HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement and Additional Provision 2 Environmental Statement

Volume 2 | Community forum area report

CFA22 | Whittington to Handsacre

July 2015

SES and AP2 ES 3.2.1.22

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Department for Transport

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Contents

List of figures

List of tables

Structure of the HS2 Supplementary Environmental Statement and Additional Provision 2 Environmental Statement

The Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES) comprise:

- a non-technical summary (NTS). This provides a summary in non-technical language of the SES (Part 1) and AP2 ES (Part 2) and of any likely significant environmental effects, both beneficial and adverse, which are new or different from those reported in the High Speed Two (HS2) Phase One Environmental Statement (ES) submitted to Parliament in November 2013 in support of the hybrid Bill (the Bill) for Phase One of HS2 (hereafter referred to as 'the main ES').

- Volume 1: Introduction to the SES and the AP2 ES. This introduces the supplementary environmental information and design changes included within the SES and amendments which have resulted in the need to amend the Bill within the AP2 ES. It also explains any changes to the scope, methodology, assumptions and limitations required for the environmental impact assessment.

- Volume 2: Community Forum Area (CFA) reports and map books. These describe the supplementary environmental information and design changes included within the SES (Part 1), amendments within the AP2 ES (Part 2) and report any new or different likely significant environmental effects arising from these changes in each CFA, compared to those reported in the main ES and, where relevant, the AP1 ES. The main local alternatives that have been considered are described, where relevant. The approach for Whittington to Handsacre (CFA22), however, is different from the approach adopted for the other CFAs due to the extent of the amendments in this area. The SES (Part 1) provides an assessment of the updated baseline from the main ES and corrections to the main ES. The AP2 ES is split into two parts: Part 2A provides a comparison between the original scheme and the AP2 revised scheme (Section 4) and a summary of the key changes to the likely residual significant effects arising from the AP2 revised scheme (Section 5). Part 2B provides a complete reassessment of the AP2 scheme as a direct replacement for the main ES and SES for CFA 22 Whittington to Handsacre (Section 6). The main local alternatives that have been considered are described, where relevant.

- Volume 3: Route-wide effects. This reports new or different likely significant route-wide effects arising from the supplementary environmental information included within the SES (Part 1) and amendments within the AP2 ES (Part 2)

compared to those reported in the main ES.

- Volume 4: Off-route effects. This reports new or different likely significant off-route effects arising from the amendments within the AP2 ES compared to those reported in the main ES and, where relevant, the AP1 ES.
- Volume 5: Appendices and Map Books. This contains supporting environmental information and associated maps.
- Glossary of terms and list of abbreviations. This contains any new or different terms and abbreviations used throughout the SES and the AP2 ES compared to those included in the main ES.

Structure of this report

This volume of the SES and AP2 ES is divided into CFA reports, which are in turn divided into two parts.

Part 1 provides supplementary environmental information relating to:

- new baseline information with respect to European Protected Species surveys, additional cultural heritage and ecology data relating to ancient woodlands, and geophysical surveys for cultural heritage; and
- corrections to the main ES.

Part 1 of each CFA report includes, where relevant:

- a description of the changes or updates within the CFA that have triggered the need for reassessment;
- an assessment of the environmental effects of the changes for relevant environmental topics considering the:
  - scope, assumptions and limitations of the SES assessment;
  - changes of relevance to the assessment;
  - environmental baseline;
  - effects arising during construction;
  - effects arising from operation; and
  - mitigation and residual effects.

The AP2 ES is split into two parts: Part 2A provides a comparison between the original scheme and the AP2 revised scheme (Section 4) and a summary of the key changes to the likely residual significant effects associated with the two schemes (Section 5). Part 2B provides a complete reassessment of the AP2 revised scheme as a direct replacement for the main ES and SES for CFA22 Whittington to Handsacre (Section 6). The main local alternatives that have been considered are described, where relevant.

Part 2A includes the following information:

- brief description of the original scheme;
- major design changes since submission of the Bill;
- consequential changes to the scheme;
- other changes to the scheme;
- summary of key construction changes;
- summary of key operational changes; and
- a summary of the key changes in likely residual significant effects since the main ES.

Part 2B: replaces the assessment of CFA22 in the main ES and SES and includes the following information:

- overview of the area;
- description of the AP2 revised scheme;
- construction of the AP2 revised scheme;
- operation of the AP2 revised scheme;
- description of the main local alternatives; and
- an assessment for the following environmental topics:
  - agriculture, forestry and soils;
  - air quality;
  - community;
  - cultural heritage;
  - ecology;
  - land quality;
  - landscape and visual assessment;
  - socio-economics;
  - sound, noise and vibration;
  - traffic and transport; and
  - water resources and flood risk assessment.

Each environmental topic section comprises: an introduction to the topic; a description of the environmental baseline within the area; and the likely significant environmental effects arising during construction and operation of the AP2 revised scheme.

1 Introduction

1.1.1 The Bill for High Speed Rail between London and the West Midlands was submitted to Parliament, with the main ES, in November 2013. The AP1 ES, which was submitted in September 2014, contained generally minor amendments to the design of the original scheme (i.e. the scheme submitted in November 2013). The Bill and associated Additional Provisions to the Bill, if enacted by Parliament, will provide the powers to construct, operate and maintain Phase One of HS2.

1.1.2 Since the submission of the main ES and AP1 ES, a number of changes or updates to environmental information and scheme design or assumptions have occurred, which may lead to new or different significant effects. These effects, depending on the type of change, are reported in the SES (Part 1) or AP2 ES (Part 2) of this document.

1.1.3 The SES contains updated environmental baseline information to the main ES and corrections to the main ES which are described in Part 1 under a series of sub-headings and assessed on a topic-by-topic basis using the same approach adopted as in the main ES. The purpose of the SES is to provide an assessment of any new or different likely significant environmental effects arising from the updated baseline and corrections to the main ES.

1.1.4 The AP2 ES CFA reports across the route assess any new or different likely significant environmental effects arising from each amendment, compared to those reported in the main ES and, where relevant, the AP1 ES. However, the approach in Whittington to Handsacre is different due to the extent of the amendments in this CFA. The AP2 ES for CFA22 is split into two parts: Part 2A compares the original scheme and the AP2 revised scheme (Section 4), and summarises the key changes to the likely residual significant effects arising from the AP2 revised scheme (Section 5). Part 2B provides a complete reassessment of the AP2 revised scheme as a direct replacement for the main ES and SES for CFA22 Whittington to Handsacre (Section 6). The main local alternatives that have been considered are described, where relevant.

1.1.5 The standard measures that will be used to mitigate likely significant adverse environmental effects during construction and operation of the AP2 revised scheme are described in the main ES, Volume 1, Section 9 and the draft Code of Construction Practice (CoCP) submitted in support of the Bill. Implementation of these measures has been assumed in this SES and AP2 ES.

1.1.6 In order to differentiate between the original proposals and subsequent changes, the following terms are used:

- 'the original scheme' - the Bill scheme submitted to Parliament in November 2013, which was assessed in the main ES;
- 'the SES scheme' - the original scheme with updated environmental baseline and corrections to the main ES described in the SES; and
- 'the AP2 revised scheme' - the original scheme as amended by the SES scheme and AP2.

Part 1: Supplementary Environmental Statement

2 Summary of changes

2.1 New environmental baseline information

Cultural heritage

2.1.1 Geophysical surveys have been undertaken in this CFA since production of the main ES (September 2013). In addition, a further review of historic mapping and other available historic data sources has been carried out to verify the status of a number of sites in the vicinity of the route, which are not currently listed on the ancient woodland inventory.

2.1.2 Details of survey and desk-based work undertaken in this CFA since September 2013 are provided in the SES and AP2 ES, Volume 5: Appendix CH-004-022 and Volume 5 map series CH-07, CH-09 and CH-10, where this is relevant to the assessment of a new or different significant effect.

2.1.3 A summary of the supplementary cultural heritage information from these sources that are relevant to the SES assessment is provided in Section 3 under 'Cultural heritage'.

Ecology

2.1.4 Surveys for great crested newt, otter and bats have been undertaken in this area since September 2013. In addition, habitat surveys have been undertaken at selected woodland locations to assist in determining if these areas represent ancient woodland. Additional desk-study information has also been collated since publication of the main ES from relevant planning applications and from Staffordshire Ecological Record (Biological Records Centre).

2.1.5 Details of all survey work and desk-study information gathered since September 2013 which is relevant to this area is provided in SES and AP2 ES, Volume 5: Appendix EC-001-003 and EC-004-003 and Volume 5 map series EC-01; EC-04; EC-05; EC-11 and EC-12.

2.1.6 A summary of the supplementary ecological information that is relevant to the SES assessment is included within Section 3 under 'Ecology'. This includes details of changes relating to the status of ancient woodland. SES and AP2 ES, Volume 5: Appendix EC-002-003 provides a summary of additional baseline survey data collected since September 2013, which has resulted in no change to the conclusions of the main ES. SES and AP2 ES, Volume 5: Appendix EC-003-003 identifies additional local/parish level effects which occur as a consequence of SES changes but are not significant.

2.2 Corrections to the main ES

2.2.1 Since submission of the Bill, the need for a number of corrections in the contents of the main ES has been identified. Table 1 provides a list of those instances where there has been a need to correct the Volume 2 CFA report for Whittington to Handsacre because of the potential to alter the significant environmental effects reported in the main ES, or a factual inaccuracy relating to significant effects has been identified. The table gives the location of the correction in the main ES, the reason for the correction, replicates the text from the main ES, where applicable, provides revised text, and identifies whether the correction changes a significant effect reported in the main ES. Where relevant, these corrections have been taken into account in the technical assessments contained within Section 3 of this SES.

Table 1: Summary of corrections to the main ES in CFA22

Reference in the main ES	Description of correction	Text in the main ES	Revised text	Change to significant effects and mitigation
Community Volume 2, CFA22 report, paragraphs 5.5.5 and 5.5.9. Operational amenity effects on residential properties at Handsacre.	Noise modelling results have confirmed that there would be no significant operational noise effects on properties at Spode Avenue, Handsacre. On this basis, there would be no significant community operational amenity effects on residential properties at Handsacre as less than five would, as a consequence, be affected.	Paragraph 5.5.5: 'The residents of five properties at Handsacre will be affected by a combination of significant noise and visual effects due to the operation of the Proposed Scheme. The change in amenity for these residents is assessed as a major adverse effect, which is significant. The properties that will be affected are: No. 15 Spode Avenue; and No.s 27, 29, 31 and 33 Chestnut Close.' Paragraph 5.5.8: 'The assessment has concluded that a small number of households on the western outskirts of Whittington and on the edge of Handsacre will experience a reduction in amenity due to a combination of significant noise and visual effects from	Delete paragraph 5.5.5 and amend paragraph 5.5.8 as follows: 'The assessment has concluded that a small number of households on the western outskirts of Whittington will experience a reduction in amenity due to a combination of significant noise and visual effects from the operation of the Proposed Scheme. The change in amenity for these residents will give rise to a major adverse effect, which is significant.'	Yes. This is a removal of a major adverse and significant effect reported in the main ES.

Reference in the main ES	Description of correction	Text in the main ES	Revised text	Change to significant effects and mitigation
		the operation of the Proposed Scheme. The change in amenity for these residents will give rise to a major adverse effect in both cases, which is significant.'		
Community CFA 22, Volume 2, Section 5, paragraph 5.4.25.	Additional traffic and transport analysis, (see the Traffic and Transport correction in this table below) has identified a new major traffic congestion effect at the junction of the A38 and Wood End Lane. The identification of a new significant traffic effect also gives rise to a new significant community isolation effect not currently reported in paragraph 5.4.25 of the main ES.	The community of Fradley will not be significantly affected during the construction of the Proposed Scheme. The village centre and the more recent housing estate and facilities to the south are too far from the construction works to be affected by significant amenity impacts and given the phasing and nature of the works on the A38 and Wood End Lane, the effects on access to facilities at Lichfield, including secondary schooling will be negligible.	The centre of Fradley and the area of more recent housing development to its south, are too far from the construction works to be affected significantly by a change in amenity during construction. However, additional construction traffic generated by the works will result in a major adverse and significant congestion effect at the junction between the A38 and Wood End Lane. This will affect residents travelling from Fradley to Lichfield on a daily basis, to access secondary schools, health centres and other facilities. As this could last for a period of approximately two years, this is assessed as giving rise to a temporary moderate adverse significant isolation effect on the community of Fradley.	Yes. This is a new temporary moderate adverse significant effect likely to arise during construction of the original scheme as a result of major traffic congestion at the A38/Wood End Lane junction. Appropriate measures to mitigate this adverse effect are expected to be brought forward either in a subsequent AP or by direct agreement with the local highway authority.
Sound, Noise and Vibration Volume 2, CFA22, Section 11, paragraph 11.5.16	Operational airborne noise assessment location 22642 (Streethay Wharf) was omitted from the list of properties that were estimated in the main ES as being likely to qualify for noise insulation.	...It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are indicated on Volume 5: Map Book - Sound, noise and vibration, Map series SV-05: - Streethay Farm,	...It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are indicated on Volume 5: Map Book - Sound, noise and vibration, Map series SV-05: - Streethay Farm, Burton Road; - Streethay Wharf, Burton Road; - Mill Farm, Lichfield; and - Ravenshaw House,	Yes. One additional dwelling is identified as being subject to a significant adverse effect, and is consequently estimated to be likely to qualify for noise insulation. The mitigation measures, including noise insulation will reduce noise inside all dwellings such that it will not reach a level that would significantly

Reference in the main ES	Description of correction	Text in the main ES	Revised text	Change to significant effects and mitigation
		Burton Road; - Mill Farm, Lichfield; and - Ravenshaw House, Curborough.	Curborough. (The predicted operational airborne sound levels at Streethay Wharf, Burton Road are presented in main ES Appendix SV-004-022.	affect residents.
Sound, noise and vibration Volume 2 CFA22 report, Section 11, Table 22	The location and details of significant effect number OSV22-C02 incorrectly included dwellings on Millcroft Way as part of the significant effect. The significant effect was correctly reported in main ES technical appendix SV-004-022.	Approaching 80 dwellings on the south of Handsacre, closest to the WCML (West Coast main line) and the tie-in to Proposed Scheme in the vicinity of Chestnut Close, Rowan Drive, Warren Croft, Barn Road, Lichfield Road and Millcroft Way.	Approaching 60 dwellings on the south of Handsacre, closest to the WCML and the tie in to Proposed Scheme in the vicinity of Chestnut Close, Rowan Drive, Warren Croft, Barn Road and Lichfield Road.	Yes The correction has resulted in a reduction in the number of impacted dwellings (from 80 to 60) that form this significant operational airborne noise effect. Mitigation is as reported in the main ES.
Traffic and Transport CFA22, Volume 2, Section 12, paragraph 12.4.16	Additional analysis and survey data since the publication of the main ES has identified that the junction of A38 and Wood End Lane (Hilliard's Cross) should have been assessed in relation to potential congestion effects.	The forecast traffic flow increases are considered not to result in a significant increase in congestion.	Changes in traffic flows will lead to a significant increase in congestion and delays for vehicle users at the junction between Wood End Lane and the connection to the A38 southbound slip roads. (major adverse effect)	Yes. There is a new major significant effect in relation to congestion and delays at the junction between Wood End Lane and the connection to the A38 southbound slip roads Appropriate measures to mitigate this adverse effect are expected to be brought forward either in a subsequent AP or by direct agreement with the local highway authority.

2.3 Topics included in the SES assessment

2.3.1 The changes described above in Sections 2.1 to 2.2 result in new or different significant effects in respect of cultural heritage and ecology. These are described in Section 3.

3 Assessment of changes

3.1 Cultural heritage

Introduction

3.1.1 This section of the report describes the environmental baseline in relation to cultural heritage that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the updated baseline introduced in Section 2, compared to the original scheme. Consideration is given to effects upon the value of heritage assets.

Scope, assumptions and limitations

3.1.2 The assessment scope, key assumptions and limitations for cultural heritage are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001 -000) and the SMR Addendum (Volume 5: Appendix CT-001-000) of the main ES.

Changes of relevance to this assessment

3.1.3 The following changes are relevant to this assessment:

- the results of geophysical surveys undertaken; and
- potential new areas of ancient woodland which may be added to the ancient woodland inventory.

Environmental baseline

Existing baseline

3.1.4 The cultural heritage baseline for the assessment takes into account information collected in support of the main ES, which included walk-over survey and geophysical survey, remote sensing data, and data from national and local registers. A full list of heritage assets is provided in Volume 2, Section 6.3 of the main ES for CFA22. In addition, the baseline has been updated with the results of survey work comprising geophysical surveys for archaeology and a further review of historic mapping and other available historic data sources to verify the status of a number of sites, which the Woodland Trust believes to be ancient woodland.

3.1.5 A summary of the baseline information relevant to the assessment of new or different effects is set out below. For those assets described in the main ES, full details are provided in the baseline reports, gazetteer of heritage assets, impact assessment tables and survey reports in Volume 5 of the main ES, and are shown on maps CH-01 (Heritage Assets within Study Area), CH-02 (Designated Heritage Assets) and CH-03 (Archaeological Character Sub-zones).

Designated assets

3.1.6 In addition to the designated assets reported in the main ES, two areas of woodland have been identified from a review of historic mapping and other relevant data as likely to meet the criteria for designation as ancient woodland and are likely to be added to the ancient woodland inventory. These are Fulfen Wood (asset reference WHA379), which is located adjacent to and north of the West Coast Main Line (WCML)

at Huddlesford (SES and AP2 ES Volume 2 CFA22 Map Book: map CH-01-125:H4), and Little Lyntus (asset reference WHA380) which is south of Woodend Lane at Fradley (SES and AP2 ES Volume 2 CFA22 Map Book: map CH-01-127:G7). These are new heritage assets which have been assessed as being of high value and are considered as ancient woodland in the following assessment.

Non-designated assets

3.1.7 In addition to the non-designated assets reported in the main ES, a new non-designated asset has been identified as an archaeological asset with several pit-like features and curvilinear ditches. The archaeology at Fulfen Wood (asset reference WHA377) is located north of the woodland (SES and AP2 ES Volume 2 CFA22 Map Book: map CH-01-125:H5). This is a new non-designated heritage asset which has been assessed as being of low value (CN045, WSI-CFA22-005). Further details of the survey can be found in SES and AP2 ES Volume 5: Appendix CH-004-022.

3.1.8 Geophysical survey at Vicar's Coppice identified linear features and pits west of Ravenshaw Wood (CN053, WSI-CFA22-005). Further details of the survey can be found in SES and AP2 ES Volume 5: Appendix CH-004-022.

Future baseline

Construction (2017)

3.1.9 The future baseline for construction in 2017 remains unchanged from that reported in the main ES.

Operation (2026)

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

Effects arising during construction

Avoidance and mitigation measures

3.1.11 The provisions set out in the draft CoCP will be followed as detailed in the main ES (Volume 5, Appendix CT-003-000).

Assessment of impacts and effects

Temporary effects

3.1.12 The results of geophysical surveys undertaken and the two areas of woodland that are likely to be added to the ancient woodland inventory will give rise to new or different significant temporary effects from that reported in the main ES. The part of Fulfen Wood (asset reference WHA379) which is not to be removed, an asset of high value, will be subject to noise during construction, which will temporarily change the character of this rural woodland. This will result in a medium adverse impact and a major adverse significant effect.

Permanent effects

3.1.13 It is considered that there are likely to be new significant permanent effects to both designated and non-designated assets as a result of new baseline information.

- Fulfen Wood (asset reference WHA379), an asset of high value, will be removed partially for construction of the scheme, for landscaping, and for construction of the WCML overbridge (north) satellite compound, a high adverse impact, resulting in a major adverse effect;
- Little Lyntus (asset reference WHA380), an asset of high value, will be completely removed for construction of the scheme, a high adverse impact resulting in a major adverse effect; and
- Archaeology at Fulfen Wood (asset reference WHA377), an asset of low value, will be removed for construction of the scheme and landscaping, a high adverse impact resulting in a moderate adverse effect.

