of the Thames River Basin District as set out within the RBMP¹¹². However, the water bodies to the south and east of the study area fall within the Upper and Bedford Ouse sub-catchment of the Anglian River Basin District and are covered by the Anglian RBMP¹¹³.
- 13.3.2 The current surface water baseline is shown on Maps WR-01-022 to WR-01-024 (Volume 5, Water Resources and Flood Risk Assessment Map Book) and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-015. Table 20 includes features potentially affected by the Proposed Scheme.

¹¹² Environment Agency (2009), *River Basin Management Plan, Thames River Basin District*.

¹¹³ Environment Agency (2009), *River Basin Management Plan, Anglian River Basin District*.

Table 20: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (and map reference)	Watercourse classification ¹¹⁴	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value ¹¹⁵
Three source streams of the River Cherwell, the largest of which is referred to as Culworth Brook	Culworth Brook will be crossed by the route three times at Lower Thorpe (SWC-CFA15-01 – SWC-CFA15-03)	Ordinary watercourse	Cherwell (Ashby to Cropredy) (GB 106039037350) Poor	Good	High
Unnamed source stream of Culworth Brook	The unnamed streams will be crossed twice north-west of Lower Thorpe (SWC-CFA15-04 and SWC-CFA15-05)	Ordinary watercourse	No status shown in RBMP – assumed status Poor	No status shown in RBMP – assumed status Good	Moderate
Tributary of River Cherwell from Danes Moor	Crossed by the route near Trafford Bridge (SWC-CFA15-06)	Ordinary watercourse	No status shown in RBMP – assumed status Poor	No status shown in RBMP – assumed status Good	Moderate
River Cherwell	Crossed by the route twice near Trafford Bridge (SWC-CFA15-07 and SWC-CFA15-21)	Main river	Cherwell (Ashby to Cropredy) (GB 106039037350) Poor	Good	High
Tributary of River Cherwell	Crossed by the route north of Osierbed Spinney (SWC-CFA15-08)	Ordinary watercourse	No status shown in RBMP – assumed status Poor	No status shown in RBMP – assumed status Good	Moderate
Highfurlong Brook	West of Aston le Walls (SWC-CFA15-09)	Main river	Highfurlong Brook (Source to Wormleighton Brook) (GB106039042660) Good	Good	High

¹¹⁴ Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a main river as a watercourse that is shown as such on a main river map. Section 72 of the Land Drainage Act 1991 defines an ordinary watercourse as 'a watercourse that is not part of a main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including 'all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by Defra on the main river map and are regulated by the Environment Agency.

¹¹⁵ For examples of receptor value see Table 43 in the SMR Addendum (see Volume 5, Appendix CT-001-000/2).

Water feature	Location description (and map reference)	Watercourse classification ¹¹⁴	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value ¹¹⁵
Unnamed drain from Boddington Feeder Channel	Runs from Boddington Feeder Channel southwards towards Springfield Farm where it peters out (SWC-CFA15-10)	Ordinary watercourse	No status shown in RBMP – assumed status Good	No status shown in RBMP – assumed status Good	Low
Boddington Feeder Channel (Oxford Canal)	South of Fir Tree House (SWC-CFA15-11)	Artificial	Boddington Feeder (Oxford Canal) (GB806100002) Good	Good	High
Unnamed tributary of Boddington Feeder Channel (Oxford Canal)	Crossed by the route to west of Lower Boddington (SWC-CFA15-12)	Ordinary watercourse	No status shown in RBMP – assumed status Good	No status shown in RBMP – assumed status Good	Moderate
Unnamed tributary of Boddington Feeder Channel (Oxford Canal)	Will be crossed by the route near Fir Tree House and further upstream near Fox Covert. (SWC-CFA15-13, SWC-CFA-26 and SWC-CFA-27, SWC-CFA15-29 and SWC-CFA15-30)	Ordinary watercourse	No status shown in RBMP – assumed status Good	No status shown in RBMP – assumed status Good	Moderate
Numerous small ponds within 1km radius of the Proposed Scheme	Various locations (see Volume 5: Appendix WR-002-015 for further detail)	Not applicable	Not applicable	Not applicable	Low

Water Framework Directive status

13.3.3 The Environment Agency predicts the ecological quality under the WFD for the following water bodies in the study area:

- ‘Cherwell (Ashby to Cropredy)’ has been classified by the Environment Agency as Poor Status due to failing quality for macro-invertebrates. The Environment Agency predicts that by 2027 the water body will be at Good Status.
- ‘Highfurlong Brook (source to Wormleighton Brook)’ has been classified by the Environment Agency as Good Status. The Environment Agency predicts that by 2027 the water body will be at Good Status; and
- ‘Boddington Feeder (Oxford Canal)’ has been classified by the Environment Agency as at Good Potential. The Environment Agency predicts that by 2015 the water body will be at Good Potential.

Abstractions and permitted discharges

- 13.3.4 There is one licensed surface water abstraction¹¹⁶ within the study area (as detailed in Volume 5: Appendix WR-002-015). There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.
- 13.3.5 The Environment Agency reports that there are 10 current consented surface water discharges within the study area (see Volume 5: Appendix WR-002-015 for further details).

Existing baseline – groundwater resources

Geology and hydrogeology

- 13.3.6 The geological formations within this area are described further, with a schematic geological cross-section in Volume 5: Appendix WR-002-015.
- 13.3.7 The location of abstractions, geological formations and indicative groundwater levels are shown on Map WR-02-015 (Volume 5, Water Resources and flood risk assessment Map Book).
- 13.3.8 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 21. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 21: Summary of geology and hydrogeology in the area

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value
Superficial deposits						
Glacial Till	South-eastern third of the study area.	Clay with flints	Unproductive	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Low
Alluvium	Spatially limited deposits associated with the Highfurlong Brook and the River Cherwell.	Clay, silt, sand and gravel	Secondary Type A	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate
Head	Occasional pockets along the courses of the River Cherwell and Highfurlong Brook (not crossed by route).	Clay, silt, sand and gravel	Secondary undifferentiated	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate

¹¹⁶ Surface water abstractions for public supply are not included.

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value
Bedrock						
Great Oolite Group	Outcrops on higher ground in the south-eastern third of the study area.	Blisworth Limestone Formation – off white to yellow limestone Rutland Formation – mudstone and siltstone Taynton Limestone Formation – ooidal limestone Horsehay Sand Formation – pale grey and brown to off-white sandstone	Composed of formations designated as Principal and Secondary aquifers.	Upper Bedford Ouse Oolite Principal 1 GB40501G402300 (Blisworth Limestone) Poor	Poor	High
				Upper Bedford Ouse Oolite Secondary GB40502G401300 (Taynton Limestone) Good	Good	
Inferior Oolite Group	Outcrops at the margins of the Great Oolite Group in the south-eastern third of the study area.	Northampton Sand Formation – sandy ironstone	Secondary type A	Byfield Jurassic GB40602G604200 (Northampton Sand Formation) Good	Good	Moderate
Lias Group	Outcrops across the northern half of the study area and in the base of the valleys in the southern half of the study area.	Whitby Mudstone Formation – mudstone and siltstone Marlstone Rock Formation – ferruginous limestone interbedded with ferruginous calcareous sandstone, and ferruginous mudstone beds Dyrham Formation – siltstone and mudstone Charmouth Mudstone Formation – shales and mudstones	Composed of formations designated as Secondary type A aquifers and unproductive strata.	Banbury Jurassic GB40602G600200 (Marlstone Rock Formation) Good	Good	Moderate (Secondary aquifers) Low (un-productive strata)

Superficial deposits

- 13.3.9 Superficial geological deposits across the southern section of the route consist of Glacial Till. They are absent from the majority of the remainder of the route with the exception of localised river alluvium and head deposits associated with the River Cherwell and Highfurlong Brook. Shallow groundwater in the alluvium is likely to be in continuity with the Highfurlong Brook and the River Cherwell with flow generally towards the watercourses (as illustrated in Map WR-02-015, Volume 5, Water resources and flood risk assessment Map Book).

Bedrock aquifers

- 13.3.10 Bedrock geology in the study area is illustrated in Map WR-02-015, Volume 5, Water Resources and Flood Risk Assessment Map Book. The 1:50,000 BGS geological maps show four faults in the study area. Three are centred around the village of Thorpe Mandeville and radiate out from the area of Lower Thorpe Farm. These faults are approximately 850m, 1500m and 950m long at the surface. The fourth is located to the north-east of the route near Chipping Warden and runs almost parallel to the route at a distance of between 350 – 600m. This fault is approximately 1km long at the surface.
- 13.3.11 The Great Oolite and Inferior Oolite generally outcrop on the high ground. They have been eroded away in the valleys to expose the underlying Lias Group.
- 13.3.12 A number of springs and issues occur at the contact of the Blisworth Limestone and the Rutland Mudstone. However, there may be some degree of hydraulic connection between the Blisworth Limestone and the aquifer formed by the Taynton Limestone, Horsehay Sandstone and Northampton Sand that underlies the Rutland Mudstone. Where the limestone, sandstone and sand formations outcrop they are likely to feed local watercourses.
- 13.3.13 Groundwater levels within the Principal and Secondary aquifers are unknown but are considered likely to be influenced by topography, with groundwater flow towards rivers.

Water Framework Directive status

- 13.3.14 The Upper Bedford Ouse Oolite Principal 1 and Secondary WFD water bodies are covered by the Anglian RBMP. The Byfield Jurassic and Banbury Jurassic WFD water bodies fall within scope of the Thames RBMP.
- 13.3.15 No WFD classification has been given by the Environment Agency to the superficial deposits.
- 13.3.16 The WFD status of groundwater in the study area is largely classified as 'Not at Risk', with 'good status', as summarised in Table 20.

Abstractions and permitted discharges

- 13.3.17 The Environment Agency reports that there are three licensed groundwater abstractions and three unlicensed groundwater abstractions within the study area. There are no Source Protection Zones (SPZ) associated with the abstractions, as

detailed in Volume 5: Appendix WR-002-015. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

- 13.3.18 The Environment Agency reports that there are 15 current consented discharges to groundwater within 1km of the Proposed Scheme, as detailed in Volume 5, Appendix WR-002-015.