Other mitigation measures

3.1.14 No further mitigation measures are required other than those set out as part of the draft CoCP (Volume 5, Appendix CT-003-000).

Cumulative effects

3.1.15 There are no new or different likely significant cumulative effects for cultural heritage as a result of the SES changes acting in combination with the AP1 amendments, or as a result of any relevant committed development.

Summary of likely residual significant effects

3.1.16 There will be new major adverse significant residual effects as a result of impacts on Fulfen Wood (asset reference WHA379) and Little Lyntus (asset reference WHA380) and a moderate adverse significant effect on archaeology at Fulfen Wood (asset reference WHA377).

Effects arising from operation

Avoidance and mitigation measures

3.1.17 The provisions set out in the draft CoCP will be followed as detailed in the main ES (Volume 5, Appendix CT-003-000).

Assessment of impacts and effects

3.1.18 The remaining part of Fulfen Wood (asset reference WHA379), an asset of high value, will be subject to a considerable increase in noise, resulting from the operation of trains which will pass immediately adjacent to the wood, which will change the character of this rural woodland. This will result in a medium adverse impact, and a major adverse effect.

Other mitigation measures

3.1.19 No further mitigation measures are required other than those set out as part of the draft CoCP (Volume 5, Appendix CT-003-000).

Cumulative effects

3.1.20 There are no new or different likely significant cumulative effects for cultural heritage as a result of the new baseline information acting in combination with the SES, or as a

result of any relevant committed development interacting with the AP2 revised scheme.

Summary of likely residual significant effects

3.1.21 There will be a significant residual major adverse effect from operational train noise on the remaining part of Fulfen Wood (asset reference WHA379).

3.2 Ecology

Introduction

3.2.1 This section of the report provides a description of the environmental baseline in relation to ecology that is relevant to the assessment and identifies any new or different likely significant environmental effects as a result of the updated baseline. Consideration is given to the potential for impacts on species, habitats and sites designated on the basis of their importance for nature conservation.

Scope, assumptions and limitations

3.2.2 The assessment scope for ecology is as set out in Volume 1 of the SES and AP2 ES. The key assumptions and limitations, and the methodology for determining significance of effects are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/01) and the SMR Addendum (Volume 5: Appendix CT-001-000/02) of the main ES.

3.2.3 To address any limitations in data, a precautionary baseline has been considered according to the guidance reported in the main ES, Volume 5: Appendix CT-001-000/2. This constitutes a 'reasonable worst-case' basis for the subsequent assessment. The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the SES Scheme.

Changes of relevance to this assessment

3.2.4 The following changes are relevant to the assessment:

- new baseline information for Fulfen Wood and Little Lyntus (review of historic mapping and habitat survey respectively); and
- new baseline information as a result of additional bat surveys, including bat trapping and radio tracking in the vicinity of Ravenshaw Wood.

Environmental baseline

Existing baseline

3.2.5 The ecological baseline for the assessment takes into account baseline information collected in support of the main ES, which included field survey data, aerial photography and relevant existing information gathered from national organisations and from regional and local sources. A full list of data sources that informed the main ES is provided in the main ES Volume 2, CFA22, Section 7.

3.2.6 The assessment also takes into account additional desk-study and survey information collected since September 2013. Supplementary information relevant to the assessment in this CFA includes: additional information on woodlands at Little Lyntus

and Fulfen Wood; and further bat survey including bat trapping and radio tracking in the vicinity of Ravenshaw Wood, the results of which are provided in SES and AP2 ES, Volume 5: Appendix EC-004-003. Further information has also been obtained from Staffordshire Biological Records Centre (EcoRecord) and from a review of relevant planning applications.

3.2.7 A summary of the baseline information relevant to the assessment of new or different significant effects is provided below. Further details of additional baseline information obtained since the main ES are provided in the SES and AP2 appendices. For those receptors described in the main ES, further details are provided in SES and AP2 ES Volume 2, CFA22, Section 7 and in Volume 5, including the CFA22 Map Book: Ecology.

Designated sites

3.2.8 There are no changes to the baseline for designated sites as described in Volume 2, CFA22, Section 7 of the main ES.

3.2.9 A review of historic mapping and other relevant data sources has been carried out on Fulfen Wood since publication of the main ES. It is located adjacent to the WCML and is over 1ha in area (comprising a 0.43ha western part and a 0.61ha eastern part). Further work has also been carried out at Little Lyntus, located near the Trent and Mersey Canal which is 1.4ha in area. This further work has concluded that both Fulfen Wood and Little Lyntus are likely to meet the criteria for designation as ancient woodland. The following assessment considers these areas as ancient woodland.

Habitats

3.2.10 Fulfen Wood has not been surveyed but is considered likely to support lowland mixed deciduous woodland, a habitat of principal importance and identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[1], and was given up to local/parish value in the main ES. The woodland comprised two separate sections, a western section which is approximately 0.43 ha in area and an eastern section which is approximately 0.61 ha in area. Although the woodland is small and fragmented, containing plantation trees, the woodland is likely to be of ancient origin and could support a more diverse flora than initially expected. Therefore, on a precautionary basis, Fulfen Wood is now considered to have up to county/metropolitan value.

3.2.11 Little Lyntus wood, near Wood End Lane (1.4ha in area) was not surveyed before submission of the main ES and, based on available information in the main ES, it was reported to be of local/parish value. It has been surveyed since publication of the main ES and additional survey has indicated that it contains a diverse ground flora including a number of ancient woodland indicator species, such as small-leaved lime (*Tilia cordata*), moschatel (*Adoxa moschatellina*), wood anemone (*Anemone nemorosa*), pignut (*Conopodium majus*), bluebell (*Hyacinthoides non-scripta*) and dog's mercury (*Mercurialis perennis*). The woodland also has ancient or veteran trees and evidence of past coppicing, as well as a ditch bank at the woodland edge. Based on the additional survey information, the woodland is likely to be ancient and is now considered to be of up to county/metropolitan value.

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

Protected and/or notable species

3.2.12 The assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) was reported in the main ES as having county/metropolitan value.

3.2.13 This assemblage, as reported in the main ES, is a diverse assemblage of bat species including: common pipistrelle, soprano pipistrelle, brown long-eared bat, Daubenton's bat, Natterer's bat, Leisler's bat, noctule and Nathusius's pipistrelle. Bat activity was primarily associated with woodland edges, interlinking hedgerows between woodland, and along the route of the canal.

3.2.14 Several tree roosts used by noctule and soprano pipistrelle bats as occasional non-breeding summer roosts were confirmed within Ravenshaw Wood, Black Slough and the Slaish during 2012/13, with peak counts of 1 or 2 bats. A high density of trees with high and moderate potential to support roosting bats was also recorded within Ravenshaw Wood, Black Slough and the Slaish.

3.2.15 Additional tree and building roosts were identified in the area used by this assemblage during the radio-tracking surveys in 2014. These included roosts used by common pipistrelle, Natterer's bat, brown long-eared bat, noctule, Brandt's bat, and Daubenton's bat. It is not known if these roosts are used as breeding roosts or non-breeding bat roosts.

3.2.16 The work carried out since publication of the main ES has added whiskered and Brandt's bat to the assemblage, bringing the total within the assemblage to 10 species. Noctule, Daubenton's bat, Natterer's bat, Leisler's bat, whiskered bat, Brandt's bat and Nathusius's pipistrelle are 'rarer' bats within England[2]. Soprano pipistrelle, noctule and brown long-eared bat are species of principal importance identified in Section 41 of the Natural Environment and Rural Communities Act (2006).

3.2.17 Based on the species composition and the concentration of known roosts, the assemblage is now considered to be of regional value, an increase from the county/metropolitan value reported in the main ES.

3.2.18 A record from Staffordshire Ecological Record from 2013 of a single pond supporting a single great crested newt near Fradley Auction Centre has been received since publication of the main ES. The pond record appears to be within the centre of a hardstanding area used as a vehicle race track. However, this pond has not been surveyed and therefore it is assumed that the pond and great crested newt population are still present. The pond is within 50m of the land required for the construction of the AP2 revised scheme and is not close to any other assumed amphibian metapopulation referred to in the main ES. The population has up to district/borough value.

[2] Number of bats between 10,000 and 100,000 individuals based on Wray S, Wells D, Long E and Mitchell-Jones T. (2010) Valuing bats in ecological impact assessment in practice. December 2010.

Future baseline

Construction (2017)

3.2.19 SES and AP2 ES Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017, additional to those identified in the main ES Volume 5: Appendix CT-004-000. None of the identified developments affect the assessment of the SES scheme's likely construction impacts on ecology.

Operation (2026)

3.2.20 SES and AP2 ES Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026, additional to those identified in the main ES Volume 5: Appendix CT-004-000. None of the identified developments affect the assessment of the SES scheme's likely operational impacts on ecology.

Effects arising during construction

Avoidance and mitigation measures

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

Assessment of impacts and effects

Designated sites

3.2.22 There are no changes to the baseline for designated sites in this area, and therefore no new or different significant effects from those reported in the main ES.

Habitats

3.2.23 Fulfen Wood is entirely within the land required for construction of the original scheme. No significant effects were reported in the main ES on Fulfen Wood due to the woodland being reported as being of local/parish value. As a result of further information collected after publication of the main ES, the woodland is now considered to be of district/borough value, and is likely to be ancient woodland. The loss of Fulfen Wood, just over 1ha in area, would therefore result in a permanent adverse effect on the conservation status of the woodland which will be significant at up to a county/metropolitan level. This is a new significant effect that was not reported in the main ES.

3.2.24 Little Lyntus woodland is entirely within the land required for construction of the original scheme. No significant effects were reported in the main ES on Little Lyntus woodland due to the woodland being valued at up to local/parish value. As a result of further survey information collected after publication of the main ES, the woodland is now considered to be of district/borough value. Therefore, the loss of the woodland, 1.4ha in area, will result in a permanent adverse effect on the conservation status of the woodland which will be significant at up to a county/metropolitan level. This is a new significant effect that was not reported in the main ES.

Species

3.2.25 The main ES reported construction impacts on the assemblage of bats using Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) including:

- loss and severance within Ravenshaw Wood, Black Slough and the Slaish;
- loss of a noctule tree roost within Black Slough plus two confirmed tree roosts which could be used by rarer bat species;
- isolation of a soprano pipistrelle tree roost within Black Slough and a noctule tree roost within Ravenshaw Wood and disturbance of bats using these roosts;
- removal of a large proportion of available tree roosting habitat;
- loss of key bat foraging habitat and severance of commuting routes along woodland edges and connecting hedgerows; and
- the creation of a 40m-wide gap within Black Slough and the Slaish for a high-pressure gas pipeline diversion, discouraging species preferring cluttered habitats, such as Myotis species and brown long-eared bat, resulting in further disruption of commuting routes and foraging areas.

3.2.26 The main ES stated that the combination of these impacts will result in an adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a county/metropolitan level.

3.2.27 As a result of further survey information collected after publication of the main ES, the assemblage of bats using Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) is now considered to be of regional value. The scheme will result in:

- the loss of eight confirmed tree roosts which surveys have now shown to be used by common pipistrelle, Daubenton's bat, Natterer's bat, and brown long-eared bat;
- disturbance of bats using confirmed tree roosts within the retained part of Ravenshaw Wood, on the edge of the woodland at Woodend Lock (south-east of) Site of Biological Importance (SBI) and confirmed building roosts at Wood End Lock Cottage and Black Slough Farm; and
- the loss and severance of Ravenshaw Wood reported in the main ES in particular would impact core areas now known to be used for foraging for whiskered/Brandt's bat, Natterer's bat and brown long-eared bat and other foraging areas used by noctule bat, Daubenton's bat and soprano pipistrelle.

3.2.28 Newly discovered roosts, commuting and foraging areas would be retained and bats would be able to continue using the Trent and Mersey Canal, which was confirmed in 2014 as a key commuting route connecting roosts and foraging areas used by the assemblage of bats. Other impacts on the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) remain unchanged from those stated in the main ES. Taking into

account the updated baseline, the combination of impacts will result in an adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a regional level. This is a different significant effect and an increase from the district/borough level significant adverse effect reported in the main ES.

Other mitigation measures

3.2.29 Based on the likely addition of Little Lyntus to the ancient woodland inventory the land required within this woodland will be reduced as far as practicable. Whilst there will be an area of ancient woodland of 0.05ha which will be permanently lost, the remainder (1.35ha) will be retained, reducing the magnitude of the effect on this ancient woodland.

3.2.30 Fulfen Wood is also likely to be added to the ancient woodland inventory and as a result, the section of Fulfen Wood located to the east of the HS2 route (0.61ha) will be retained. This will result in a different significant effect, reducing the loss of ancient woodland to 0.43ha. However, there will remain a permanent adverse effect significant at the district/borough level.

3.2.31 There is a requirement for additional compensation to address the loss of 0.43ha of ancient woodland at Fulfen Wood and the 0.05ha of ancient woodland from Little Lyntus due to the change in status of these woodlands. There is also a requirement for additional compensation to address the impacts on the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood). Appropriate measures are being brought forward through the AP2 revised scheme. See Part 2 Section 11 for a full description of the measures proposed and the reporting of the revised effects taking the proposed measures into account.

Summary of likely residual significant effects

3.2.32 The mitigation, compensation and enhancement measures described in the main ES reduce effects to a level that is not significant except for the loss of ancient woodland.

3.2.33 Ancient woodland is irreplaceable. The loss of just over 0.43ha of ancient woodland within Fulfen Wood will result in a permanent adverse effect which will be significant at up to a county/metropolitan level. This is an additional residual effect which was not reported in the main ES. There will also be a new residual effect due to the permanent loss of 0.05ha within Little Lyntus ancient woodland.

3.2.34 This increases the total amount of ancient woodland loss for the SES scheme in this area from 5.4 ha, as reported in the main ES, to 5.9 ha.

3.2.35 Compensation for residual effects will be brought forward through a range of measures included within the AP2 revised scheme.

Effects arising from operation

Avoidance and mitigation measures

3.2.36 There are no additional avoidance or mitigation measures to those described in the main ES.

Assessment of impacts and effects

3.2.37 The main ES identified species of bat that could be particularly at risk of collision with trains as: Natterer's bat, noctule bat, Daubenton's bat, brown long-eared bat and pipistrelle species. Given the concentration of bats in the vicinity of Ravenshaw Wood, Black Slough and the Slaish, where the route would be at grade or on low embankment, the main ES stated that there could be an increased risk of collision of bats with trains. The radio-tracking work in 2014 identified whiskered and Brandt's bat within the bat assemblage using habitats associated with Ravenshaw Wood, Black Slough and the Slaish. These low-flying bat species would therefore also be at risk from collision with trains. The main ES reported that, although there is a risk of individual bats being killed or injured by collision with trains, the impacts are unlikely to result in significant effects on the conservation status of any of the species concerned. The additional baseline information does not change the level of effect reported in the main ES.

Other mitigation measures

3.2.38 The original scheme includes measures to discourage bats from foraging close to the route, including planting that has been designed to create a 'funnel' effect to encourage bats to fly beneath the route, notably in the vicinity of the Wyrley and Essington Canal, the Trent and Mersey Canal, the Curborough Brook, and the Bourne Brook, rather than up and over the railway.

3.2.39 In Ravenshaw Wood, Black Slough and the Slaish, two measures were included in the original scheme to address the impacts of habitat loss and severance on bat populations in the area. Firstly, to reduce the risk of collision with trains where woodland habitat is severed in Ravenshaw Wood, Black Slough and the Slaish, a physical barrier will be installed at the top of the embankment slopes on both sides of the route between the Trent and Mersey Canal viaducts and the Kings Bromley Footpath 0.392 underpass. This will force bats up and over the route and reduce the risk of collision with trains.

3.2.40 Secondly, new woodland planting included in the original scheme will enhance habitat connectivity, commuting, foraging and roosting opportunities away from the route. The new woodland edges will be set back from the route and will be scalloped to create sheltered areas favoured by insects and provide suitable commuting and foraging areas away from the railway. These rides and woodland edges will be designed to encourage the bats to fly toward the Trent and Mersey Canal viaducts and the Kings Bromley Footpath 0.392 underpass. These measures will be suitable to mitigate effects on the additional species identified within the assemblage of bats using Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) during the survey work undertaken since publication of the main ES. The implementation of the measures included in the main ES reduces the effect on the assemblage of bats concerned to a level that it is not significant. No additional mitigation is required.

Summary of likely residual significant effects

3.2.41 Following the implementation of the mitigation measures described in the main ES the significant residual effects from operation of the SES scheme in this area are unchanged from those reported in the main ES.

Part 2A: Summary of the revised scheme and changes to likely residual significant effects

4 Summary of the revised scheme

4.1 Introduction

4.1.1 Part 2A provides comparison between the original scheme and the AP2 revised scheme (Section 4) and a summary of the key changes to the likely residual significant effects arising from the AP2 revised scheme (Section 5).

4.2 Description of the original scheme

4.2.1 The main ES describes the original scheme as crossing Whittington Heath Golf Club and proceeding in a northerly direction. The original scheme would curve to the west, passing over the West Coast Main Line (WCML), the South Staffordshire Line (SSL) and the A38, to the east of Lichfield. It would then pass west of Fradley Business Park and split to provide a spur for Phase Two to Manchester, which would continue to just north of the Trent and Mersey Canal.

4.2.2 The original scheme would curve to the west crossing over the Manchester spur, twice crossing over the Trent and Mersey Canal on viaduct, then Curborough Brook and through Ravenshaw Wood. It would then pass over the existing A515, before connecting with the WCML to the south of Handsacre.

4.2.3 The original scheme would require the demolition of seven dwellings and Whittington Heath Golf Club house and associated building in this area. Twenty satellite and three main construction compounds were required. The scheme required construction sidings at Streethay to receive bulk excavated material by rail for transfer onto vehicles for movement into the required locations in this CFA. Four permanent road diversions or realignments were required; a section of Shaw Lane would be closed permanently; and a number of utilities, including gas, water, telecommunications and electricity would be diverted.

4.2.4 The original scheme included landscape planting and ecological mitigation within the project at a number of locations. For example, habitat creation would include a number of new woodlands to create linkage between existing woodland habitats adjacent to retained sections of Ravenshaw Wood, Black Slough and the Slaish.

4.3 Major design changes since submission of the Bill

4.3.1 Since publication of the main ES in November 2013, there have been further refinements to the route, arising from discussions with landowners, the Canals and Rivers Trust, and Parish, County and District Councils, to identify and develop two major design amendments.

4.3.2 The first major amendment relates to the crossing of the A38, WCML and SSL.

4.3.3 The original scheme would cross Whittington Heath Golf Club and then curve to the west, passing over the WCML, the SSL and the A38, to the east of Lichfield on a series of viaducts and embankments. It would then pass west of Fradley Business Park and split to provide a spur for Phase Two to Manchester.

4.3.4 A number of options for the horizontal and vertical alignment of the route in this area were considered during the development of the original scheme. This included an alignment which took the HS2 route under the A38, WCML and SSL, rather than over it. This option was not taken forward at that time, as reported in the main ES, due to the nature of the geology and hydrology in the area indicating that it would be difficult to construct the crossings of these railways and highway. Based on the information available at the time, it was assessed that the construction would result in an unacceptable level of disruption to the existing transport infrastructure.

4.3.5 However, since the publication of the main ES, further stakeholder engagement has made it clear that there remains a strong preference for this option, and further technical work and subsequent ground investigations have shown that original assumptions regarding the nature of the geology and hydrology could be refined, such that a construction methodology can be adopted which would avoid having an unacceptable level of disruption on the A38, WCML and SSL.