Surface water/groundwater interaction

- 13.3.19 Springs and seepages ('issues') are shown on Ordnance Survey maps in the following locations in close proximity to the route of the Proposed Scheme:

- at Greatworth Fields, approximately 280m south-west of the route;
- north-east of Greatworth, approximately 100m south-west of the route near Greatworth Hall;
- south of Greatworth at Floyds Farm, approximately 1km south-west of the route;
- near Keepers Cottage approximately 1km south-west of the route;
- near Oldbarn Spinney 650m south-west of the route;
- 250m north-east of the alignment at Painters Spinney;
- around Lower Thorpe; and
- in the valley of the River Cherwell and close to Chipping Warden and Appletree.

- 13.3.20 It is likely that shallow groundwater is present in close proximity to these springs and seepages.

Water dependent habitats

- 13.3.21 The route will not cross any areas with statutory ecological designations in relation to surface water.

- 13.3.22 In addition to the watercourses identified in Table 20, there are a number of potentially water dependent ecological sites in the study area. These include:

- Trafford Bridge Marsh LWS;
- Culworth Marsh LWS;
- Washbrook Spinney LWS; and
- Washbrook Lake LWS.

- 13.3.23 There are, in addition, small areas of woodland to the west and south-east of Greatworth that may contain some areas of water dependent habitat. There is also an area of habitat with fen characteristics at Costow Field.

- 13.3.24 There are identified water dependent habitats comprising ponds at Lower Thorpe and Aston le Walls as illustrated on Maps WR-01-022 to WR-01-024 (Volume 5, Water Resources and Flood Risk Assessment Map Book).
- 13.3.25 Further information on the above ecological receptors is given in Section 7 of this report.

Existing baseline – flood risk

River flooding

- 13.3.26 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping¹¹⁷. Detailed hydraulic modelling has been undertaken for the Cherwell tributaries at Lower Thorpe and for the River Cherwell at Edgcote.
- 13.3.27 At Lower Thorpe hamlet and Lower Thorpe Farm there are residential properties (more vulnerable – high value receptors) within Flood Zone 3 (including Twin Oaks, Water End and Manor Cottages). Near where the route will cross the River Cherwell on the Edgcote viaduct there are two residential properties in Flood Zone 3 (Edgcote Mill and Home Farm). Land used by the equestrian centre at Washbrook Farm is located within Flood Zone 3 near the Highfurlong Brook viaduct (less vulnerable – moderate value receptor). The Washbrook Farm buildings are located in Flood Zone 1. Otherwise the land use within the flood zones is agricultural (less vulnerable – moderate value receptor) or water-compatible (low value receptor). The flood risk assessment in Volume 5: Appendix WR-003-015 provides further details of receptors within the flood zones and their vulnerability.
- 13.3.28 Environment Agency records show historic flooding within the study area in the valleys of the River Cherwell and the Highfurlong Brook shown on Maps WR-01-022 to WR-01-024 (Volume 5, Water resources and flood risk assessment Map Book).
- 13.3.29 The Proposed Scheme will cross the flood zones of the Cherwell tributaries at Lower Thorpe, the River Cherwell and two tributaries north of Edgcote, and the Highfurlong Brook west of Aston le Walls.
- 13.3.30 Close to Lower Thorpe, the tributary stream of the River Cherwell (Map WR-01-023, SWC-CFA15-02 and SWC-CFA15-03) has a catchment size of 3km². It is not modelled by the Environment Agency.
- 13.3.31 A site-specific hydraulic model has been constructed to more accurately determine the extent of flooding, and to assess the impact of the Proposed Scheme. The route, which will be on viaduct, will cross approximately 200m of Flood Zone 3 in this location, parallel to the natural flow direction. The flood risk assessment in Volume 5: Appendix WR-003-015 provides further details.
- 13.3.32 The crossing of the valley of the River Cherwell close to Edgcote will pass over a number of watercourses, comprising the River Cherwell north of Edgcote Road (Map WR-01-023, SWC-CFA15-07) (upstream catchment of 78km²), and tributaries from Trafford Bridge south of Edgcote Road (Map WR-01-023, SWC-CFA15-06) (upstream

¹¹⁷ Environment Agency; Flood maps; <http://www.environment-agency.gov.uk/homeandleisure/37837.aspx>; Accessed October 2013.

catchment of 5km²) and along the north edge of Osierbed Spinney (Map WR-01-023, SWC-CFA15-08) (upstream catchment of 3km²). The route will cross a total length of approximately 500m of Flood Zone 3, with the direction of the Proposed Scheme parallel to the natural flow.

- 13.3.33 The Highfurlong Brook west of Aston le Walls (Map WR-01-024, SWC-CFA15-09) has a catchment size of 23km² at the location of the proposed crossing. The route will cross approximately 170m of Flood Zone 3, perpendicular to the river flow direction. The watercourse meanders considerably throughout this section of the river.

Surface water flooding

- 13.3.34 The agreed data set for surface water flooding is the Environment Agency Flood Map for Surface Water¹¹⁸ (FMfSW).
- 13.3.35 There are areas at risk of surface water flooding shown on Maps WR-01-022 to WR-01-024 (Volume 5, Water resources and flood risk assessment Map Book) for the 1 in 200 annual probability (0.5%) rainfall events. Areas at risk include the upper reaches of the Radstone Brook north-west of Radstone (Map WR-01-024, SWC-CFA14-09), a tributary of the River Great Ouse west of Greatworth Hall and three tributary watercourses of the River Cherwell at Lower Thorpe (east of Thorpe Mandeville – SWC-CFA15-01, south of the boating lake at Manor House Farm – SWC-CFA15-02 and west of Culworth Grounds – SWC-CFA15-04, all on Map WR-01-023). Surface water flooding is also predicted south-east of Danesmoor Spinney, associated with a tributary drain of the River Cherwell, and to the south of Lower Boddington.
- 13.3.36 There is a dry valley to the north of Cedars Farm where shallow (less than 0.1m) surface water flooding is predicted for flood events with an annual probability less than 1 in 30 (3.33%). This dry valley is downstream of a watercourse that has been intercepted by the artificial Boddington Feeder Channel watercourse.
- 13.3.37 There are no cases of historic flooding within the study area specifically listed within the Northamptonshire Preliminary Flood Risk Assessment¹¹⁹ (PFRA) or within the various flood risk documents held by the West Northamptonshire Joint Planning Unit.

Sewer flooding

- 13.3.38 The agreed data sets for sewer flooding are the Northamptonshire PFRA and the West Northamptonshire Strategic Flood Risk Assessment¹²⁰ (SFRA).
- 13.3.39 The West Northamptonshire SFRA does not explicitly list any areas crossed by the route as being at risk of flooding from sewers. The general risk of flooding from sewers within the South Northamptonshire District is stated as 'minimal', and is therefore not considered further within this assessment.

Artificial water bodies

- 13.3.40 The agreed data set for flooding from artificial water bodies is the Environment Agency Reservoir Inundation Map.

¹¹⁸ Environment Agency (2010), *Flood Map for Surface Water*.

¹¹⁹ Northamptonshire County Council (2011), *Northamptonshire Preliminary Flood Risk Assessment*.

¹²⁰ West Northamptonshire District Council and Scott Wilson (2009), *West Northamptonshire Level 2 Strategic Flood Risk Assessment*.

- 13.3.41 The route will cross an area with a residual risk of flooding from the Boddington Reservoir at the crossing of the Highfurlong Brook west of Aston le Walls (Map WR-01-024, SWC-CFA15-09). This reservoir is located 1.8km north-east of the route and feeds the Oxford Canal by way of an artificial watercourse. It is maintained by the Canal & River Trust.
- 13.3.42 The likelihood of such flooding occurring is extremely low and, given the distance of the Proposed Scheme from the reservoir and the fact that it will not impact on the residual risk of reservoir failure, it has not been considered further within this assessment. Further details can be found in the FRA (Volume 5: Appendix WR-003-015).

Groundwater flooding

- 13.3.43 The agreed data set for groundwater flooding is the Northamptonshire PFRA.
- 13.3.44 The Northamptonshire PFRA states that there is a significant risk of flooding from groundwater-bearing chalk and limestone aquifers across the district.

Future baseline

- 13.3.45 Appendix CT-004-015 identifies developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The potential cumulative effects arising from committed developments in relation to water resources and flood risk have been considered as part of this assessment of the construction and operation of the Proposed Scheme.
- 13.3.46 Developments are required to comply with the National Planning Policy Framework¹²¹ (NPPF), development plans and other legislation and guidance. As such committed developments should have a neutral effect on the water resources and flood risk baseline.
- 13.3.47 There are no committed developments that are likely to cause significant changes to the water resources and flood risk baseline prior to construction of the Proposed Scheme in this study area.
- 13.3.48 WFD future status objectives are set out in Table 20 and Table 21. This potential change in baseline is not considered to result in the reported effects from the Proposed Scheme changing in significance.

Climate change

- 13.3.49 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the Proposed Scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, except for flood flows described below, these changes

¹²¹ Department for Communities and Local Government (2012), *National Planning Policy Framework Technical Guidance*.

are not considered to result in the reported effects from the Proposed Scheme changing in significance.

- 13.3.50 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.
- 13.3.51 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.
- 13.3.52 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Sections 7 and 8 of Volume 1 and Table 13 of Volume 5: Appendix CT-009-000.

13.4 Effects arising during construction

Avoidance and mitigation measures

- 13.4.1 The general approach to mitigation is set out in Volume 1, Section 9.
- 13.4.2 The following are examples of avoidance and mitigation measures that will reduce potential adverse effects on water resources and flood risk. Further details are shown in Volume 5: Appendix WR-002-015 and WR-003-015.
- 13.4.3 The following measures will reduce potential impacts to surface water resources that could arise from construction.
- 13.4.4 The detailed design of all surface watercourse realignments and crossings will be completed in consultation with the Environment Agency to meet their objectives with respect to hydraulic capacity, flood risk, ecology and hydromorphology. Where reasonably practicable, the permanent channel realignments will be constructed in advance of other activities associated with the construction of the Proposed Scheme. The design mitigation, including consideration of design features aligned with the objectives of the WFD (for example use of soft engineering solutions, aquatic marginal planting and the inclusion of natural forms), will ensure that the channels and structures are sufficiently sized to avoid a permanent impact on flow. The following surface water crossings and associated diversions will be dealt with in this way, as discussed further in Volume 5: Appendix WR-002-015:
- the River Cherwell and tributaries near Lower Thorpe (Map WR-01-023, SWC-CFA15-01 to SWC-CFA15-05);
 - the River Cherwell and tributaries at Trafford Bridge near Edgcote (Map WR-01-023, SWC-CFA15-06 to SWC-CFA15-08 and SWC-CFA15-21);