4.3.6 As a result a revised scheme has been developed which lowers the HS2 route by a maximum of 22.3m from north of the A51 Tamworth Road to north of the A38, so that the route can run in cutting to the east of Lichfield and pass beneath the WCML, the SSL and the A38, instead of the original scheme alignment that ran on embankments and viaducts to cross above the existing transport infrastructure.

4.3.7 The second major amendment relates to the Handsacre link as it crosses the Trent and Mersey Canal.

4.3.8 In the original scheme, the route would curve to the west from the A38 crossing over the Manchester spur, twice crossing over the Trent and Mersey Canal on viaduct, then over Curborough Brook and through Ravenshaw Wood. It would then pass over the existing A515 Lichfield Road, before connecting with the WCML to the south of Handsacre (the Handsacre link).

4.3.9 In the main ES an option to avoid a double crossing of the Trent and Mersey Canal was considered. It was reported that, although an alignment could have been developed, other constraints would mean the speed of the link would reduce to 170kph and it would still pass close to the canal and through the conservation area. As this alignment did not meet the original objective of avoiding impacts on the canal and required a speed reduction that significantly impacted on the potential operation of HS2, the option was not taken forward.

4.3.10 Following further discussions with key stakeholders such as the Canals and Rivers Trust and Staffordshire County Council, it was evident that this option would be preferable to those stakeholders despite still passing close to the Trent and Mersey Canal. As a result of these discussions, HS2 developed this option further by moving the route 250m towards the west which balanced the operational performance of the railway with the proposals presented by the stakeholders.

4.3.11 As a result, the AP2 revised scheme has been developed which realigns the Handsacre link approximately 250m south-west of the original scheme to pass alongside the Trent and Mersey Canal with one crossing of the canal by the Manchester spur, instead of the original scheme alignment that crossed the canal three times. As the Handsacre link was no longer required to be elevated to cross the Trent and Mersey Canal, the route was lowered between Fradley Park and the A515 to run mostly at the existing ground level.

4.3.12 Whilst these two major amendments have a number of benefits (including, for example, reduction in the visual impact of the scheme) it also results in new and different effects on areas and receptors which were either not previously affected or affected to a lesser degree. These significant effects of the AP2 revised scheme are considered in detail in Part 2B and a comparison of the key changes between the two schemes is summarised in Section 5.

4.4 Consequential changes to the scheme

4.4.1 As a result of these two major rail alignment changes, the following design changes were also required:

- lowering of the Darnford Lane overbridge;
- realignment of Capper's Lane to the north with a new bridge over the Wyrley and Essington Canal and a new connection to Broad Lane east of the HS2 route;
- realignment of a section of Wyrley and Essington Canal to the south;
- realignment of Fulfen Wood watercourse, Mare Brook North and Mare Brook South watercourses in the Broad Lane/Capper's Lane area and the Fradley area;
- realignment of Wood End Lane; and
- diversion of Netherstowe Lane and a short section of Watery Lane.

4.4.2 In addition, the following changes to the construction arrangements were required:

- the demolition of nine buildings, 23 fewer than the original scheme;
- two main civil engineering compounds and 16 civil engineering satellite construction compounds, four fewer than the original scheme;
- one main and eight satellite compounds for rail systems, four more than the original scheme due to the enabling works required for going under the WCML and SSL;
- Streethay construction sidings have been removed from the scheme;
- ten road diversions or realignments and stopping-up of a section of Shaw Lane, four more road diversions or realignments than the original scheme;
- the diversion of the National Grid High voltage electricity line near Streethay has been removed from the scheme; and

- revision of the construction programme for the AP2 revised scheme, resulting in a reduction in the duration of the civil engineering works in this CFA.

4.5 Other changes to the scheme

4.5.1 Following stakeholder engagement and design refinement, further changes in the AP2 revised scheme have been included:

- changed width and height of Whittington Footpath 16 underpass;
- changed access to Ravenshaw Cottage;
- new public highway between A515 Lichfield Road and Shaw Lane to provide alternative access for Tuppenhurst Lane; and
- relocation of balancing pond and access at Handsacre from the west side of the route to the east side.

4.6 Summary of key operational changes

4.6.1 The operation of the revised scheme would remain as reported in the main ES. A full description of the operation of CFA22 is provided in Section 6.

5 Summary of changes to likely residual significant effects

5.1 Agriculture, forestry and soils

5.1.1 The Lichfield area amendments result in new effects on some agricultural holdings and changes to the effects to other holdings. In addition, some agricultural holdings will no longer be affected by the scheme because of its westward alignment shift.

5.1.2 There has been a change to the balance of land required temporarily and permanently, with less land required overall for the AP2 revised scheme. During construction, much less land will be required (80.8ha decrease), reducing from 326.6ha required for the original scheme, to 245.8ha for the AP2 revised scheme. Conversely, there will be an increase in the amount of land required permanently (13.30ha increase), from 165.0ha required for the original scheme to 178.3ha for the AP2 revised scheme.

5.1.3 The main ES reported that approximately 165.0ha of agricultural land would be permanently required including 137.3ha of best and most versatile (BMV) agricultural land. The westward move of the alignment has resulted in an increase of 13.2ha in the BMV land will be permanently required.

5.1.4 The main ES reported a permanent requirement for land from 25 agricultural holdings. Of these, three (Hill Farm Streethay, Streethay Farm and Black Slough Farm) were likely to cease to operate. The SES and AP2 ES reports that construction of the AP2 revised scheme will result in the permanent requirement for land from 28 agricultural holdings.

Summary of key changes in likely residual significant effects (construction)

5.1.5 The AP2 revised scheme requires less agricultural land temporarily (80.8ha) compared to the main ES. Much of this reduced area is BMV land (72.8ha). However, this will not change the level of significance of the residual effects on BMV agricultural land reported in the main ES, which remains as moderate adverse (significant).

5.1.6 The AP2 revised scheme will, however, require an additional 13.3 ha of agricultural land permanently compared to the main ES. Of this, 13.2ha is BMV land. However, this will not change the level of significance of the residual effects on BMV agricultural land reported in the main ES, which remains as moderate adverse (significant).

5.1.7 The main changes to the likely residual significant effects on agricultural holdings resulting from the AP2 revised scheme in comparison with the original scheme are summarised below:

- there are ten agricultural holdings which are affected by the AP2 revised scheme that were not affected by the original scheme. Three will experience new residual significant effects. These are: Land off Capper's Lane B (CFA22/41) which will experience a moderate adverse (significant) residual effect due to 4.1ha (or 20% of the holding) being required permanently; the

residual effect on Land to the south and north of Mill farm (CFA22/43 will be major/moderate adverse (significant) due to 1.7ha (or 62% of the holding) being required permanently; and the residual effect on Land to the west of Mill Farm (CFA22/43) is major/moderate adverse (significant) due to 0.7ha (or 100% of the holding) being required permanently;

- for Big Lyntus Wood (CFA22/09), the level of significance of the residual effects reported in the main ES changes from negligible (not significant) to moderate adverse (significant) as a result of the AP2 revised scheme. This is because there was no land required permanently for the original scheme, but the AP2 revised scheme requires 0.8ha (or 12% of the holding) permanently;
- for Fulfen Farm (CFA22/01), the level of significance of the residual effects reported in the main ES changes from minor adverse (not significant) to moderate adverse (significant) as a result of the AP2 revised scheme. This is due mainly to the magnitude of severance, which increases from low to medium;
- the AP2 revised scheme no longer requires land temporarily or permanently from eight agricultural holdings. Of these eight holdings, only one, Riley Hill Woodend Farm (CFA22/11) was reported in the main ES as experiencing a residual significant effect (major/moderate adverse), and this is avoided with the AP2 revised scheme;
- there are two holdings where the level of significance of the residual effects reported in the main ES changes from moderate adverse (significant) to minor adverse (not significant) as a result of the AP2 revised scheme. These are Ravenshaw Wood East (CFA22/12) where the land required permanently decreases from 3.9ha (or 26% of the holding) to 1.7ha (or 11% of the holding), and Ravenshaw Wood West (CFA22/14) where the land required permanently decreases from 2.9ha (or 24% of the holding) to 1.5ha (or 12% of the holding);
- the AP2 revised scheme will avoid demolition of agricultural buildings at three holdings reported in the main ES, as follows: Hill Farm Streethay (CFA22/4) for which the residual effect remains as reported in the main ES as major/moderate adverse (significant) due to 7.7ha (or 27% of the holding) being required permanently; Streethay Farm (CFA22/5) for which the residual effect remains as reported in the main ES as major/moderate adverse (significant) due to 5.2ha (or 16% of the holding) being required permanently; and New Farm Elmhust (CFA22/18) for which the residual effect reduces from major adverse (significant) to major/moderate adverse (significant) due to the residual permanent land loss of 3.8ha (or 11% of the holding);
- for Huddlesford House Farm (CFA22/03) the level of significance of the residual effects reported in the main ES changes from moderate adverse (significant) to major/moderate adverse (significant). This is because the magnitude of severance increases from low to high;
- for Curborough House Farm (CFA22/07), the level of significance of the residual effects reported in the main ES changes from moderate (significant) to major/moderate adverse (significant) as a result of the AP2 revised scheme.

This is because the amount of land required permanently increases from 28.3ha (or 16% of the holding) to 37.3ha (or 22% of the holding);

- for Curborough Farm (CFA22/08), the level of significance of the residual effects reported in the main ES changes from moderate (significant) to major/moderate adverse (significant) as a result of the AP2 revised scheme. This is because the amount of land required permanently increases from 22.4ha (or 8% of the holding) to 30.0ha (or 11% of the holding);
- while the level of significance of residual effects reported in the main ES stays the same as a result of the AP2 revised scheme for Black Slough Farm (CFA22/13), i.e. major adverse (significant), the amount of land required permanently will increase from 12.7ha (or 23% of the holding) to 20.7ha (or 37% of the holding);
- while the level of significance of residual effects reported in the main ES stays the same as a result of the AP2 revised scheme for Brokendown Wood (CFA22/24), i.e. major/moderate adverse (significant), the amount of land required permanently will increase from 1.1ha (or 28% of the holding) to 2.3ha (or 47% of the holding);
- while the level of significance of residual effects reported in the main ES stays the same as a result of the AP2 revised scheme for Land adjacent to Easthill House (CFA22/32), i.e. major/moderate adverse (significant), the amount of land required permanently will decrease from 1.3ha (or 54% of the holding) to 0.5ha (or 21% of the holding); and
- for land on the north-east side of Marsh Lane (CFA22/07), the level of significance of the residual effects reported in the main ES changes from major/moderate (significant) to moderate adverse (significant) as a result of the AP2 revised scheme. This is because the amount of land required permanently will decrease from 0.4ha (or 20% of the holding) to 0.3ha (or 16% of the holding).

Summary of key changes in likely residual significant effects (operation)

5.1.8 The main ES reported no significant effects on agriculture, forestry or soils during operation and there are no new or different effects for agriculture, forestry or soils as a result of the AP2 revised scheme, in comparison with the main ES.

5.2 Air quality

5.2.1 The air quality assessment for the construction phase considered construction dust and emissions from construction traffic and construction sidings.

5.2.2 With regard to construction dust, the AP2 revised scheme does not change the magnitude of construction activities in terms of dust-generating potential from that in the main ES, nor are the distances of receptors from the activities altered sufficiently to result in any new or different significant residual effects.

5.2.3 With regard to construction traffic emissions, there will be a change in the magnitude of impact of construction traffic emissions from that reported in the main ES. However, this would not result in new or different significant residual effects.

5.2.4 The Streethay construction sidings have been removed for the AP2 revised scheme and there would be no effects from rail emissions during construction as a result of the AP2 revised scheme.

5.2.5 Overall the main ES reported no significant effects on air quality during construction and there are no new or different significant effects due to construction for air quality as a result of the AP2 revised scheme, in comparison with the main ES.

Summary of key changes in likely residual significant effects (construction)

5.2.6 The main ES reported no significant effects on air quality during construction and there are no new or different significant effects due to construction for air quality as a result of the AP2 revised scheme, in comparison with the main ES.

5.2.7 With regard to construction dust, the AP2 revised scheme does not change the magnitude of construction activities in terms of dust-generating potential from that in the main ES, nor are the distances of receptors from the activities altered sufficiently to result in any new or different significant effects.

5.2.8 With regard to construction traffic emissions, there will be a change in the magnitude of impact of construction traffic emissions from that reported in the main ES. However, this would not result in new or different significant residual effects on air quality.

5.2.9 The Streethay construction sidings have been removed for the AP2 revised scheme and there would be no effects from rail emissions during construction as a result of the AP2 revised scheme.

Summary of key changes in likely residual significant effects (operation)

5.2.10 The air quality assessment for the operational phase considered emissions from traffic.

5.2.11 With regard to operational emissions, the changes due to the AP2 revised scheme will not be sufficient to change the magnitude of impact of operational traffic emissions from that reported in the main ES and there will be no new or different significant residual effects.

5.3 Community

5.3.1 The lowering of the scheme in cutting and lowered embankments, as well as moving the alignment westward, has reduced the number of community resources affected by the original scheme.

5.3.2 The key changes of relevance to the community assessment are:

- a reduction in the number of residential properties that will need to be demolished from eight to two; and
- changes to temporary and permanent land required has reduced the number of recreational facilities and open spaces likely to be significantly affected from five to two.

Summary of key changes in likely residual significant effects (construction)

5.3.3 The AP2 revised scheme will avoid the original scheme's significant adverse effects on the following resources:

- Darnford Moors Golf Club;
- Horsepower Equestrian Centre; and
- moorings on the Trent and Mersey Canal at Wood End Lock.

5.3.4 In addition, the AP2 revised scheme will retain five of the six residential properties at Streethay that would need to be demolished under the original scheme, thereby removing the permanent moderate adverse significant effect that was reported in the main ES.

5.3.5 The significance of the adverse effects on the Whittington Heath Golf Club and the Lichfield Cruising Club will be unchanged in the AP2 revised scheme. The AP2 revised scheme includes amendments to widen the Whittington Footpath 16 underpass to permit use of the underpass by golf buggies and small maintenance vehicles to support the Golf Club's ambitions to maintain the course either side of the HS2 route. However, this will not change the overall conclusion reported in the main ES that there will be a permanent major adverse residual significant effect on the Whittington Heath Golf Club.

5.3.6 Similarly, although the AP2 revised scheme will have slightly different impacts on the Lichfield Cruising Club's facilities in the vicinity of Capper's Lane, the overall significance of effects will be unchanged from those reported in the main ES. The AP2 revised scheme will give rise to both a temporary moderate adverse significant effect on the cruising club due to the need to close approximately 12 of its moorings during construction and a permanent moderate adverse significant effect due to the loss of its boat maintenance area, associated car parking and slipway.

Summary of key changes in likely residual significant effects (operation)

5.3.7 The AP2 revised scheme will not give rise to any new or different significant operational effects and will not change the level of significance of effects reported in the main ES.

5.4 Cultural heritage

5.4.1 The Lichfield area amendments have resulted in changes to land temporarily and permanently required. As a result, new cultural heritage resources require assessment.

Some resources (seven) are no longer significantly affected by the scheme. Six additional resources are now significantly affected.

Summary of key changes in likely residual significant effects (construction)

5.4.2 During construction, the AP2 revised scheme will reduce major/ moderate significant residual effects reported in the main ES and SES to minor adverse or neutral non-significant effects on the following assets:

- the Trent and Mersey Canal conservation area (asset reference WHA340), neutral effect;
- the site of cropmarks at Wood End (asset reference WHA344), neutral effect;
- Coventry Canal (asset reference WHA309), neutral effect;
- the site of cropmarks at Brokendown Wood (asset reference WHA345), neutral effect;
- archaeological deposits related to the prehistoric landscape at Mare Brook (asset reference WHA320), neutral effect;
- the historic landscape of Curborough piecemeal enclosure (asset reference WHA227), permanent minor adverse; and
- archaeological deposits within relict fields at Ravenshaw Wood (asset reference WHA321), permanent minor adverse.

5.4.3 The revised alignment reduces the number of demolitions required from the group of buildings Field Cottage, Streethay Cottage and Elverceter (asset reference WHA039) from three to one. As a result the permanent moderate adverse significant effect reported in the main ES is reduced to a minor adverse effect which is not significant. However, the retention of two of the buildings during construction, introduces a temporary moderate adverse significant effect on this asset that was not reported in the main ES.

5.4.4 The revised alignment avoids the demolition of the cottage called 'Rough Stockings' (asset reference WHA046), reducing the high adverse permanent impact reported in the main ES to medium; however, this will remain a moderate adverse effect. A new temporary moderate adverse significant effect will also occur due to the retention of this building.

5.4.5 Due to the removal of the Streethay sidings for the AP2 revised scheme, Hill Farm, Streethay (asset reference WHA 090) will no longer be demolished. This reduces the permanent moderate adverse significant effect reported in the main ES to minor adverse which is not significant. However, the retention of the farm during construction introduces a temporary moderate adverse significant effect on this asset that was not reported in the main ES.

5.4.6 The revised alignment reduces the impacts on Trent and Mersey Canal - Bridge 53 and Wood End Lock (asset reference WHA338), and Wood End Cottage (asset reference WHA339). For the Bridge 53 and Wood End Lock, the permanent adverse effect is reduced to minor adverse, which is not significant. For Wood End Lock Cottage, the temporary major adverse effect is reduced to moderate adverse.

5.4.7 There will be a change to the permanent impacts at Streethay Manor and moated site (WHA132) during construction from high to medium adverse. This will still result in a major adverse effect and this remains a significant adverse effect.

5.4.8 There will also be an increase in the significance of effects reported in the main ES and SES from minor adverse/negligible to major/moderate adverse at construction at six heritage assets, primarily due to shifting the alignment westwards by 250m:

- Willow Cottage (asset reference WHA064);
- archaeological features comprising a boundary bank and earthworks (asset reference WHA319) at Woodend;
- ancient woodland at Big Lyntus (asset reference WHA221);
- ancient woodland at Vicar's Coppice (asset reference WHA225);
- Streethay House Farm (asset reference WHA259) – temporary effect only; and
- Ravenshaw Wood (asset reference WHA222).

Summary of key changes in likely residual significant effects (operation)

5.4.9 The AP2 revised scheme will have two new significant effects compared to those reported in the main ES and SES.

5.4.10 During operation, an increased effect from minor adverse to major adverse at Big Lyntus (asset reference WHA221) will occur for the AP2 revised scheme compared to the SES. This is a new significant effect.

5.4.11 There will also be increased effect on Willow Cottage (asset reference WHA064) which was previously reported as unaffected during operation in the main ES but will now result in a moderate adverse significant effect.

5.5 Ecology

5.5.1 Realignment of the scheme has resulted in the need to consider, within the assessment, ecological resources that were not affected by the original scheme, such as Big Lyntus Wood. In addition, the AP2 revised scheme has altered the impacts and resultant effects upon some ecological resources. For example, the reduction in the loss of ancient woodland within Ravenshaw Wood reduced effects.

5.5.2 In Ravenshaw Wood, Black Slough and the Slaish, the original scheme includes the provision of a physical barrier to address the impacts of habitat loss and severance on bat populations in the area. This would be erected at the top of the embankment slopes on both sides of the route between the Trent and Mersey Canal viaducts and the Kings Bromley Footpath 0.392 underpass, to force bats up and over the route and reduce the risk of collision with trains. Due to the realignment of the AP2 revised scheme and the reduced severance and fragmentation impacts on woodland within Ravenshaw Wood, Black Slough and the Slaish, this mitigation measure is no longer required to maintain the favourable conservation status of the local bat populations and therefore has been removed from the AP2 revised scheme.

5.5.3 The main ES reported approximately 5.4ha of ancient woodland would be lost within Ravenshaw Wood, John's Gorse and Hanch Wood, and Vicar's Coppice. The SES

scheme will result in the loss of an additional 0.43ha of ancient woodland from Fulfen Wood and 0.05 ha from Little Lyntus due to a change in the status of these woodlands, therefore affecting approximately 5.9ha of ancient woodland. Approximately 81.6ha of woodland planting would be provided as part of the original and SES scheme, including approximately 20.1 ha for ecological compensation and 61.5 ha of landscape planting.