- the Highfurlong Brook west of Aston le Walls (Map WR-01-024, SWC-CFA15-09); and
- the Boddington Feeder Channel south of Fir Tree House and its tributary south of Fox Covert (Map WR-01-024, SWC-CFA15-11 to SWC-CFA15-13, plus SWC-CFA15-26, 27, 29 and 30).

- 13.4.5 Culvert length will be reduced wherever possible and will be designed with invert levels below the firm bed of the watercourse to negate the impact on flows and sediment transfer. Where possible, consideration will be given to provide mitigation for the loss of open channel by means of sensitive design at either end of the culvert in order to retain and, if possible, enhance the overall quality of the watercourse. Where there is loss of length due to straightening, the aim, where possible, will be to offset this by increasing channel length up or downstream of the culvert to at least match the lost length of channel. Culverts will be designed in line with Construction Industry Research and Information Association (CIRIA)¹²² 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.
- 13.4.6 Drainage from access roads and hard standings will discharge, where reasonably practicable, to sustainable drainage systems (SuDS) balancing ponds, prior to subsequent discharge to groundwater, surface watercourses or, if necessary, to sewer. The balancing ponds will provide mitigation to ensure that rainfall run-off from the route will be released in a controlled manner to the receiving watercourses reducing the potential for adverse impact on the water quality and flow of the receiving watercourse. The balancing ponds, shown on Maps CT-06-068 to CT-06-079 (Volume 2, CFA15 Map Book), will be designed where practicable to discharge at existing run-off rates and will accommodate for events up and including the 1 in 100 annual probability (1%) including an allowance for climate change.
- 13.4.7 Highways works will include the temporary or permanent realignment of a number of minor roads and the A361 Byfield Road and B4525. Appropriate mitigation will be provided to address the risks to the receiving watercourses for both flow and water quality during the detailed design of the Proposed Scheme using the Design Manual for Roads and Bridges¹²³ and CIRIA guidance¹²⁴ to control the run-off rate and water quality in accordance with the necessary approvals.
- 13.4.8 The following measures will reduce potential impacts to groundwater/surface water interactions that could arise from construction.
- 13.4.9 Drainage around cuttings will be discharged to the nearest watercourse crossed by the route near the cuttings, which will minimise the impacts on the watercourses which otherwise might have reduced flow due to some interception of groundwater that would provide some baseflow. This would happen at the following locations:

¹²² CIRIA (2010), *C689 Culvert design and operation guide*, CIRIA, London, UK.

¹²³ Department for Transport (DfT), *Design Manual for Roads and Bridges: Volume 4, Section 2*.

¹²⁴ Murname, E., Heap, A. and Swain, A. (2006), *C648 Control of Water Pollution from Linear Construction Sites*, CIRIA, London, UK.

- the watercourse flowing south-west away from the route near Greatworth Hall near Greatworth south cutting (Map WR-01-022, D6);
- tributary of the River Cherwell at Lower Thorpe Farm near Greatworth north cutting (Map WR-01-024, SWC-CFA15-17);
- the River Cherwell valley at Trafford Bridge near Edgcote cutting (Map WR-01-024, SWC-CFA15-21); and
- the Highfurlong Brook west of Aston le Walls and the Chipping Warden green tunnel (Map WR-01-024, SWC-CFA15-09).

- 13.4.10 The following measures will reduce potential impacts to flood risk that could arise from construction.
- 13.4.11 To reduce potential adverse effects on flood risk, all culverts will be designed to convey the 1 in 100 year annual probability (1%) flow including an allowance for climate change, and the diverted watercourses will be designed with at least equal capacity to the existing system to ensure no loss of conveyance.
- 13.4.12 There will be embankments and viaduct piers located within the floodplain at Lower Thorpe (Map WR-01-023, crossings SWC-CFA15-02 to SWC-CFA15-04), which will result in a loss of floodplain storage. The piers in the River Cherwell floodplain at Edgcote (Map WR-01-023, SWC-CFA15-06, 07 and 21) will result in a loss of floodplain storage and some constriction in flow. The Highfurlong Brook viaduct will span the majority of the floodplain of the Highfurlong Brook (Map WR-01-024, SWC-CFA15-09), with viaduct piers and part of the southern approach embankment located within the floodplain.
- 13.4.13 Replacement floodplain storage will be provided to mitigate for loss of floodplain storage associated with these components of the Proposed Scheme. The replacement floodplain storage areas provided in the current design are shown on Maps CT-06-068 to CT-06-079 (Volume 2, CFA15 Map Book). Further details are contained in the FRA (Volume 5: Appendix WR-003-015). Replacement floodplain storage areas will be provided prior to the construction of built structures within the floodplain, in consultation with the Environment Agency.
- 13.4.14 The draft 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). These will provide effective management and control of the impacts during the construction period.
- 13.4.15 The following examples illustrate how measures in the draft CoCP will reduce potentially adverse effects arising during construction on water resources and flood risk.
- 13.4.16 In accordance with draft CoCP, Section 16, monitoring will be undertaken in consultation with the Environment Agency prior to, during and post construction, if required, to establish baseline conditions for surface water and groundwater, including springs and spring fed watercourses, and to confirm the effectiveness of agreed temporary and permanent mitigation measures.

- 13.4.17 With regards to surface water, Section 16 of the draft CoCP stipulates that works in or near watercourse at the crossings and realignments or diversions such as the River Cherwell, Highfurlong Brook and Boddington Feeder Channel will be designed in consultation with the Environment Agency so that sediment mobilisation is managed, the potential for contamination from fuel spills is minimised and the works are timed to minimise the impact on water quality and water dependent habitats and species.
- 13.4.18 Pro-active management practices will ensure that, should a pollution incident occur, the impact is reduced, controlled and reported to relevant parties and remediated in accordance with Section 5 of the draft CoCP.
- 13.4.19 Any dewatering requirements, such as during construction of the Greatworth green tunnel, the Edgcote cutting and the Thorpe Mandeville cutting will be in compliance with the draft CoCP, Section 16 to ensure that water quality impacts on the River Cherwell or Highfurlong Brook, where dewatering water is discharged, are minimised.
- 13.4.20 With regard to groundwater, groundwater quality impacts from surface infiltration at construction sites, such as the Chipping Warden green tunnel main compound or the Greatworth green tunnel satellite compound, will be minimised through the requirements of the draft CoCP, Section 16.
- 13.4.21 Section 16 of the draft CoCP sets out the requirements for dewatering of shallow groundwater for excavation works to ensure that and changes to local groundwater levels and the hydrogeological regime are minimised, particularly within the immediate area surrounding the construction of pile caps and any deep utility diversions in the area of the valley floor. This would include the use of cut-offs and applying relatively short time-scales for the dewatering involved.
- 13.4.22 In accordance with Section 16 of the draft CoCP, excavated material storage and site offices will be located outside of the flood zones, where practicable, to avoid having an impact on the risk of flooding from the River Cherwell or Highfurlong Brook. This has not been possible at Lower Thorpe and the River Cherwell at Edgcote, where due to the nature of the work, compounds have been located within areas of flood risk. These will have site-specific flood risk management plans prepared prior to construction.

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 result in significant effects are provided in the Water Resources Assessment report in Volume 5: Appendix WR-002-015 and Flood Risk Assessment in Volume 5: Appendix WR-003-015.
- 13.4.25 An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within the route-wide Water Resources Appendix (Volume 5: Appendix WR-001-000).
- 13.4.26 It is not considered that projected climate change effects, combined with the effects from the construction of the Proposed Scheme, will alter the significance of any of the

reported effects on surface water, groundwater or water dependent habitats (see Volume 3: Route-wide Effects Assessment for further information).

Temporary effects

Surface water

- 13.4.27 The assessment shows that there will be no significant temporary adverse effects on surface water resources during the construction period.

Groundwater

- 13.4.28 There are four abstraction locations along the hillside at Appletree 300m to 1.2km from the route (Map WR-02-015, C7). These four abstractions are covered by a single private licensed abstraction and are assumed to abstract from the Dyrham Formation, although there is only one operational abstraction within 1km of the Proposed Scheme, located about 750m from the route.
- 13.4.29 Groundwater flow in this part of the Dyrham Formation is likely to be approximately parallel to the route. During construction, the Chipping Warden green tunnel and Edgcote cutting will act as groundwater sinks which could change the groundwater flow in the area and could impact on groundwater abstraction at Appletree. These abstractions are moderate value receptors and if there is any measurable impact at these abstractions this would lead to a moderate adverse effect which would be significant.
- 13.4.30 The Greatworth green tunnel (from Greatworth to Lower Thorpe) may affect groundwater-fed springs and spring-fed watercourses either side of the route (to the north-east and south-west). The springs near Painters Spinney, Oldbarn Spinney and issues south-west of Greatworth Hall are generally located along the outcrop of the underlying Whitby Mudstone, and are fed by rain percolating through the more permeable layers above the mudstone. The route in this area will be along a low ridgeline. In general, groundwater is likely to be flowing from the ridgeline towards the springs and watercourses. As such, constructing the green tunnel cutting will result in moderate impacts to groundwater flows to the issues at Oldbarn Spinney and Painters Spinney, since the excavation will act as a temporary groundwater sink. The other springs near Greatworth Hall are not as likely to be impacted in a significant manner. The impacts at Painters Spinney and Oldbarn Spinney are likely to be moderate, resulting in a moderate adverse effect on springs and spring fed watercourses (generally of moderate value, or less), resulting in significant effects.
- 13.4.31 There are several springs emerging south east of Chipping Warden which feed some minor watercourses that are tributaries to the River Cherwell. The drainage of the Chipping Warden green tunnel could intercept groundwater that would flow to these springs, resulting in moderate impacts and moderate effects which would be significant. This would only occur during construction as the green tunnel, when completed, should allow groundwater flow to return to pre-construction flow paths in this area.