5.5.4 The AP2 ES reports approximately 8.5ha of ancient woodland will be lost as a result of the AP2 revised scheme. This loss will be from Fulfen Wood, Big Lyntus, Little Lyntus, Ravenshaw Wood, Vicar's Coppice, John's Gorse and Hanch Wood. This is an increase in the loss of ancient woodland of approximately 2.6ha compared to the SES scheme. There is a reduction in the loss of ancient woodland from Ravenshaw Wood as a result of the AP2 revised scheme and there is no longer any effect upon ancient woodland within the Slaish.

5.5.5 Over 90ha of woodland will be planted in the AP2 revised scheme to support existing habitat throughout this CFA; 31.2ha for ecological compensation and 59.6ha as landscape planting. Due to the amount of woodland provided as compensatory habitat, particularly in the north of the area, the main ES reported a permanent beneficial effect on the conservation status of woodland habitat. The AP2 revised scheme retains this beneficial effect.

5.5.6 The SES scheme will result in impacts on the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) including:

- the loss of eight confirmed tree roosts which surveys have now shown to be used by common pipistrelle, Daubenton's bat, Natterer's bat, and brown long-eared bat;
- disturbance of bats using confirmed tree roosts within the retained part of Ravenshaw Wood, on the edge of the woodland at Woodend Lock (south-east of) SBI and confirmed building roosts at Wood End Lock Cottage and Black Slough Farm; and
- the loss and severance of Ravenshaw Wood reported in the main ES in particular would impact core areas now known to be used for foraging for whiskered/Brandt's bat, Natterer's bat and brown long-eared bat and other foraging areas used by noctule bat, Daubenton's bat and soprano pipistrelle.

5.5.7 The combination of these impacts will have an adverse effect on the conservation status of the assemblage that will be significant at a regional level.

5.5.8 The AP2 revised scheme will result in the loss of the same number of tree roosts as the SES scheme although some of these will be different roosts, six from Ravenshaw Wood and Black Slough and two from Woodend Lock (south-east of) SBI. There will also still be disturbance of retained roosts within Ravenshaw Wood and Woodend Lock Cottage. However, the AP2 revised scheme will result in a reduction in the loss of key foraging and commuting habitat around Ravenshaw Wood, Black Slough and the Slaish, used by the bat assemblage as well as reduction in the loss of trees with high and moderate potential to be used by roosting bats and the effects on the assemblage can be mitigated to a level which makes them not significant.

5.5.9 There is an adverse effect on a Daubenton's bat roost within the Curborough Brook culvert as the AP2 revised scheme may result in abandonment of a potential swarming site and this roosting habitat cannot be readily recreated elsewhere. This is a new residual effect which was not reported in the main ES for the original scheme. This assessment is precautionary. Further work to establish the status of the roost will be carried out as part of ongoing survey work to be undertaken prior to construction.

Summary of key changes in likely residual significant effects (construction)

5.5.10 The main changes between the likely key residual significant effects reported in the main ES in comparison with the AP2 revised scheme are summarised below:

- overall the SES scheme would result in the loss of 5.9ha of ancient woodland; the AP2 revised scheme results in the loss of 8.5ha of ancient woodland, including loss within Big Lyntus wood which was not affected by the original scheme and the losses at Fulfen Wood and Little Lyntus, which are likely to be added to the ancient woodland inventory;
- ancient woodland within Ravenshaw Wood that was affected by the original scheme would continue to experience a significant effect from the AP2 revised scheme, although the amount of ancient woodland loss is reduced; and
- loss of a Daubenton's bat population roosting within Curborough Brook culvert.

Summary of key changes in likely residual significant effects (operation)

5.5.11 The AP2 revised scheme will result in a reduction in the loss of key foraging and commuting habitat around Ravenshaw Wood, Black Slough and the Slaish used by the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood). This will reduce the extent to which bats will be at risk of collision with trains and mitigation will reduce these effects to a level which is not significant. A physical barrier to address the impacts of habitat loss and severance on this bat assemblage is no longer required to maintain the favourable conservation status of the local bat populations and has therefore has been removed from the AP2 revised scheme.

5.6 Land quality

5.6.1 The main ES reported that construction and operation of the scheme in this area was not likely to result in any adverse residual effects on land quality. Similarly, the AP2 ES reports that construction and operation of the scheme in this area is not likely to result in any adverse residual effects on land quality, with implementation of the CoCP. The residual effects on land quality reported in the main ES therefore remain unchanged.

5.7 Landscape and visual assessment

5.7.1 The lowering of the HS2 route within the local landscape between Whittington and Fradley will result in a change in effects reported in the landscape and visual assessment from the main ES.

5.7.2 The majority of the original scheme would be elevated above the local landscape, crossing low-lying land south east of Lichfield on tall embankments and the WCML, SSL and A38/Rykneld Street on viaducts, whilst the Manchester spur would cross the Trent and Mersey canal on a viaduct, with the Handsacre link crossing in two locations, one in parallel with the Manchester spur.

5.7.3 The lowering of the AP2 revised scheme avoids the use of tall embankments and viaducts south and east of Lichfield, instead passing beneath the WCML, SSL and A38/ Rykneld Street and diverging the Handsacre link from the Manchester spur in Fradley to pass west of the Trent and Mersey canal at ground level. The design differences between the original scheme and the AP2 revised scheme result in changes to construction and operational effects on both landscape character areas (LCAs) and representative viewpoints.

5.7.4 The main ES reported that construction would result in temporary effects on the existing landform, field pattern and vegetation cover which would significantly affect the character and appearance of the local landscape, and would also affect views from representative viewpoints along the length of the route.

5.7.5 The AP2 ES reports that some temporary construction effects on landscape character will be lessened due to the reduction in the number of construction compounds - from 19 in the original scheme to 16 in the AP2 revised scheme - and also due to the avoidance of the need for construction sidings at Streethay, between the A38/ Rykneld Street and the SSL. The sidings would have occupied an area for at least seven years (one year of construction, four years six months in use, one further year as a stockpile, and six months to decommission).

5.7.6 The AP2 ES reports that the type and duration of temporary construction effects on some viewpoints will alter due to the general lowering of the route. Construction effects on some viewpoints at Streethay will be reduced due to the use of cuttings and underbridges between the WCML and north of the A38/ Rykneld Street, combined with the absence of Streethay rail construction sidings and the use of fewer construction compounds. These viewpoints will include those from Streethay Wharf (354.6.003), Hilliard's Cross Bridge (356.4.004) and Bear's Hay Farm (356.2.008).

5.7.7 The AP2 ES also reports increases in temporary significant construction effects on some viewpoints west of the Curborough Brook dive-under, and west of the realigned Handsacre link, due to the increased proximity and visibility of the AP2 revised scheme from these viewpoints. These viewpoints will include Highfields Bungalow (357.2.001), Black Slough Farm (362.2.001) and Birch Ridings (362.2.003).

5.7.8 The main ES also reported that operation would result in significant effects on local landscape character and on representative viewpoints, although the growth and maturing of mitigation planting would substantially reduce these landscape and visual effects over time. Some residual significant visual effects would occur where the visibility of taller engineered landforms, prominent viaducts, infrastructure and overhead line equipment would remain beyond operational year 15.

5.7.9 The AP2 ES reports similar effects on landscape character for operation as reported in the main ES, as the general lowering of the route will not result in changes to the significance of effects on LCAs due to the geographical extent of these areas across the local landscape.

5.7.10 However, for viewpoints, the AP2 ES reports that there will be substantially fewer significant operational effects as the height of engineered landforms, infrastructure and overhead line equipment will be near to ground level or within cuttings, with a corresponding reduction in the need for viaducts from nine to four. The viaducts and associated embankments will be lower in the AP2 revised scheme than reported in the main ES (for example, Capper's Lane viaduct and Fulfen Wood south embankment which will be approximately 5m in height instead of 15m). Similarly, the AP2 revised scheme will reduce the number of viaducts crossing the Trent and Mersey Canal, as there will only be one viaduct for the Manchester spur with the Handsacre link, at ground level west of the canal.

Summary of key changes in likely temporary significant effects (construction)

Landscape

5.7.11 The main ES reported that the construction of the original scheme would have temporary significant effects on the Sandstone Estatelands, Settled Farmlands and Settled Heathlands landscape character areas. The AP2 ES reports that there will be no new or different effects for landscape character as a result of the revised scheme.

Viewpoints

5.7.12 The main ES reported that the construction of the original scheme would have temporary significant effects on many of the viewpoints; however, the AP2 ES reports that there will be some reductions in temporary significant effects on the following viewpoints:

- Viewpoint 354.6.003: north-west from Streethay Wharf on the Coventry Canal, adjacent to the A38 - would be moderate adverse (main ES) and will be minor adverse (non-significant) (AP2 revised scheme);
- Viewpoint 356.4.004: south-west from Hilliard's Cross bridge (A38 flyover) - would be major adverse (main ES) and will be minor adverse (non-significant) (AP2);
- Viewpoint 356.2.008: west from Bear's Hay Farm, south of the Coventry Canal and the A38 - would be moderate adverse (main ES) and will be minor adverse (non-significant) (AP2); and
- Viewpoint 360.3.001: north east from the Trent and Mersey canal, close to Wood End Lock cottage - would be major adverse (main ES) and will be moderate adverse (AP2).

5.7.13 The AP2 ES also reports some increases in temporary significant construction effects on the following viewpoints:

- Viewpoint 357.2.001: north-east from Highfields Bungalow- would be moderate adverse (main ES) and will be major adverse (AP2);
- Viewpoint 362.2.001: north from Black Sough Farm, on Wood End Lane - would be moderate adverse (main ES) and will be major adverse (AP2);
- Viewpoint 362.2.003: east from residence (Birch Ridings) on Wood End Lane

near Vicar's Coppice - would be moderate adverse (main ES) and will be major adverse (AP2); and

- Viewpoint 362.3.002: north from PRoW Kings Bromley footpath 0.392, near Tomhay Wood - would be moderate adverse (main ES) and will be major adverse (AP2).

Summary of key changes in likely residual significant effects (operation)

Landscape

5.7.14 The main ES reported that the construction of the original scheme would have significant effects on the Sandstone Estatelands, Settled Farmlands and Settled Heathlands landscape character areas (LCAs). The AP2 ES reports that there will be no new or different effects for landscape character as a result of the AP2 revised scheme, as the general lowering of the route will not result in changes to the significance of the effects due to the geographical extent of these areas within the local landscape. The significant effects will reduce over time due to the growth and maturing of proposed mitigation planting.

Viewpoints

5.7.15 The main ES reported that the operation of the original scheme would have significant effects on viewpoints, whilst the AP2 ES reports a lessening in significant effects on many of these viewpoints. This will be due to the general lowering of the route between Whittingham and Fradley, though there will be an increase in effects on some viewpoints due to closer proximity to the realigned Handsacre link. For the majority of viewpoints, significant effects identified at operational year 1 will reduce over time, as the proposed mitigation planting matures and reaches its designed intention.

5.7.16 The AP2 revised scheme retains Hill Farm, Streethay and the route of the PRoW Streethay footpath 6 (353.3.007), which will then experience a moderate adverse effect in year 1.

5.7.17 In operational year 1, five viewpoints around Streethay and two viewpoints near the Trent and Mersey Canal will improve from major/moderate adverse non-significant (main ES) to minor adverse/negligible (non-significant) (AP2 revised scheme). In year 15, a total of 16 significant effects on viewpoints reported in the main ES will no longer be significant for the AP2 revised scheme: four in the Whittington area; six in the Streethay area, and six in the Fradley, Curborough and Hanch area. Three changed significant view effects will occur in the Fradley, Curborough and Hanch areas as a result of the AP2 revised scheme moving the Handsacre link westwards compared to the original scheme.

5.7.18 In comparison with the main ES, the AP2 ES reduces adverse effects in year 1 of operation at seven viewpoints. For year 15 of operation, there will be a reduction in adverse effects at 16 viewpoints.

5.7.19 However, there will be an increase in adverse effects due to the AP2 revised scheme in year 1 of operation for one viewpoint, and an increase in such effects in year 15 of operation for 8 viewpoints.

5.7.20 Viewpoint 358.2.003: View south-west from Gorse Farm, Gorse Lane major adverse effect year 1 of operation will experience a change in year 1 from minor adverse/negligible (non-significant) (main ES) to major/moderate adverse (significant) (AP2 revised scheme):

5.7.21 The following viewpoints will experience a change in year 15 from minor adverse/negligible (non-significant) (main ES) to moderate adverse (significant) (AP2 revised scheme):

- Viewpoint 357.2.001: View north-east from Highfields Bungalow;
- Viewpoint 358.2.003: View south-west from Gorse Farm, Gorse Lane;
- Viewpoint 358.3.001: View south-west from the PRoW Alrewas Footpath 0.256 near Fradley Wood;
- Viewpoint 359.3.002: View south-west from the PRoW Alrewas Footpath 44 at its junction with Alrewas Footpath 0.252 and 0.256, near Fradley Junction;
- Viewpoint 360.4.006: View north and north-east from Wood End Lane near Ravenshaw Wood;
- Viewpoint 362.3.001: View north from Black Slough Farm on Wood End Lane;
- Viewpoint 362.2.003: View east from residential property (Birch Ridings) on Wood End Lane near Vicar's Coppice; and
- Viewpoint 362.3.002: View north from the PRoW Kings Bromley Footpath 0.392, near Tomhay Wood.

5.7.22 The following viewpoints will experience a change in year 1 from major/moderate adverse (significant) (main ES) to minor adverse/negligible (non-significant):

- Viewpoint 354.2.001: View west from Streethay Farm adjacent to the A38, Streethay;
- Viewpoint 354.3.006: View west from King's Orchard Marina, adjacent to the Coventry Canal;
- Viewpoint 360.3.001: View north-east from the Trent and Mersey Canal, close to Wood End Lock Cottage;
- Viewpoint 353.2.008: View east from residences along Burton Old Road, Streethay;
- Viewpoint 354.6.003: View north-west from Streethay Wharf on the Coventry Canal south of the A38;
- Viewpoint 356.4.004: View south-west from Hilliard's Cross bridge (A38 flyover); and
- Viewpoint 363.2.001: View south east from Wood End Common Barn.

5.7.23 The following viewpoints will experience a change in year 15 from major/moderate adverse (significant) (main ES) to minor adverse/negligible (non-significant) (AP2 revised scheme)

- Viewpoint 349.2.004: View north-east from Marsh Farm;
- Viewpoint 350.2.002: View west from Huddlesford House (and farm), Huddlesford Lane;
- Viewpoint 350.3.005: View north-west from PRoW Whittington footpath 8 between Capper's Lane and Darnford Lane;
- Viewpoint 350.4.006: View north-west from Darnford Lane near Ellfield Nurseries;
- Viewpoint 350.3.007: View north-west from PRoW Whittington Footpath 7, at Capper's Lane;
- Viewpoint 351.2.001: View east/north-east from Fulfen Farm located between the A38 and Capper's Lane;
- Viewpoint 351.2.002: View north-east from Fulfen Cottages on Capper's Lane;
- Viewpoint 351.4.004: View south-east from the A38 near crossing with WCML;
- Viewpoint 352.2.002: View north-west from Huddlesford junction near canalside residential property;
- Viewpoint 353.3.001: View north-east from the PRoW (junction between Footpath references Streethay 3 and Streethay 2) near Streethay House Farm;
- Viewpoint 354.2.001: View west from Streethay Farm adjacent to the A38, Streethay;
- Viewpoint 354.3.006: View west from King's Orchard Marina, adjacent to the Coventry Canal;
- Viewpoint 354.6.003: View north-west from Streethay Wharf on the Coventry Canal south of the A38;
- Viewpoint 355.3.003: View east from the PRoW Streethay Footpath 7, to the east of Curborough House;
- Viewpoint 356.2.007: View west from Orchard Farm (situated to the north of the A38); and
- Viewpoint 360.3.001: View north-east from the Trent and Mersey Canal, close to Wood End Lock Cottage.

5.8 Socio-economics

5.8.1 The main ES reported that the original scheme in this area would result in a direct impact on three business accommodation units within the area: the Whittington Heath Golf Club, airfield buildings near Streethay and an entertainment business (the Delta Force Paintball facility) at Ravenshaw Wood. However, from an employment

perspective, no significant adverse residual socio-economic effects were reported in the main ES with regards to construction and operation of the original scheme. Similarly, the AP2 ES reports that construction and operation of the AP2 revised scheme in this area is not likely to result in any significant adverse residual effects on socio-economic conditions. The residual effects reported in the main ES therefore remain unchanged.

5.8.2 As a consequence of the AP2 revised scheme, land requirements for HS2 temporary sidings and land needed for the HS2 alignment will no longer be required, and therefore the airfield buildings near Streethay and the entertainment business (paintball facility) at Ravenshaw Wood will be retained. It is therefore considered that the effects of the original scheme on these units as reported in the main ES (Volume 2, CFA Report 22, Section 10) are removed and these resources are no longer considered to be directly impacted.

5.8.3 In the main ES, it was estimated that land required for the construction of the original scheme would result in the displacement or possible loss of approximately 50 jobs within this area. In comparison, it is estimated that the AP2 revised scheme would result in the displacement or possible loss of approximately 20 jobs within this area. Overall, therefore, it is considered that the AP2 revised scheme would result in the net retention of 30 jobs compared to the original scheme.

5.9 Sound, noise and vibration

5.9.1 The lowering of the scheme by approximately 20m and the lowered embankments, as well as moving the alignment westwards, requires the demolition of two residential properties, a reduction of five from those required for the original scheme. The dwellings that will now remain as a result of the AP2 revised scheme have been included in both the construction and operational assessment; at Hill Farm, east of the A38 in Streethay; and around The Manor, Burton Road, north-east of Streethay. In addition there are also changes to the levels of construction traffic when compared to the original scheme.

Summary of key changes in likely residual significant effects (construction)

5.9.2 The main ES did not identify any dwellings in the area which are forecast to experience noise levels higher than the noise insulation trigger levels as defined in the draft Code of Construction Practice (CoCP) or any receptor or community in which the adverse effects identified were considered to be significant.

5.9.3 As a result of the AP2 amendments, one residential building on Broad Lane has been estimated as likely to qualify for noise insulation. The mitigation measures, including noise insulation, will reduce noise inside the dwelling such that it will not reach a level where it would significantly affect residents. With regard to noise outside dwellings the mitigation measures also reduce the effects of outdoor construction noise on the acoustic character around the local residential communities such that the adverse effects identified are not considered to be significant.

5.9.4 The assessment does not identify any new or different residual significant construction noise or vibration effects compared to the main ES.

Summary of key changes in likely residual significant effects (operation)

5.9.5 The main ES reports that the design of the project incorporates noise barriers in the form of landscape earthworks, noise fence barriers and 'low-level' barriers on viaducts to mitigate noise effects during operation.

5.9.6 Four dwellings - located at the Manor in Streethay, Streethay Farm on the Burton Road, Mill Farm at Lichfield and at Ravenshaw House at Curborough - were estimated to be likely to qualify for noise insulation. The SES reported a further dwelling, Streethay Wharf, that was also estimated as likely to qualify for noise insulation. 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.

5.9.7 In the main ES, operation of the railway was assessed as likely to result in increases in external noise that are considered significant when assessed on a community basis for residential areas around the south of Handsacre closest to the WCML and at Whittington in the vicinity of Darnford Lane, Marsh Lane and Lichfield Road.

5.9.8 The AP2 revised scheme is lowered in the landscape throughout the CFA by up to 20m with a series of cuttings and low embankments instead of the embankments and viaducts that would have occurred in this area. The design still incorporates landscape earthworks, noise fence barriers and 'low-level' barriers on viaducts to reduce operational noise.