Flood risk

- 13.4.32 No significant temporary adverse effects on flood risk have been identified within the assessment.

Cumulative effects

- 13.4.33 There are no committed developments that have been identified which will result in significant cumulative temporary effects.

Permanent effects

Surface water

- 13.4.34 The assessment shows that there will be no significant permanent adverse effects on surface water resources.

Groundwater

- 13.4.35 There is one spring (issue) 400m east of Costow House near Thorpe Mandeville (SWC-CFA15-01) that would be lost by constructing the Thorpe Mandeville cutting. The cutting will result in a moderate impact on local groundwater flows, and the permanent loss of the spring which would be a moderate adverse effect and thus significant. These issues and springs feed a tributary of the River Cherwell and there will therefore be an impact on baseflow to this 800m section of watercourse. This reduction in flow and groundwater levels near Costow House could also permanently affect the water dependent habitats present at Costow Fields.
- 13.4.36 There are no other permanent significant adverse effects on groundwater.

Flood risk

- 13.4.37 The assessment has shown that there will be no significant permanent effects on flood risk resulting from all sources of flooding.

Cumulative effects

- 13.4.38 There are no committed developments that have been identified which will result in significant cumulative permanent effects.

Other mitigation measures

- 13.4.39 No other mitigation measures are envisaged for surface water.
- 13.4.40 At Appletree, there is the potential for significant adverse effects on abstractions during construction. Specific monitoring of groundwater levels and abstraction rates will be undertaken. Subject to monitoring outcomes, further mitigation options include deepening of the pump setting depth or increasing the depth of the boreholes or, if required, provision of an alternative supply. With the implementation of such measures, if necessary, there will be no permanent significant effect on the abstractions during construction.
- 13.4.41 There are no practicable measures possible to mitigate the temporary impacts on the springs at Painters Spinney and Oldbarn Spinney, but the effects will not persist after construction is completed.

- 13.4.42 There are no practicable measures possible to mitigate the temporary impacts on the springs south east of Chipping Warden. These springs contribute flow in the River Cherwell. Construction drainage from parts of the Chipping Warden green tunnel and from the Edgcote cutting will be discharged upstream of Chipping Warden into the River Cherwell to mitigate the temporary impacts on flow in the river.

Summary of likely residual significant effects

- 13.4.43 During construction the water that would otherwise flow into Painters Spinney and Old Barn Spinney would be drawn into the Greatworth green tunnel during its construction resulting in temporary moderate adverse effects on the springs in these locations. The effect on groundwater levels and springs is expected to recover post construction with no significant adverse effects.
- 13.4.44 There will be a permanent loss of a spring at Costow House due to the construction of the Thorpe Mandeville cutting, and groundwater would be intercepted by the cutting that would affect the natural flow watercourses near Costow House. This reduction in flow and groundwater levels near Costow House could also permanently affect the water dependent habitats present at Costow Fields.

13.5 Effects arising from operation

Avoidance and mitigation measures

- 13.5.1 Generic examples of design measures that will mitigate impacts so that there will be no significant adverse effects on the quality and flow characteristics of surface watercourses and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1, Section 8.
- 13.5.2 Site specific examples of design measures that will mitigate impact include the drainage arrangements for the Proposed Scheme in the study area. This comprises a number of balancing ponds for either railway or highway drainage and land drainage areas. These ponds and their associated access tracks are shown in Maps CT-06-068 to CT-06-079 (Volume 2, CFA15 Map Book).
- 13.5.3 Generic examples of management measures during operation and management of the Proposed Scheme that will mitigate impacts so that there are no significant adverse effects on the quality and flow characteristics of surface watercourses and groundwater bodies are described in Volume 1, Section 9, and in the operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.
- 13.5.4 As noted in the generic assessment in Volume 3, the risk of pollution from accidental spillage is considered to be extremely low. Incorporation of appropriate spillage control measures within the drainage of the three viaducts will reduce this risk further.
- 13.5.5 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, Section 9.

Assessment of impacts and effects

- 13.5.6 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

- 13.5.7 There are considered to be no further measures required to mitigate adverse effects on surface water resources or groundwater resources or flood risk.

Summary of likely residual significant effects

- 13.5.8 No significant residual effects are anticipated on surface water, groundwater or flood risk with the operation of the Proposed Scheme.

14 References

- Bat Conservation Trust (BCT) (2012), *The state of the UK's bats: National Bat Monitoring Programme Population Trends 2012*, BCT, London.
- British Standard BS10175 Investigation of Potentially Contaminated Sites* (2011).
- Buckinghamshire & Milton Keynes Environmental Records Centre (2009), *Criteria for the Selection of Local Wildlife Site in Berkshire, Buckinghamshire and Oxfordshire*.
- Cherwell District Council (1996), *Adopted Local Plan, Saved Policies*.
- Cherwell District Council (1995), *Cherwell District Landscape Assessment*.
- Cherwell District Council (2011), *Non-Statutory Cherwell Local Plan*.
- Cherwell District Council (2012), *Proposed Submission Cherwell Local Plan*.
- Cherwell District Council (2013), *Proposed Submission Cherwell Local Plan, Focused Consultation*.
- Construction Industry Research and Information Association (CIRIA) (2010), C689 Culvert design and operation guide, CIRIA, London, UK.
- Colin Plant Associates (2006), *Invertebrates and Ecological Assessment. Unpublished Report to the Institute of Ecology and Environmental Management*.
- Cranfield University (2001), *The National Soil Map of England and Wales 1:250,000 scale*. National Soil Resources Institute, Cranfield University, UK.
- Daventry District Council (2010), *Saved Policies from the Daventry District Local Plan* (June 1997) saved 28 September 2007, Daventry District Council.
- Department for Environment, Food and Rural Affairs (Defra) (2010), *Based Background Maps for NO_x, NO₂, PM₁₀ and PM_{2.5}*; <http://laqm.defra.gov.uk/maps/maps2010.html>. Accessed September 2013.
- Department for Environment, Food and Rural Affairs (Defra) (2009), *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*.
- Department for Environment, Food and Rural Affairs (Defra) (2005), *Likelihood of Best and Most Versatile Agricultural Land*.
- Department for Environment, Food and Rural Affairs (Defra), (2009), *Soil Strategy for England*.
- Department for Environment, Food and Rural Affairs (Defra) (2011), *The Natural Choice: securing the value of nature*.
- Department for Transport (DfT), *Design Manual for Roads and Bridges: Volume 4, Section 2*.
- Department for Transport (DfT), *Design Manual for Roads and Bridges: Volume 11, Environmental Assessment, Section 3*. <http://www.dft.gov.uk/ha/standards/dmrb/vol11/section3/hd4509.pdf> Accessed September 2013.

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. Strasbourg, European Parliament and European Council.

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, (Water Framework Directive) Strasbourg, European Parliament and European Council.

Environment Agency (2010), *Flood Map for Surface Water.*

Environment Agency; Flood maps; <http://www.environment-agency.gov.uk/homeandleisure/37837.aspx>; Accessed October 2013.

Environment Agency (2009), *River Basin Management Plan, Thames River Basin District.*

Environment Agency (2009), *River Basin Management Plan, Anglian River Basin District.*

Government Office for the East Midlands (2009), *East Midlands Regional Plan,* The Stationery Office.

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

Homes and Communities Agency (HCA) (2010), *Employment Densities Guide 2nd Edition.*

Institute of Air Quality Management (IAQM) (2012), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance.*

Jackson, P. (2012), *The Barn Owl in Northamptonshire 2012.* Stoke Bruerne.

Murname, E., Heap, A. and Swain, A. (2006), *C648 Control of Water Pollution from Linear Construction Sites,* CIRIA, London, UK.

National Planning Practice Guidance; Noise; <http://planningguidance.planningportal.gov.uk>; Accessed: October 2013.

Natural England (1996), *The Character of England 1996.* <http://www.naturalengland.org.uk/publications/nca/default.aspx>. Accessed 8 January 2013.

Natural England (2010), *Higher Level Stewardship Farm Environment Plan (FEP) Manual.*

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

The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, London. Her Majesty's Stationery Office.

Northamptonshire Biodiversity Partnership (The Wildlife Trusts) 2007 (2010), *Wildlife Site Criteria: Northamptonshire.*

Northamptonshire County Council (2011), *Control and Management of Development DPD.*

Northamptonshire County Council (2006), *Current Landscape Character Assessment.*

Northamptonshire County Council (2010), *Minerals and Waste Development Framework Core Strategy Development Plan Document.*

Northamptonshire County Council (2011), *Northamptonshire Preliminary Flood Risk Assessment*.

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

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

Office for National Statistics (ONS) (2012), *UK Business: Activity, Size and Location 2011*, ONS, London.

Oxfordshire County Council, Natural England and the Earth Trust (2004), *Oxfordshire Wildlife and Landscape Character Study*.

R.I.F.T. Airsoft; About R.I.F.T. Airsoft; <http://riftairsoft.com/content.php?46-about-r-i-f-t>. Accessed: October 2013.

Soil Survey of England and Wales (1984), *Soils and their Use in South East England*.

South Northamptonshire District Council (1997), *Adopted Local Plan, Saved Policies*.

South Northamptonshire Council (2013), *Culworth Conservation Area Appraisal and Management Plan*.

South Northamptonshire District Council (2007), *South Northamptonshire Local Plan Saved Policies*.

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

The Regional Strategy for the East Midlands (Revocation) Order 2013 (SI2013 No. 629). The Stationery Office, UK.

Valuation Office Agency; *Business Floorspace (Experimental Statistics)*; http://www.voa.gov.uk/corporate/statisticalReleases/120517_CRLFloorspace.html; Accessed October 2013.

Water Resources Act 1991. London, Her Majesty's Stationery Office.

West Northamptonshire Joint Planning Unit (2012), *Joint Core Strategy*.

West Northamptonshire Joint Planning Unit (2012), *Proposed Changes to the West Northamptonshire Joint Core Strategy Pre-Submission – Schedule 1: Significant Proposed Changes*.