5.9.9 As a result of the AP2 amendments, the number of properties estimated as likely to qualify for noise insulation has reduced to two: Mill Farm, Lichfield, and Streethay Wharf, Streethay. 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.

5.9.10 The AP2 amendments have resulted in a general reduction in operational noise around Streethay. The mitigation included in the amendments has avoided any new operational noise significant effects in this CFA.

5.9.11 The residual significant effects identified in the main ES (as amended by the SES) in the residential areas around the south of Handsacre, closest to the WCML and at Whittington in the vicinity of Darnford Lane, Marsh Lane and Lichfield Road remain unaltered by the AP2 amendments.

5.10 Traffic and transport

5.10.1 The AP2 changes in the vertical and horizontal alignment of the route lead to changes to levels of construction traffic and in particular the amount of excavated material arising both in this CFA and from other CFAs compared to the original scheme. The location of compounds, their access to the highway network and construction lorry routes have also changed. In particular:

- the Streethay construction sidings, part of the original scheme, are no longer required in the AP2 revised scheme and vehicles transporting material for earthworks reduces from 1,550 heavy good vehicles (HGVs) per day with the original scheme to 400 per day with the AP2 revised scheme;

- the roadheads at Nanscawen Road and Wood End Lane generated 1,500 HGVs per day with the original scheme and this reduces to 730 HGVs per day with the AP2 revised scheme;
- all the satellite compounds east of A38 – except Lichfield Road underbridge and Darnford Lane overbridge satellite compounds, which access via the A51 – are accessed from haul routes through the Capper's Lane main compound, avoiding the use of the local roads as far as possible. There will be limited construction traffic along Capper's Lane, to the east of the main compound, and on Broad Lane; and
- the volume of traffic on the A5192, Capper's Lane and A5127 Burton Road is now assessed to be limited to construction traffic accessing the A38 overbridge north-west and north-east compounds located north of Streethay adjacent to the A5127 Burton Road/A38 junction.

5.10.2 In addition to the roads referred to above, there will be reduced traffic flows on the A38 between the A5206 junction and Wood End Lane and on Wood End Lane. HGV two-way traffic flows on the A38 and Wood End Lane amounted to 1,700 per day with the original scheme, but reduce to 1,000 per day with the AP2 revised scheme.

Summary of key changes in likely residual significant effects (construction)

5.10.3 In summary, compared with the original scheme, changes in the residual significant effects in relation to construction traffic-related severance for non-motorised users during construction are as below:

- the major adverse significant effects reported for the original scheme on Broad Lane no longer apply with the AP2 revised scheme;
- the major adverse significant effects reported for the original scheme on Capper's Lane no longer apply with the AP2 revised scheme, except for the section east of the A38 slip road to the Capper's Lane main compound, a distance of 150m; and
- The moderate adverse significant effect reported for the original scheme on the A5192 Capper's Lane, west of the A38, no longer applies with the AP2 revised scheme.

5.10.4 There is a new minor adverse significant effect on journey ambience, due to non-motorised users having to use Alrewas Footpath 31 adjacent to construction traffic.

5.10.5 In relation to Streethay Footpath 6, this was partly closed during construction with the original scheme but with the AP2 revised scheme it remains open. There is a minor adverse significant effect on journey ambience with the AP2 revised scheme, as construction vehicles will operate alongside the footpath which remains the same as for the original scheme.

Summary of key changes in likely residual significant effects (operation)

5.10.6 In summary, compared with the original scheme, the residual significant effects during operation relate to the following:

- the realignment of Netherstowe Lane results in a moderate adverse significant effect due to increases in distance travelled by road users, although these are expected to be very low as Netherstowe Lane is a narrow single-lane road with passing places, and a minor adverse significant effect due to increased journey times and delays for non-motorised users; and
- Shaw Lane south of Tuppenhurst Lane is closed in both the original scheme and the AP2 revised scheme. With the original scheme, the alternative route led to a 4.5km increase in distance, but this is reduced to 2.2km in the AP2 revised scheme by using the Tuppenhurst Lane extension diversion route. In both the original and AP2 revised schemes, the closure of Shaw Lane results in a minor adverse significant effect.

5.11 Water resources and flood risk

5.11.1 The main ES reported that construction and operation of the original scheme in this area was not likely to result in any adverse residual effects on surface water, groundwater or flood risk. Similarly, the AP2 ES reports that construction and operation of the AP2 revised scheme in this area is not likely to result in any adverse residual effects on surface water, groundwater or flood risk.

5.11.2 The main difference and benefit between implementing the AP2 revised scheme as compared with the original scheme is that the AP2 revised scheme removes the need to cross the Trent and Mersey Canal twice near Fradley Wood. The diversion of the Mare Brook to pass through the Mare Brook South Culvert and its tributary to pass though the Mare Brook North Culvert will require watercourse diversions which will add approximately 300m of channel length and provide the opportunity for ecological and hydromorphological enhancement.

Part 2B: Additional Provision 2 Replacement Environmental Statement

Introduction

Part 2B provides a new assessment of all the amendments, as well as other design changes following stakeholder engagement and design refinement since the main ES, and replaces the assessment provided in Volume 2, CFA22 of the main ES. Collectively, these are described as the 'Lichfield area amendments' and are shown in the CFA22 Map Book as reference AP2-022-001. The main local alternatives that have been considered are described, where relevant.

6 Overview of the area and description of the AP2 revised scheme

6.1 Overview of the area

6.1.1 The Whittington to Handsacre CFA covers approximately 11.5km of the scheme in the district of Lichfield in Staffordshire, where it passes approximately 1km to the east of Lichfield to connect with the WCML at Handsacre. The area extends from the parish of Whittington in the south, near Defence Medical Services Whittington (Whittington Barracks), through Streethay, Fradley and Kings Bromley, to its northern boundary at Handsacre. The area includes all or part of the parishes of Whittington, Lichfield, Fradley and Streethay, Curborough and Elmhurst, Kings Bromley, Longdon, and Armitage with Handsacre.

6.1.2 The area is the northernmost section of the scheme (see Volume 4 for 'off-route' works on the WCML between Lichfield and Colwich). The northern extent includes the WCML between A515 Lichfield Road and B5013 Lichfield Road in Handsacre and, consequently, modifications to the WCML railway in this area. The southern boundary is defined as the A51 Tamworth Road, at Whittington Heath. For the purposes of this SES and the AP2 ES, properties fronting the A51 north of the junction with Jerry's Lane and Common Lane at Whittington Heath are assessed within this area rather than the Drayton Bassett, Hints and Weeford area (CFA21), which lies to the south as shown in Figure 1.

Settlement, land use and topography

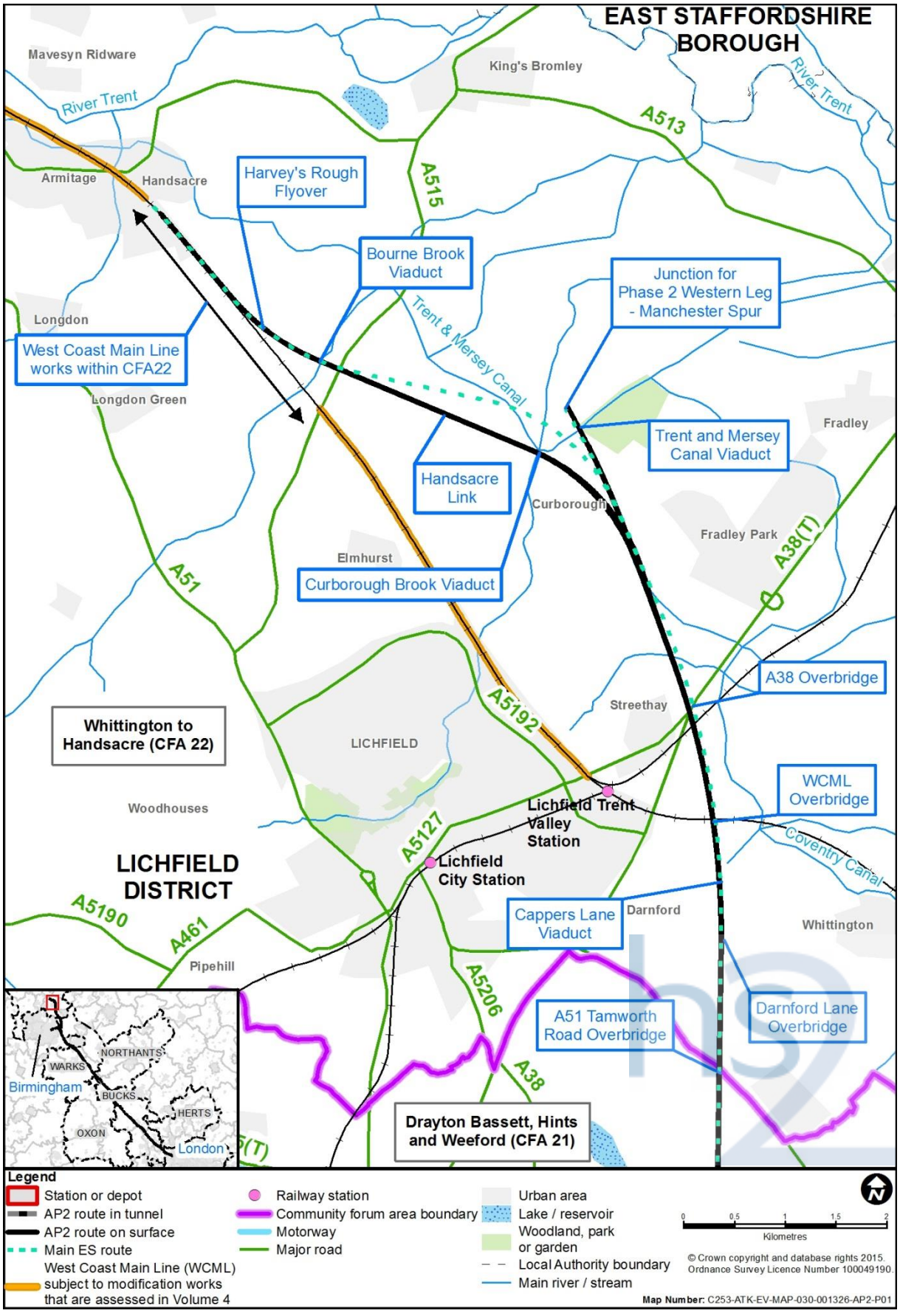
6.1.3 The Whittington to Handsacre area is predominantly rural in character, with the exception of Fradley Park, a substantial business park, and the town of Handsacre. Agriculture is the main land use; mostly arable on the drier ground of the southern part of the area, with more grazing on the wetter ground in the northern part of the area. Within this pattern there are smaller pockets of land associated with horse

grazing, market gardening and farming practices involving extensive use of polytunnels[3]. The agricultural land is interspersed with small villages, hamlets and isolated properties, but is also close to several larger settlements (see Maps CT-10-61b to CT-10-65, SES and AP2 ES Volume 2, CFA22 Map Book).

6.1.4 The landform between Whittington and Handsacre is broadly defined by the raised heath plateau at Whittington sloping north-westwards down towards Streethay and skirting the wide valley of the River Trent. In the valley, the river terraces create gentle and shallow slopes around the eastern edge of Lichfield that are characterised by some small pockets of steeper slopes around other brooks and streams. Away from the valley, the north-western fringes of Lichfield begin to rise to meet the high ground of Cannock Chase, away to the west.

[3] A polytunnel is a large tunnel made of polythene and used as a greenhouse. Collins English Dictionary. Complete & Unabridged 10th Edition. 2009 © William Collins Sons & Co. Ltd.

Figure 1: Area context map



Key transport infrastructure

6.1.5 The A38 connects Birmingham and Sutton Coldfield in the south to Lichfield and Fradley, before continuing north to Burton on Trent and Derby. The A515 links Lichfield with Kings Bromley, acting as a main route through the countryside west of Alrewas and Burton on Trent. The A51 runs west from Tamworth along the southern edge of the area to Lichfield and then continues north-west to Rugeley and along the Trent valley. Wood End Lane provides a link between the A38 and the A515, serving the business park at Fradley. The WCML runs north-west past Lichfield, through Handsacre, and continues along the Trent valley. The South Staffordshire Line (SSL) runs north-east through Lichfield and connects with the WCML railway to the east of the city before continuing on past Fradley and Alrewas. All of these road and rail routes will be crossed by the AP2 revised scheme.

6.1.6 There is a well-developed network of Public Rights of Way (PRoW) in the area, although there are no promoted recreational routes. There are also towpaths along the Coventry Canal and the Trent and Mersey Canal. The Coventry Canal passes through Whittington and Huddlesford, past King's Orchard Marina and Lichfield Wharf, to the east of Streethay and past Fradley to join the Trent and Mersey Canal at Fradley Junction. At its nearest point, the towpath would be within 100m of the construction works and would come within 180m of the route. The Trent and Mersey Canal passes through Fradley Junction and swings north-west near Wood End Lane at Fradley, passing Kings Bromley Marina and the north-east edge of Handsacre. The Manchester spur will cross the Trent and Mersey Canal near its bend north of Wood End Lane; the link to the WCML at Handsacre would pass to the south of the canal.

6.1.7 The Sustrans National Cycle Network Route No. 54 passes through the area. The route connects Lichfield with Fradley and Alrewas to the north, and runs along the existing highways of Netherstowe Lane, east of Curborough, Wood End Lane and Gorse Lane at Fradley Park.

6.1.8 In total, the AP2 revised scheme will cross eight PRoW, plus the Trent and Mersey tow path and one on-road cycle route in this area.

Socio-economic profile

6.1.9 To provide a socio-economic context for the area, data for the demographic character areas (DCA) of Lichfield East and Whittington, Fradley and Armitage with Handsacre are used[4]. In total, the population of the DCAs is approximately 18,000. The area's labour market outperforms England's as a whole; unemployment is at a low of 4% in Fradley DCA and a high of approximately 6% in Armitage with Handsacre DCA, which is lower than the national level of approximately 7%[5].

Notable community facilities

6.1.10 Of the communities that lie closest to the route, Whittington and Handsacre have the greatest range of facilities and local services. Whittington, in the southern part of the area, has shops that meet day-to-day needs, including a pharmacy, a post office, a

[4] A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).
[5] All data comes from the 2011 Census.

convenience food store, a coffee shop, hairdresser and an estate agent. There is also a primary school, a branch GP surgery, a church, a hospice and a number of community halls in the village. The village is the centre of the catchment for some facilities, notably the primary school, which includes the southern part of the area as well as the Hints and Weeford communities, which fall within the adjoining Drayton Bassett, Hints and Weeford area to the south (see CFA21).

6.1.11 Also in the south, a small community has established around Whittington Barracks, a Ministry of Defence establishment. There is a children's day care nursery at the Barracks, which is a public facility. Family living accommodation extends around the eastern side of the Barracks. There are also playing fields to the north and east of the Barracks, which at present are used regularly by a local football club. The Whittington Arms public house is situated on the south side of the A51 Tamworth Road to the west of the barracks, whilst the Whittington Heath Golf Club lies on the north side of the road.

6.1.12 The small village of Huddlesford has a public house beside the Coventry Canal but no other community facilities. The AP2 revised scheme crosses Capper's Lane at the Lichfield Cruising Club, which is based at Huddlesford and has moorings along both the Coventry Canal and the remaining section of the Wyrley and Essington Canal at Capper's Lane Bridge.

6.1.13 Lichfield is the main centre for many of the communities within the area, with a wide range of commercial and public facilities. With the exception of the Handsacre and Kings Bromley communities, all of the villages in the area fall within the catchment for secondary schools at Lichfield. Streethay lies just north-east of Lichfield and has a public house and local shop. Fradley Park lies to the north of Streethay; the AP2 revised scheme will pass between Streethay and the business park.

6.1.14 There are a number of attractions and recreational facilities in the area, including the visitor centre and public house on the Trent and Mersey Canal at Fradley Junction and the craft and antiques centre at Curborough.

6.1.15 Handsacre, in the north of the area, merges with the adjoining settlement of Armitage and has a small number of shops, including a baker, butcher, pharmacy, newsagent and a greengrocer/convenience store. There is a primary school on the southern edge of Handsacre and a child care day nursery. Armitage with Handsacre also has community halls, churches, open spaces and public houses, as well as a local police station and a GP surgery.

Recreation, leisure and open space

6.1.16 Whittington Heath Golf Club is just north of the A51 Tamworth Road in the south of the area. There is a visitor centre on the Trent and Mersey Canal at Fradley Junction, Midland Karting is on Wood End Lane near Gorse Lane, the Curborough Motor Racing Sprint Course is on Netherstowe Lane, and further north along Wood End Lane are the Dragonara Miniature Horse Stud and the Delta Force Paintball facility, which uses land at Vicar's Coppice.

6.1.17 To the east of Streethay and the A38 there is an equestrian centre at Streethay Farm, which offers riding lessons to the general public. Land adjacent to the equestrian

centre is used as an airfield for recreational flying and a number of aircraft are based at the site. The runways lie directly north-east of the route of the AP2 revised scheme.

6.1.18 Boat mooring facilities are available at various locations on the canals in the area. The Coventry Canal is served by moorings at Huddlesford, on the nearby Wyrley and Essington branch, at the recently opened King's Orchard Marina (consent for 130 berths), at Streethay Wharf (65 berths, plus boat hire, boat building and maintenance) and near Fradley Junction. The Trent and Mersey Canal is served by moorings at and near Fradley Junction, either side of Wood End Lock and at the Kings Bromley Marina, (approximately 275 berths). The AP2 revised scheme will be close to berths at the first five locations and within 500m of berths at the Kings Bromley Marina. There is also a static caravan site, Kingfisher Holiday Park, adjacent to Fradley Junction.

Policy and planning context

Planning framework

6.1.19 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 AP2 revised scheme in the local context, relevant local plan documents and policies have been considered in relation to environmental topics.

6.1.20 There are a number of key planning designations in the area, which include green belt, conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens and ancient woodland. These are shown on the maps in SES and AP2 ES, Map Book CT-10-061b to CT-10-065.

6.1.21 The Lichfield District Local Plan Strategy 2008-2029 (which encompasses Lichfield District Council), was adopted on 17 February 2015[6].

Committed development

6.1.22 Developments with planning permission or sites allocated in adopted development plans, on or close to the AP2 revised scheme, are shown on SES and AP2 ES Map CT-13-061b to CT-13-065 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 are treated as potential receptors from the AP2 revised scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic. The following developments are relevant to several topic assessments in this area:

- ref: 12/00746/OUTMEI – Land North of Burton Road and Northeast of the WCML, Streethay, Lichfield, Staffordshire. Demolition of three curtilage Listed buildings associated with Streethay House Farm and construction of a sustainable mixed-use urban extension, comprising of up to 750 dwellings; a primary school; mixed-use community hub/local centre to include retail development, community buildings, care home; comprehensive green infrastructure, including footpaths, cycleways, open space, children's play

[6] Lichfield District Council (2012), Lichfield District Local Plan Our Strategy July 2012 (Proposed Submission) and Schedule of Proposed Modifications to the Local Plan: Strategy Proposed Submission March 2013, adopted 17 February 2015.

areas, and sustainable urban drainage systems, foul and surface water drainage infrastructure including attenuation ponds, car parking up to a maximum 75 parking spaces; and other ancillary infrastructure and ground remodelling. All matters reserved except for points of access, which includes two points of access from Burton Road;

- ref: 14/00056/COU – Hill Farm, Ash Tree Lane, Lichfield, Staffordshire WS13 8ND. Change of Use of traditional constructed barns to form 2 two-bedroom dwellings with associated works;
- ref: 14/00875/FULM – Roxane UK Limited, Hanger 5, Fradley Airfield, Wood End Lane, Fradley, Lichfield, Staffordshire WS13 8EL. Erection of storage building and new canopies for storage, creation of new parking area and access way, forklift service workshop and associated works;
- ref: 14/00898/FULM – Land at Gorse Lane, Fradley, Lichfield, Staffordshire. Provision of a landscaped balancing pond;
- ref: 14/00974/FUL – Land to the east of the A38 and north of the WCML, Lichfield, Staffordshire. Construction of temporary haul road required to facilitate the delivery of construction materials to Lichfield Park;
- ref: 13/00162/FULM – UK Pallet Express Delivery, Fradley Business Centre, Wood End Lane, Fradley, Lichfield, Staffordshire WS13 8NF. Demolition of existing Auction Centre and erection of new warehouse, covered loading area, ancillary office building and associated yard and car parking;
- ref: 10/01498/OUTMEI – Land at Fradley Park, Halifax Avenue, Fradley, Lichfield, Staffordshire. Demolition of existing buildings and redevelopment of the site to provide up to 750 new homes, primary school, health centre, nursery, public house, public and private open space, car and cycle parking together with landscaping and associated servicing (all matters reserved except points of access);
- ref: 11/01305/FULM – Hanger 5, Fradley Airfield, Wood End Lane, Fradley, Lichfield, Staffordshire WS13 8EL. Alterations and extensions to existing industrial unit to form a water-bottling plant facility and associated works and ref: 12/00418/FUL – Hanger 5, Fradley Airfield, Wood End Lane, Fradley, Lichfield, Staffordshire WS13 8EL. Extension to water-bottling facility;
- ref: 12/00747/LBC - Streethay House Farm, Burton Road, Streethay, Lichfield, Staffordshire, WS13 8LT. Demolition of three curtilage Listed buildings associated with the Grade II Listed Streethay House Farm;
- ref: Allocation: Policy Lichfield 5: East of Lichfield (Streethay), Lichfield District LP Strategy, East of Lichfield (north of Streethay). Allocated: 750 homes in Lichfield District; and
- ref: Allocation Policy Frad4: Fradley Housing, Lichfield District LP Strategy, Land At Fradley Park, Halifax Avenue, Fradley, Lichfield, Staffordshire Development will be focused on the former airfield, utilising current brownfield land, along with further housing development accommodated on

land to the north of the Coventry Canal and on land north of Hay End Lane and west of Old Hall Lane. Planning ref 14/00516/OUTMEI -- Allocated: 1000 homes and associated transport, social and green infrastructure. Application 10/01498/OUTMEI for 750 homes (CFA22/P/10) granted 24th October 2013.

6.1.23 Where such developments lie wholly or partly within the land required for the AP2 revised scheme, it is assumed that these will not be commenced or completed in their proposed form. These are noted in SES and AP2 ES, Volume 5: Appendix CT-004-000 and referred to in the relevant topic sections.

6.1.24 Planning applications yet to be determined and sites that are proposed allocations in development plans that have yet to be adopted, on or close to the AP2 revised scheme, are termed 'proposed developments'. These are listed in SES and AP2 ES, Volume 5: Appendix CT-004-000. They are not included in the assessment. The progress of these proposals is being monitored by HS2 Ltd and appropriate action will be taken if they are approved.

Phase Two

6.1.25 Within this area, the junction and a short length of the route for the western leg of the Phase Two route (Manchester spur) form part of the AP2 revised scheme.

6.1.26 Whilst the detail of design and construction for Phase Two has not been developed, it is anticipated that, if Phase Two proceeds, then construction is likely to start in 2023 or 2024 and would continue for up to nine years, although works in this area would not necessarily be carried out for that entire period. The Phase Two works may therefore overlap with the commissioning period of Phase One. Any effects from construction of Phase Two on receptors in this area would be described in the Phase Two ES.

6.2 Description of the AP2 revised scheme

6.2.1 The following section describes the main features of the AP2 revised scheme in the Whittington to Handsacre area, including the main environmental mitigation measures. Further generic information on typical permanent features is provided in the main ES, Volume 1, Section 5. Similarly, a general description of the approach to mitigation is set out in the main ES, Volume 1, Section 9.

6.2.2 The AP2 revised scheme will require some land on a permanent basis, key features of which are illustrated on SES and AP2 ES, Volume 2: CFA22 Map Book, Maps CT-06-123b to CT-06-130a. Land that will also be required, but only on a temporary basis for construction, is set out in Section 5.3 and illustrated on SES and AP2 ES Volume 2: CFA22 Map Book, Maps CT-05-123b to CT-05-130a.

6.2.3 In general, features are described from south to north along the route (and east to west for features that cross the AP2 revised scheme).

Overview

6.2.4 The AP2 revised scheme through this area will be approximately 11.5km in length. From A51 Tamworth Road, the route initially crosses Whittington Heath Golf Club proceeding north over Lichfield Road, Whittington and then under the realigned Darnford Lane just to the east of Whittington Hill Farm. With Lichfield to the west, the route curves to the north-west passing over the realigned Wyrley and Essington Canal and beneath the realigned Capper's Lane and the WCML. The route then continues to the east of Streethay in cutting, passing under the SSL, the A38 and its slip roads.

6.2.5 The route passes to the west of Fradley Business Park, crossing over the realigned Mare Brook south, Alrewas footpath 31 and the realigned Wood End Lane. The proposed spur provided in Phase One for the Phase Two route (Manchester spur) commences alongside Fradley Park. The Manchester spur passes over the HS2 line from Handsacre (the Handsacre link); it then crosses over Wood End Lane, Alrewas Footpath 44 and the Trent and Mersey Canal. The construction of the spur will end just to the north of the Trent and Mersey Canal. The spur will include the junction off the Phase One line and a length of the Phase Two route towards the north-west sufficient to allow construction of Phase Two, without affecting the operation of Phase One.

6.2.6 The Handsacre link curves towards the west, passing close to the Trent and Mersey Canal, over Alrewas Footpath 44, the National Cycle Network Route 54 and Curborough Brook. It then passes under the realigned Wood End Lane. The route continues through Ravenshaw Wood and Black Slough Wood. As the route crosses over Kings Bromley Footpath 0.392, it curves back toward the north-west, crossing over the existing A515 Lichfield Road and Bourne Brook. The route will connect with the WCML to the south of Handsacre, where the existing WCML southbound tracks are realigned to the east.

6.2.7 See the main ES, Volume 1 for descriptions of typical features of the HS2 rail corridor, embankments and viaducts (Sections 5.2, 5.3 and 5.10 respectively).

A51 Tamworth Road to Capper's Lane

6.2.8 The AP2 revised scheme enters this area in a cutting approximately 7.5m deep under the A51 at Whittington Heath Golf Club. This section of the AP2 revised scheme will be in cutting or on embankment with underpasses for Whittington Footpath 16 and Lichfield Road and an overbridge for Darnford Lane, as the route starts to fall towards the Trent valley.

6.2.9 Key features of this section, which is approximately 2km long, will include (see SES and AP2 ES Volume 2: Maps CT-06-123b, F6 to CT-06-124, C6):

- an approximately 4km-long cutting (continued from Drayton Bassett, Hints and Weeford area (CFA21)) with a maximum depth of up to 15m (7.5m at the A51 Tamworth Road overbridge);
- an embankment for approximately 735m, reaching a maximum height of approximately 10m, with an underbridge for the Lichfield Road, which will remain on its existing alignment;
- a cutting for approximately 480m to a maximum depth of approximately 4m

crossed by the Darnford Lane overbridge, approximately 40m north of the existing road;

- an embankment approximately 230m long up to Capper's Lane viaduct, with a maximum height of 5m;
- Capper's Lane viaduct with a maximum height of 7m and 130m in length with noise barriers over the brook floodplain and the Wyrley and Essington Canal realignment; and
- a short embankment approximately 90m in length and a height of 6m.

6.2.10 Landscape earthworks with landscape mitigation planting will be provided from Lichfield Road to Capper's Lane viaduct. Other mitigation measures for this area include two areas of flood compensation regrading, to the east and west of Capper's Lane viaduct.

6.2.11 Whittington Footpath 16 will be realigned to a proposed underpass in Whittington Heath Golf Club which will be suitable for small vehicles associated with the golf course. Sandy Lane (Whittington Bridleway 17) will be diverted for a short distance along the route of Whittington Footpath 16 to Lichfield Road.

6.2.12 Approximately 300m of the Wyrley and Essington Canal will be permanently realigned to the south of its existing alignment.

6.2.13 A small infiltration pond will be provided within the golf course (see SES and AP2 ES Volume 2, CT-06-123b, C7). A railway drainage pond will also be provided on the east side of the route in the vicinity of Mill Farm (see SES and AP2 ES Volume 2, CT-06-124,-D6). Access to the pond will be provided via a new road from Capper's Lane which will also serve as an accommodation access to land to the west of the Hs2 route.

Capper's Lane to Streethay

6.2.14 The AP2 revised scheme will continue north in cutting, up to a maximum depth of 19m to pass beneath the WMCL, SSL and the A38. This section will be approximately 2.2km long (see SES and AP2 Volume 2: CFA22 Map Book, Maps CT-06-124, C6 to CT-06-126, H4). Key features of this section include:

- Streethay Cutting, of approximately 2.4km with a maximum depth of 19m as it passes Hill Farm, with retaining walls in its lower parts along most of its length, for protection against groundwater ingress and incorporating:
  - a culvert over the realigned Fulfen Wood watercourse;
  - an overbridge for Capper's lane realignment approximately 5m above ground level.
  - an overbridge to enable the AP2 revised scheme to pass beneath the WCML (see SES and AP2 ES Volume 2: Map CT-06-125, I5), with the minimum necessary headroom to limit the depth of cutting needed for the AP2 revised scheme;
  - an overbridge to maintain access for Hill Farm and provide continuity for Streethay Footpath 6 (see SES and AP2 ES Volume 2 Map CT-06-125, F4 to E6); and

- overbridges for the SSL and the A38 Rykneld Street and its slip roads which will be retained at their existing height.

6.2.15 A combination of landscape earthworks with landscape mitigation planting will be provided from Capper's Lane to the SSL on both sides of the route. Ecological mitigation will be provided adjacent to the realigned Fulfen Wood watercourse.

6.2.16 Approximately 500m of Capper's Lane will be realigned and extended to the north and will include a new overbridge over the HS2 route and a new junction with Broad Lane (see SES and AP2 ES Volume 2: Map CT-06-124, C5 to B9). Whittington Bridleway 20 will be diverted between Broad Lane and the realigned Capper's Lane. Streethay Footpath 6 will also be realigned over a short distance to the north. A new access to Streethay Manor will be provided from the A5127 Burton Road.

6.2.17 Realignment of Fulfen Wood watercourse, to enable the watercourse to pass under the HS2 route, includes ground reprofiling to prevent potential surface water flow into the Streethay cutting (see SES and AP2 ES Volume 2: Map CT-06-125, I8 to G4) and culverts under the realigned Capper's Lane and WCML.

6.2.18 A pumping station will be provided to the east of the route, accessed from Streethay via Streethay Footpath 6 accommodation overbridge. An associated balancing pond will also be provided to the east and accessed from Broad Lane (see SES and AP2 ES Volume 2: Map CT-06-125, H5).

6.2.19 An auto transformer station will be located to the west of the HS2 route and accessed from Capper's Lane (see SES and AP2 ES Volume 2: Map CT-06-124, C7).

Streethay to the Trent and Mersey Canal

6.2.20 The AP2 revised scheme continues north predominantly on embankment, up to a maximum of 12.2m in height. This area includes the grade-separated junction for the Phase Two line to the north-west. The length of this section will be approximately 2.4km. Key features of this section include (see SES and AP2 ES Volume 2: CFA22 Map Book, Maps CT-06-125, H4 to CT-06-127, C8):

- The Curborough embankment of approximately 2.3km length comprises two parts. The first section is approximately 1.1km in length (see SES and AP2 ES Volume 2: Map CT-06-126, J4 to CT-06-127, H7) with a maximum height of approximately 11m, and incorporates an underpass for the realigned Alrewas Footpath 31, including a culvert for the diversion of Mare Brook South under the HS2 route. Approximately 1km south of Wood End Lane, this embankment widens to accommodate four tracks on the approach to the junction with the Phase Two western leg; and

6.2.21 This junction and a short length of the route for the western leg of the Phase Two route (Manchester spur) form part of the AP2 revised scheme. The Manchester spur includes:

- a dive-under structure, approximately 200m long, to carry the Manchester spur under the southbound connection from the WCML at Handsacre, using retaining walls where adjacent tracks are at different heights (see SES and AP2 ES Volume 2: Map CT-06-127, I7);

- an embankment approximately 1km long with a maximum height of 12m to form the Manchester spur, including an underpass for the realigned Wood End Lane;
- a 100m long viaduct over the Trent and Mersey Canal (See SES and AP2 ES Volume 2: CT-06-127, D4); and
- an embankment approximately 200m long and a maximum of 7m in height. At this point the Phase One works terminate (see SES and AP2 ES Volume 2: CT-06-127, B3).

6.2.22 The Curborough embankment continues and curves north-west for a further 1.2km and includes separation of the tracks through the junction with the Manchester spur which descends to approximately ground level at this point.

- a viaduct approximately 65m long and a maximum height of 6m over Curborough Brook with noise barriers (see SES and AP2 ES Volume 2: Map CT-06-127, C7); and
- an embankment, Ravenshaw Wood embankment, approximately 2.3km long incorporating an overbridge for the realigned Wood End Lane.

6.2.23 Wood End Lane will be permanently realigned between the junction with Gorse Lane and Black Slough Farm. The realignment will be approximately 2.2km long and will pass under the Manchester spur, over Curborough Brook and over the HS2 route. New accesses will be provided for Wood End Lock (see SES and AP2 ES Volume 2: Map CT-06-128, I7), and for the hangers in Fradley Business Park (see SES and AP2 ES Volume 2: Map CT-06-127, F5 to G5).

6.2.24 Watery Lane will be extended a short distance to a junction with the realigned Wood End Lane and a new junction created for the retained section of Wood End Lane. In addition a new highway drainage balancing pond will be provided between the realigned and existing Wood End Lane. Access to Netherstowe Lane will be maintained via a diversion which will connect with the existing Wood End Lane in the vicinity of Curborough Brook. Alrewas Footpath 31 will be diverted through an underpass and aligned to the route included in the adjacent committed development at Fradley. National Cycle Network Route 54 will be re-routed along the Netherstowe Lane diversion, under Curborough Brook viaduct and the realigned Wood End Lane. From this point it connects back to the realigned Wood End Lane. Alrewas Footpath 44 will also be diverted under the Curborough viaduct and realigned Wood End Lane.

6.2.25 Landscape mitigation planting will be provided from the A38 to the existing Wood End Lane on the both sides of the route and for the Manchester spur. Landscape earthworks will be provided south of Mare Brook on both sides of the route and on the west side of the route between Mare Brook and Little Lyntus. Extensive areas of ecological mitigation are also provided within this section on either side of the route (see SES and AP2 ES Volume 2: Map CT-06-126 and CT-06-127).

6.2.26 A package substation (Mare Brook package substation) is provided to the east of the route (see SES and AP2 ES Volume 2: CT-06-126, F4) and accessed from a new road off Nanscawen Road.

6.2.27 An auto-transformer station will be provided in the area of land defined by the Manchester spur, the Hs2 route and the realigned Wood End Lane.

6.2.28 In this section of the AP2 revised scheme, four balancing ponds are provided for the railway drainage. They are situated:

- south of Nanscawen Road and accessed from the track off Nanscawen Road (see SES and AP2 ES Volume 2: Map CT-06-126, F4);
- beside the Curborough dive-under to drain the low section of the southbound Handsacre link (see SES and AP2 ES Volume 2: CT-06-126, B5);
- beside Wood End Lane for the northern section of the Manchester spur embankment (see SES and AP2 ES Volume 2: Map CT-06-127, G5 to H6); and
- beside a new access off the Netherstowe Lane extension (south of Little Lyntus) to capture surface runoff from the main line (see SES and AP2 ES Volume 2: CT-06-127, I8 to H8).

Trent and Mersey Canal to the WCML

6.2.29 The route continues through parts of Ravenshaw Wood and Black Slough on low embankments which gradually rise to a maximum height of 11m. The tie-in with the WCML will be provided via a grade-separated junction to the south of Handsacre. The approximate length of this section, the Handsacre link, is 4.7km. Key features of this section include:

- Ravenshaw Wood embankment of approximately 2.3km in length, continuing from the previous section (see SES and AP2 ES Volume 2: Map CT-06-127, C8; to Map CT-06- 129, G7), which for the most part is approximately 1m in height, rising to approximately 10m at its northern end. The embankment runs through the southerly parts of Ravenshaw Wood and Black Slough, incorporating Kings Bromley Footpath 0.392 underpass and an underbridge for the A515, constructed over the route of the existing road (see SES and AP2 ES Volume 2: Map CT-06-129, G7);
- a viaduct approximately 125m long over Bourne Brook (see SES and AP2 ES Volume 2: Map CT-06-129, F7 to G7);
- an embankment, Shaw Lane embankment, approximately 550m long and approximately 13m high, with a retaining wall on the west side (see SES and AP2 ES Volume 2: Map CT-06-129, F7 to C6);
- a junction between the WCML and HS2, with the two easternmost tracks of the WCML realigned approximately 40m to the east of their current position, at the point where HS2 will cross the WCML. Realignment will be for approximately 1.6km from the A515 Lichfield Road to the southern end of Handsacre, with the existing rail earthworks widened; and
- the 130m long Harvey's Rough flyover carrying the HS2 tracks over the two realigned WCML tracks to join:
  - an embankment, approximately 1km long, descending from 8m high to the same

level as the existing WCML – the HS2 tracks would then converge with the central WCML tracks with the railway junction having six tracks for approximately 1km until the tie-in point (see SES and AP2 ES Volume 2: CT-06-129, C6); and

- a short length of the two western WCML tracks will be realigned approximately 2m to the west and will require a low retaining wall.

6.2.30 Localised areas of landscape earthworks will be provided in the vicinity of Wood End Farm and Shaw Lane Farm. Landscape mitigation planting will also be provided from the Trent and Mersey Canal to just south of Handsacre on both sides of the route.

6.2.31 In addition, ecological mitigation will be provided north and south of the route, to provide compensation for the loss of ancient woodland including large areas adjacent to Ravenshaw Wood, Black Slough Wood, Tomhay Wood, Vicars Coppice and John's Gorse (see SES and AP2 ES Volume 2: Map CT-06-128 and CT-06-129). Landscape planting or hedgerows will be provided on both sides of the realigned WCML (see SES and AP2 ES Volume 2: Map CT-06-129 and CT-06-130a).

6.2.32 Within this section several highway and footpath amendments will occur. An access road will be provided south of the A515 Lichfield Road for Ravenshaw Cottage. Kings Bromley Footpath 0.392 will be realigned to an underpass (see SES and AP2 ES Volume 2: Map CT-06-128, B7). Shaw Lane will be stopped up between the WCML and Tuppenhurst Lane; Tuppenhurst Lane will be extended to the A515 Lichfield Road (see SES and AP2 ES Volume 2: Map CT-06-129, D5 to G6). A balancing pond will be located to the east of this road (see SES and AP2 ES Volume 2: Map CT-06 129, F6). The existing WCML underpass for the Kings Bromley Footpath 6 will be extended (see SES and AP2 ES Volume 2: Map CT-06-130a, H6). A balancing pond and access will be located on the east side of the WCML south of Handsacre and will be accessed from an access point into Handsacre (see SES and AP2 ES Volume 2: Map CT-06-130a, F6 to C5).

6.2.33 A package substation will be provided south of the HS2 route in the vicinity of Black Slough (see SES and AP2 ES Volume 2: Map CT-06-128, D7).

6.2.34 In addition to the realignment of the WCML, work will be undertaken to modify signalling, power supplies and access for the new railway junction. Works associated with the WCML in the Whittington to Handsacre area include additional and changed signal gantries.

6.2.35 Other modifications to the WCML to the south of the A515 Lichfield Road and to the north of the B5014 Lichfield Road in Handsacre are addressed in the AP2 ES Volume 4: Off-route effects.

6.3 Construction of the AP2 revised scheme

6.3.1 This section sets out the strategy for construction of the AP2 revised scheme in the Whittington to Handsacre 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.

6.3.2 The assessment presented in this AP2 ES is based on the construction arrangements as described in this section.

6.3.3 In addition to the land that will be required permanently by the AP2 revised scheme, land will also be required on a temporary basis for construction. Key temporary construction features are illustrated on the SES and AP2 ES Volume 2: CFA22 Map Book, Maps CT-05-123b to CT-05-130a. 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.

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

Overview of the construction process

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

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

6.3.6 General provisions relating to the construction process are set out in more detail in the main ES Volume 1, Section 6.4, and Section 4 of the draft CoCP (see main ES Volume 5: Appendix CT-003-000) including:

- the approach to environmental management during construction and the role

of the CoCP (draft CoCP, Section 4);

- working hours (draft CoCP, Section 5);
- the management of construction traffic (draft CoCP, Section 14); and
- the handling of construction materials (draft CoCP, Section 15).

Advance works

6.3.7 General information about advance works can be found in the main ES, Volume 1, Section 6.5.

6.3.8 Advance works will be required before commencing construction works and will typically include:

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

Engineering works

6.3.9 Construction of the railway will require engineering works along the entire length of the route, and within land adjacent to the route. This will comprise two broad types of engineering work:

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

6.3.10 The construction of the AP2 revised scheme will be subdivided into sections, each of which will be managed from compounds. The construction compounds would act as the main interface between the construction work sites and the public highway, as well as performing other functions as described below. Compounds would either be main compounds or satellite compounds, which are generally smaller. Some compounds would be used for civil engineering works and others for railway installation works, and in some cases for both.

6.3.11 In the Whittington to Handsacre area there will be two main civil engineering compounds, 16 civil engineering satellite compounds, one rail system main compound and eight rail system compounds. There will also be two roadheads. The Handsacre rail systems main compound would also manage three satellite compounds for the WCML modifications beyond this area (see SES and AP2 ES Volume 4).

6.3.12 Figure 2 shows the management relationship for civil engineering works compounds and Figure 3 for the railway installation works compounds. Details about individual compounds are provided in subsequent sections of this report.

General overview of construction compounds

6.3.13 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 (e.g. 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.

6.3.14 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.

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

- railheads will connect with the existing railway network for the delivery of materials for the construction of the rail systems; further details are provided in Section 6.3;
- roadheads will require an area of land for the storage and loading and unloading of bulk earthworks materials which are moved to and from the site on public highways; and
- living accommodation for the construction workforce.

6.3.16 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.

6.3.17 Further information on the function of compounds, including general provisions for their operation including security fencing, lighting, utilities supply, site drainage and codes of worker behaviour are set out in the main ES, Volume 1, Section 6.3 and the draft CoCP, Section 5.

Figure 2: Schematic of construction compounds for civil engineering works

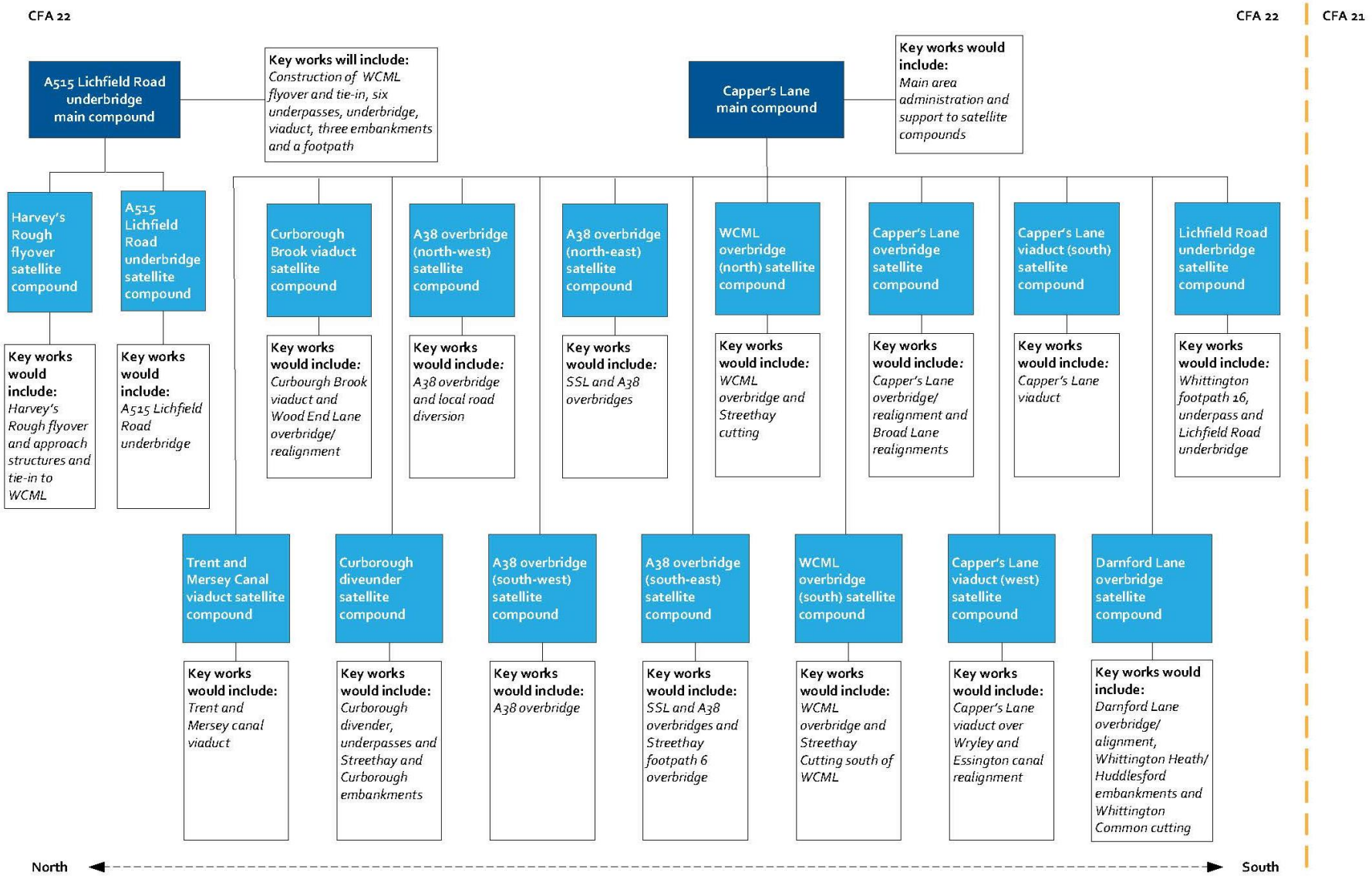
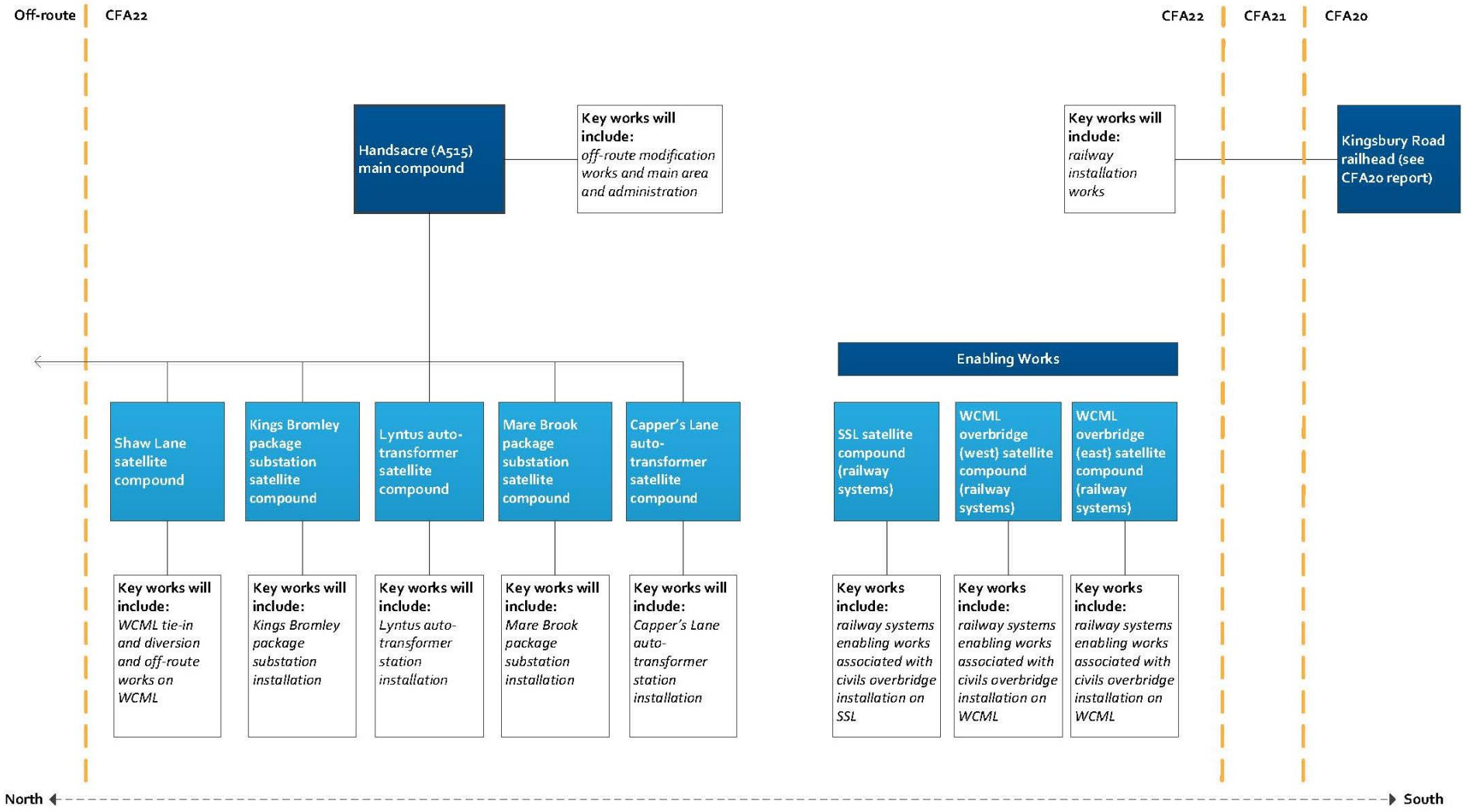


Figure 3: Schematic of construction compounds for railway installation works



Construction traffic routes

6.3.18 The movement of construction vehicles carrying materials, plant, other equipment and workforce (or moving empty) will take place both within the construction sites, on public roads and via the rail network. The construction compounds will provide the interface between the construction works and the public highway or rail network, and the likely road routes to access compounds are described in subsequent sections below.

6.3.19 Movements between the construction compounds and the work sites will be on designated haul roads within the site, often along the line of the AP2 revised scheme or running parallel to it.

Capper's Lane main compound

6.3.20 This compound will comprise the main area administration and support for construction works in the Whittington to Handsacre area between the Lichfield Road underbridge satellite compound to the Curborough Brook viaduct satellite compound, as well as construction works in the Drayton Bassett, Hints and Weeford area north of the Brockhurst Lane green overbridge satellite compound (see Map CT-05-125, I9 to I10). The compound will be established in 2018 and be operational for approximately five years. There will be an average of 105 workers and a peak of 145 workers. Access will be provided from the A38 via the Capper's Lane.

6.3.21 The Capper's Lane main compound will manage the following principal works in this area in addition to the support facilities identified in Section 6.3:

- earthworks (cuttings, embankments and culverts); and
- mitigation planting and landscape earthworks.

6.3.22 Finalisation works would include landscaping and planting.

Demolitions

6.3.23 The buildings that will need to be demolished in this area are listed in Table 2.

Table 2: Demolition works for the part of CFA22 managed from the Capper's Lane main compound (up to the Curborough Brook viaduct satellite compound)

Description of demolished buildings	Location
Whittington Heath Golf Club, A51 Tamworth Road, Whittington. Clubhouse and one other building (total buildings demolished – 2)	Map CT-05-123b, F6
Ellfield House, Darnford Lane, Whittington. One outbuilding (total buildings demolished – 1)	Map CT-05-124, G6
Ivy Cottage, Broad Lane. One outbuilding (total buildings demolished – 1)	Map CT-05-124, B7
Field Cottage, Burton Road, Streethay. One residential property (total dwellings demolished – 1)	Map CT-05-125, B7

Highways and road realignments

6.3.24 Within the part of CFA22 managed from the Capper's Lane main compound, eight roads would be diverted, realigned and/or be subject to traffic management measures during construction of the AP2 revised scheme, as follows (illustrated on the construction map series CT-05 (AP2 ES Volume 2: CFA22 Map Book):

- temporary diversion of Lichfield Road, Whittington to the north for a period of approximately 9 months, while a new online underpass is built;
- permanent realignment of Darnford Lane with a new offline overbridge to the north;
- permanent realignment of Capper's Lane approximately 300m to the north, including a new bridge over the Wyrley and Essington Canal. The current length of Capper's Lane west of the HS2 route would be retained for access;
- temporary diversion of Broad Lane to the south to a temporary junction with Capper's Lane, for approximately two years and eight months and then permanent diversion of Broad Lane with a new junction to realigned Capper's Lane and overbridge;
- phased diversion of the A38 southbound slip road and main carriageways for approximately 27 months during construction and permanent construction of a new underbridge;
- permanent realignment of Wood End Lane with a new offline underbridge to the south under the Manchester spur and Curborough Brook bridge alongside Curborough Brook viaduct and overbridge crossing the HS2 route;
- permanent diversion of Netherstowe Lane along the west side of the HS2 route to connect to the existing Wood End Lane; and
- permanent diversion of a short section of Watery Lane west of the HS2 route to connect to the realigned Wood End Lane.

6.3.25 In most cases overnight or weekend closures would be required to complete the tie-in of the new highways to the existing.

A38 Overbridges

6.3.26 Construction of the A38 overbridge structures, taking the HS2 route under the A38 and its slip roads, will be undertaken using standard construction techniques.

6.3.27 To maintain safe operation of the highway, it will be necessary to undertake the works under traffic management, which will operate for a period of approximately two years and three months on the A38 and its slip roads, and is likely to include temporary speed restrictions and reduced lane widths, for safety and to provide adequate working space.

6.3.28 Temporary slip roads will be constructed at the Streethay junction for both the northbound and southbound sliproads. These will comprise:

- a southbound sliproad realignment passing over a temporary bridge or culvert

installed on an already completed section of the new railway cutting for approximately 9 months; and

- a northbound sliproad realignment joining the main carriageway away from the overbridge worksite, temporarily stopping up an existing access to Elverceter and Streethay Cottages for approximately 18 months. The new access to Streethay Manor will be used to provide temporary access to the cottages during the construction sequence.

6.3.29 The sequence of construction is envisaged to be from south to north as follows:

- preparation and enabling works, including monitoring the existing road embankment;
- access provided to enable the construction of the SSL overbridge, which can then be used to enable the A38 works;
- completion of the structure immediately adjacent to the south side of the southbound sliproad and diversion of the sliproad over the already built structure;
- construction of the new cutting and southbound sliproad bridge and cutting up to the southern side of the main southbound carriageway, with access from the south under the SSL;
- reinstatement of the southbound sliproad to its new overbridge; concurrently diversions of the main carriageways and northbound sliproads to enable the construction of the southbound main carriageway overbridge section; at this stage access to the Streethay Manor and other properties to the north of the A38 will be facilitated through new access from the A5127 Burton Road;
- construction of the southbound main carriageway overbridge section and associated cutting with access from the south under the SSL;
- diversion of the northbound main carriageway over the new southbound main carriageway;
- construction of the northbound main carriageway overbridge section and associated cutting with access from the south under the SSL;
- reinstatement of the main carriageways and northbound sliproads to their new overbridge;
- completion of construction of the cutting north of the A38 with access from the south under the SSL and A38; and
- full excavation and structural completion of the cutting will follow on, post completion of all the overbridge structures.

Railways

6.3.30 The AP2 revised scheme will pass below the WCML and SSL. This increases the complexity of design and construction of the crossings and has greater impact on the operations of Network Rail and the Train Operating Companies. These works will be

coordinated with other work sites (e.g. Handsacre and Euston) in order to minimise impacts on rail operations.

6.3.31 Construction as well as site offices and welfare sites have been identified specifically for the works associated with the WCML and SSL crossings; two for the WCML east and west of the existing railway and one for the SSL.

6.3.32 The WCML Railway Systems satellite compounds will be used to provide office accommodation and material storage for works associated with the new bridge installation. They will also include access to the tracks of the WCML.

6.3.33 The Streethay SSL Railway Systems satellite compound will be utilised to provide office accommodation and material storage for the works to the SSL. It will also include access to the tracks of the SSL.

West Coast Main Line

6.3.34 Construction of the new overbridge for the WCML has been assumed for the purpose of this assessment to use a methodology known as 'boxjacking'.

6.3.35 This method involves the construction of a concrete box structure which is built offline. This is then slid into position using hydraulic jacks during a closure of the railway.

6.3.36 The sequence of construction is envisaged to be:

- preparation and enabling works, including monitoring the existing railway;
- minor modifications to the existing WCML (e.g. repositioning of overhead line equipment) to allow the new overbridge to be constructed. Where necessary these may require overnight or weekend possessions of the railway in advance of, and following, the main overbridge works;
- groundworks either side of the WCML to locally create the new HS2 cutting;
- construction of the overbridge structure offline to the south within the new cutting;
- sliding of the box under the WCML during a six-day blockade. This will take place over a holiday period to minimise disruption; and
- finalisation works.

South Staffordshire Line

6.3.37 Constructing the new overbridge for the SSL has been assessed assuming the construction methodology described below:

- preparation and enabling works, including monitoring of the existing railway;
- minor modifications to the railway to allow the new overbridge to be constructed. Where necessary these may require overnight or weekend possessions of the railway;
- installation of pile foundations during up to 8 weekend possessions (the possessions required on the SSL are not expected to affect passenger

services);

- installation of bridge deck during a weekend possession; and
- excavation beneath the SSL and the completion of the final structure to complete the works.

6.3.38 Possessions will be closely coordinated with the timetable as this is currently, and envisaged to be at the time of construction, a freight-only railway. This may negate or significantly mitigate any disruption to railway operations.

PRoW realignments

6.3.39 The following six PRoW would be realigned in the Capper's Lane main compound area:

- temporary realignment of Whittington Footpath 16 for a period of approximately 6 months for construction of new underpass and permanent realignment close to its current route;
- temporary diversion of Sandy Lane (also known as Whittington Bridleway 17) for a period of approximately 9 months, then permanent realignment onto Lichfield Road;
- permanent diversion of Whittington Bridleway 20, from the permanent diversion of Broad Lane to the realigned Capper's Lane;
- permanent realignment of Streethay Footpath 6 between Streethay and the Coventry Canal on a new accommodation overbridge;
- permanent realignment of Alrewas Footpath 31 in a new underpass north of its existing route; and
- permanent realignment of Alrewas Footpath 44 to the north under Curborough Brook bridge and Curborough Brook viaduct (main line) and the temporary realignment of Alrewas Footpath 44 between the pier of the Trent and Mersey Canal viaduct (Manchester spur) and the permanent realignment of the footpath to the north under Curborough Brook bridge and Curborough Brook viaduct (main line).

6.3.40 Permanent realignment of National Cycle Network route 54 to the north under Curborough Brook underbridge and Curborough Brook viaduct (main line) will also be required, as will minor adjustments to the Trent and Mersey canal and towpath to allow a safe route around the works during installation of the bridge decks over the canal for the Manchester spur.

Utilities

6.3.41 A number of utilities will need to be diverted for the works, the principal diversions within the Capper's Lane main compound area being:

- Large-diameter water mains as follows:
  - 12inch water main of strategic importance with restricted outages, at Wood End Lane;

- 460mm water distribution main on Burton Road with permanent diversion under A38 Rykneld Street overbridge; and
- 18inch water distribution main along Wood End Lane to be realigned within the permanently realigned Wood End Lane.

Watercourse diversions

6.3.42 The AP2 revised scheme includes the following changes to watercourses:

- realignment of the disused Wyrley and Essington Canal is proposed under Capper's Lane viaduct (AP2 ES Volume 2: CFA22 Map Book, Map CT-06-124, C6 to D6);
- the realignment of Fulfen Wood watercourse to the south side of the WCML to pass under HS2 before returning north under the WCML to its existing course near Fulfen Wood; also the diversion of the section north of the WCML southwards under the railway to meet the southern diversion to Fulfen Wood culvert (AP2 ES Volume 2: CFA22 Map Book, Map CT-06-125, J5 to G5); and
- permanent realignment of Mare Brook South watercourse northwards to Mare Brook South culvert (AP2 ES Volume 2: CFA22 Map Book, Map CT-06-126, H3) and permanent realignment of Mare Brook North watercourse eastwards to new peripheral drainage ditches/watercourses both sides of proposed landscape mitigation earthworks (AP2 ES Volume 2: CFA22 Map Book, Map CT-06-126, E4 to D5).

6.3.43 Works to construct the viaduct over the Trent and Mersey canal would be undertaken through management of canal traffic flows and with the provision of a protection deck over the canal. There may be an occasional need to close the Trent and Mersey canal overnight to safely construct some of the works.

Finalisation works

6.3.44 Finalisation works would include landscaping and planting.

Satellite construction compounds

6.3.45 Fourteen satellite construction compounds would be managed from the Capper's Lane main compound, to construct the works in this area. Table 3 details the principal construction activity, start date, approximate duration, number of workers and highway access route for each associated programme.

Table 3: Satellite construction compounds managed by the Capper's Lane main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (avg/peak)	Highways access route
Lichfield Road underbridge satellite compound (Map CT-05-124, H6)	Construction of Whittington Footpath 16 underpass, Lichfield Road underbridge	2018	1.5 years	14/20	Lichfield Road/A51 Tamworth Road/A5206 London Road / A38

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (avg/peak)	Highways access route
Darnford Lane overbridge satellite compound (Map CT-05-124, G6)	Construction of Darnford Lane overbridge, Whittington Heath/Huddlesford embankments and Whittington Common cutting	2018	3 years	18/30	Haul route to Lichfield Road via Lichfield Road underbridge satellite compound
Capper's Lane viaduct (south) satellite compound (Map CT-05-124, D6)	Construction of Capper's Lane viaduct over canal	2018	2 years	20/30	Haul route via Capper's Lane main compound
Capper's Lane viaduct (west) satellite compound (Map CT-05-124, C7)	Construction of Capper's Lane viaduct over canal	2018	2 years	20/30	Haul route via Capper's Lane main compound
Capper's Lane overbridge satellite compound (Map CT-05-124, B6)	Construction of Capper's Lane overbridge and associated road diversions	2018	3 years	20/30	Haul route via Capper's Lane main compound
WCML overbridge (south) satellite compound (Map CT-05-125, I4 and I5)	Construction of WCML and Capper's Lane overbridges and Streethay Cutting	2018	2 years	55/80	Haul route via Capper's Lane main compound
WCML overbridge (north) satellite compound (Map CT-05-125, H5)	Construction of WCML overbridge and Streethay Cutting	2018	3.5 years	20/30	A38 or Haul route via Capper's Lane main compound
A38 overbridge (south-east) satellite compound (Map CT-05-125, D6)	Construction of SSL, and A38 and Streethay Footpath 6 overbridges	2018	1 year	20/30	A38 or haul route via Capper's Lane main compound
A38 overbridge (north-east) satellite compound (Map CT-05-125, C5)	Construction of SSL and A38 overbridges	2018	2 years	20/30	Farm route via Capper's Lane Main Compound (light vehicles only) A38/A5127 southbound slip road Exit via A5127/A5192/A38
A38 overbridge (south-west) satellite compound (Map CT-05-125, D7)	Construction of A38 overbridge	2019	1 year	20/30	A38/A5127 southbound slip road via A38 overbridge (north-east) satellite compound
A38 overbridge (north-west) satellite compound	Construction of A38 overbridge and local road diversions	2019	2 years	30/30	A38/A5192/A5127. Exit via A38/A5127 northbound slip road

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (avg/peak)	Highways access route
(Map CT-05-125, C7)					
Curborough dive under satellite compound (Map CT-05-127, F6-G6)	Construction of Mare Brook diversion, Alrewas Footpath 31 underpass, Wood End Lane underpass, Curborough dive under, Trent and Mersey Canal viaduct and Streethay/Curborough embankments	2018	3 years	32/100	Wood End Lane to A38
Curborough Brook viaduct satellite compound (Map CT-05-127, D6 to D7)	Construction of Curborough Brook viaduct, Curborough Brook roadbridge and Wood End Lane overbridge	2018	4 years	70/100	Wood End Lane to A38
Trent and Mersey Canal viaduct satellite compound (Map CT-05-127, D4-D5)	Construction of Trent and Mersey Canal viaduct	2018	1.5 years	20/30	Haul route via Curborough dive-under satellite compound

Temporary worker accommodation sites

6.3.46 A temporary worker accommodation site will be located within this section of the AP2 revised scheme adjacent to the Capper's Lane main compound (Map CT-05-125, H8 to G9) and will comprise living accommodation, welfare facilities and car parking for approximately 29 workers over a period of approximately five years. Temporary worker accommodation will adhere to the mitigation measures set out within the draft CoCP (Volume 5: Appendix CT-003-000).

Roadheads

6.3.47 Roadheads are areas for the storage and loading and unloading of bulk earthworks material which is moved to and from the site on public highways.

6.3.48 There will be two roadheads managed from the Capper's Lane main compound within the Whittington to Handsacre area:

- the A38 Southbound roadhead consists of two areas located between the HS2 route, the A38 and the WCML and accessed from temporary slip roads off the A38 (AP2 ES Volume 2: CFA22 Map Book, Map CT-05-125, G9, H8 and D7, E7). It will be operational for approximately four years beginning in 2018; and
- the Wood End Lane roadhead located to the northeast of Wood End Lane and accessed from the A38 via Wood End Lane (AP2 ES Volume 2: CFA22 Map Book, Map CT-05-127, D5 to F6) will be operational for approximately four years beginning in 2019.

A515 Lichfield Road underbridge main compound

6.3.49 This main construction compound will comprise the main area administration and support facilities for construction works in the northern part of the area, north of Wood End Lane (CT-05-129, F5 to G6). The compound will also support construction

of underpasses for Kings Bromley Footpath 0.392 and Kings Bromley Footpath 6, A515 Lichfield Road underbridge, Bourne Brook viaduct, Harvey's Rough flyover, WCML tie-in and Ravenshaw Wood/Shaw Lane/Lilac embankments. The compound will be established in 2018 and will be operational for approximately five and half years. There will be an average of 91 workers and a peak of 150 workers. The compound will be accessed from the A515 Lichfield Road.

Demolitions

6.3.50 The buildings that would need to be demolished in this area are listed in Table 4.

Table 4: Demolitions in CFA22 managed by the A515 Lichfield Road underbridge main compound (from Curborough Brook viaduct to the B5014 Lichfield Road in Handsacre)

Description of buildings	Location
Hanchwood House, Shaw Lane, Handsacre. One dwelling and three outbuildings (total buildings demolished –4)	Map CT-05-129, G7

Highways and road realignments

6.3.51 Within this part of the Whittington to Handsacre area, two roads would be diverted, realigned and/or subject to traffic management measures during construction of the AP2 revised scheme as follows (illustrated on the construction map series CT-05 (SES AP2 ES Volume 2: CFA22 Map Book):

- temporary realignment of the A515 Lichfield Road to the north of the current alignment for a period of approximately 18 months, for construction of a new online underbridge; and
- a section of Shaw Lane of approximately 340m will be stopped up at the existing crossing of the WCML with traffic diverted west to A515 Lichfield Road via an extended Tuppenhurst Lane.

6.3.52 Where necessary, overnight or weekend closures would be required to complete the tie in of the new and existing highways.

Railways

6.3.53 Works to construct the new junction between HS2 and the WCML will use standard construction techniques. This assessment is based on the following phased construction works:

- construct realigned lengths of WCML realigned eastern tracks and Harvey's Rough flyover away from the operational railway;
- connect and commission the realigned length of WCML and remove redundant existing WCML tracks;
- complete construction of HS2 embankment and tracks between WCML lines;
- to accommodate the new junction, the existing rail systems would also need to be modified, including signalling, power and communications; and
- where these works affect the operational railway, they would be undertaken in planned non-disruptive night time and weekend closures of the WCML.

PRoW realignments

6.3.54 The following two PRoW would be realigned in the Whittington to Handsacre area managed by the A515 Lichfield underbridge main compound:

- permanent realignment of Kings Bromley Footpath 0.392 in a new underpass; and
- temporary closure of Kings Bromley Footpath 6 for approximately six months, with permanent reinstatement in a new extended underpass.

Utilities

6.3.55 Numerous utilities would need to be diverted for the works. The principal diversions include:

- high-pressure gas mains as follows:
  - 600mm gas main within Ravenshaw Wood to permanent realignment north of Ravenshaw Wood;
- high-voltage electricity supplies as follows:
  - 400kV overhead electricity transmission line at Handsacre south of Shaw Lane with replacement of existing towers to provide sufficient clearance over the route and temporary diversion alongside the route;
  - 132kV overhead electricity transmission line with diversion down Lichfield Road across the route alongside Wood End Lane to the junction with Watery Lane near Vicar's Coppice; and
  - the overhead electricity transmission line works will require access to modify towers down the line from the main works.
- large-diameter water mains as follows:
  - 33inch and 36inch water main diversions to new culvert below Bourne Brook viaduct between A515 Lichfield Road and Shaw Lane.

Watercourse diversions

6.3.56 The following watercourses will be diverted in the Whittington to Handsacre area managed by the A515 Lichfield Road main compound: two realignments of unnamed watercourses to Kings Bromley North culvert and Handsacre East culvert (SES and AP2 ES, Volume 2: CFA22 Map Book, Map CT-06-130a, G6 and E6).

Finalisation works

6.3.57 Finalisation works will include landscaping and planting.

Satellite construction compounds

6.3.58 Two satellite compounds will be managed from the A515 Lichfield Road underbridge main compound. Table 5 details the principal construction activity, start date, approximate duration, number of workers and highway access route for each associated programme.

Table 5: Satellite construction compounds managed by A515 Lichfield Road main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
A515 Lichfield Road underbridge satellite compound (Map CT-05-129, G9 to G10)	Construction of A515 Lichfield Road underbridge	2018	1.5 years	20/30	A515 Lichfield Road
Harvey's Rough flyover satellite compound (Map CT-05-129, D7 to D8)	Construction of Harvey's Rough flyover and approach structures to allow track crossovers to tie in to WCML; demolition of Shaw Lane overbridge.	2019	1 year	20/30	Shaw Lane/B5014 Lichfield Road/A515 Lichfield Road

Temporary worker accommodation sites

6.3.59 A temporary worker accommodation site will be located adjacent to the A515 Lichfield Road underbridge main compound (Map CT- 05-129, G5 and F6) and will comprise living accommodation, welfare facilities and car parking for approximately 30 workers over a period of approximately five and a half years. Temporary worker accommodation will adhere to the mitigation measures set out within the draft CoCP (Volume 5: Appendix CT-003-000 of the main ES).

Handsacre (A515) main compound

6.3.60 This compound will comprise the main area for administration and support for the Whittington to Handsacre rail installation works as well as the modifications to the WCML from Lichfield to Colwich (see CT-05-129, E8). The compound will also help facilitate the WCML diversion and connection in Handsacre. The Handsacre (A515) compound would be retained during the testing and commissioning phase of the works and would be restored on completion of the HS2 Phase One works.

6.3.61 The Handsacre (A515) main compound will be established in 2021 and would be operational for approximately five years. It will be operational to serve the works associated with the:

- modifications to the WCML from Lichfield to Colwich; these are anticipated to commence in 2021 and conclude in 2023; and
- diversion and connection to the WCML, as well as modifications to the WCML within the Whittington to Handsacre area which will commence in 2021.

6.3.62 There will be an average of 37 workers and a peak of 138 workers.

6.3.63 The compound will be accessible from the A515 Lichfield Road. This will include a new permanent connection from the A515 Lichfield Road to an existing National Rail access road.

6.3.64 The railway systems installation works will include track, overhead power 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. Before the railway systems installation can commence, adequate civil engineering work will need to be completed to allow a continuous track laying sequence. The railway systems installation will have its own mobile welfare facilities for the site staff.

6.3.65 The compound will be used to manage the following key railway systems installation works in this section of the AP2 revised scheme:

- installation of two auto-transformer stations (Capper's Lane auto-transformer station and Lyntus auto-transformer station); and
- installation of two package substations (Mare Brook and Kings Bromley).

6.3.66 On the WCML, the installation of new signal gantries and removal of redundant ones will be undertaken using a crane, sited on a temporary crane platform adjacent to the railway. Gantries will typically be lifted into place or removed overnight during temporary track possessions, in order to avoid disruption to rail services. The locations of the six crane platforms within the Whittington to Handsacre area (CFA22) are shown on AP2 ES Volume 2: Maps CT-05-129 and CT-05-130a.

6.3.67 The main ES, Volume 1, Section 5 provides descriptions of typical railway systems (Section 5.15 to 5.17), and Section 6 describes associated construction activities (Section 6.13 and 6.23 to 6.25, respectively). The main ES, Volume 1, Section 5.16 also provides descriptions of typical power supply features, including auto-transformer stations, and Section 6.23 describes associated construction techniques.

6.3.68 Finalisation works would include landscaping and planting.

Satellite construction compounds

6.3.69 Five satellite compounds will be managed from the Handsacre main compound.

6.3.70 Table 6 details the principal construction activity, start date, approximate duration, number of workers and highway access route for the associated programme.

Table 6: Railway installation works satellite compounds managed by Handsacre (A515) main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
Capper's Lane auto-transformer satellite compound (Map CT-05-124, C7)	Facilitate the Capper's Lane auto-transformer fit- out	2022	1 year	26/38	Capper's Lane/A38
Mare Brook package substation satellite compound (Map CT-05-126, F4)	Facilitate the Mare Brook package substation fit-out	2022	4 weeks	2/4	Nanscawen Road/ Wood End Lane/A38
Lyntus auto-transformer satellite compound (Map CT-05-127, F6)	Facilitate the Lyntus auto-transformer fit-out	2022	1 year	26/38	Wood End Lane/A38
Kings Bromley package substation satellite compound (Map CT-05-128, C8)	Facilitate the Kings Bromley package substation fit-out	2022	4 weeks	2/4	Wood End Lane/A38
Shaw Lane satellite compound (Map CT-05-129, D7 to D8)	Modification works for WCML	2023	4 months	64/64	Shaw Lane/B5014 Lichfield Road/A515 Lichfield Road

Railhead at Kingsbury Road

6.3.71 Kingsbury Road railhead (in CFA20) will act as the main compound for the rail systems installation from Long Itchington Wood tunnel to Handsacre connection, and to Birmingham Curzon Street.

6.3.72 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.

6.3.73 The railway compound will facilitate the following activities:

- permanent way (ballast and/or slab track) installation;
- overhead line electrification installation;
- train control;
- signalling;
- telecommunication fit-out; and
- low-voltage line side power fit-out.

6.3.74 See the main ES Volume 2 report for CFA20 for more details of the Kingsbury Road railhead.

Rail systems satellite compounds

6.3.75 The Kingsbury Road railhead will provide main compound support for rail systems installation works within the Whittington to Handsacre area.

Enabling works rail systems satellite compounds

6.3.76 In order to facilitate the civil engineering works to install the WCML and SSL overbridges, three rail systems enabling works satellite compounds are required to be operational in advance of the main Handsacre (A515) compound. The WCML overbridge (east and west) and South Staffordshire Line satellite compounds will be used to manage the modifications to Network Rail infrastructure required before the civil engineering works proceed and to reinstate the track and other railway systems following the installation of the overbridges.

6.3.77 Table 7 details the principal construction activity, start date, approximate duration, number of workers and highway access route for the three enabling works rail systems satellite compounds.

Table 7: Enabling works rail systems satellite compounds

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
WCML overbridge (west) satellite compound (rail systems) (Map CT-05-125, I7)	WCML overbridge works	2019	1.5 years	43/73	Haul route via Capper's Lane main compound
WCML overbridge (east) satellite compound (rail systems) (Map CT-05-125, H4, I3)	WCML overbridge works	2019	1.5 years	43/73	A38 or haul route via Capper's Lane main compound
South Staffordshire Line satellite compound (rail systems) (Map CT-05-125, C6)	SSL overbridge works	2019	1.5 years	43/73	Farm route via Capper's Lane Main Compound (light vehicles only) A38/A5127 southbound slip road Exit via A5127/A5192/ A38

Construction waste and material resources

6.3.78 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and worker accommodation site waste that will be produced during construction of the AP2 revised scheme in the Whittington to Handsacre area have been prepared and are presented in AP2 ES Volume 5: Appendix WM-001-000.

6.3.79 Most of the excavated material that will be generated across the AP2 revised scheme will be reused as engineering fill material or in the landscape mitigation earthworks of the AP2 revised scheme, either with or without treatment.

6.3.80 Based on the mitigation earthworks design approach adopted for the AP2 revised scheme, local excess or shortfall of excavated material within the Whittington to Handsacre area would be managed with the aim of contributing to an overall balance

of excavated material on a route-wide basis. The overall balance of excavated material is presented in SES and AP2 ES, Volume 3, Section 19.

6.3.81 The quantity of surplus excavated material originating from the Whittington to Handsacre area that will require off-site disposal to landfill as excavation waste is shown in Table 8. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for reuse within the AP2 revised scheme.

6.3.82 The quantities of demolition, construction and worker accommodation site waste that will be reused, recycled and recovered (i.e. diverted from landfill) have been based on the landfill diversion performance of similar projects as follows:

- demolition waste: 90%;
- construction waste: 90%; and
- worker accommodation site waste: 50%.

6.3.83 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 8.

Table 8: Estimated construction demolition and excavation waste

Waste type	**Estimated material quantities that would be generated (tonnes)**	**Estimated quantity of waste for off-site disposal to landfill (tonnes)**
Excavation	2,436,795	0
Demolition	5,984	598
Construction	54,758	5,476
Worker accommodation sites	1,079	540
TOTAL	2,498,616	6,614

6.3.84 The assessment of the likely significant environmental effects associated with the disposal of CDEW and worker accommodation site waste has been undertaken for the AP2 revised scheme as a whole (see SES and AP2 ES, Volume 3, Section 19).

Commissioning of the railway

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

Construction programme

6.3.86 A construction programme that illustrates indicative periods for the construction activities in the area described above is provided in Figure 4.

6.3.87 Although the main works would not commence until 2nd quarter 2018, some early works such as the establishing of ecological mitigation areas and major utility diversion are likely to start at some time in 2017.

Figure 4: 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																																				
Capper's Lane main compound																																				
Whittington Heath embankment																																				
Whittington Common cutting																																				
Huddlesford embankment																																				
Fulfen Wood embankment																																				
Lichfield Road underbridge satellite compound																																				
Lichfield Road underbridge																																				
Damford Lane overbridge satellite compound																																				
Darnford Lane overbridge																																				
Capper's Lane viaduct (south/west) satellite compounds																																				
Wyrley and Essington canal diversion																																				
Capper's Lane viaduct																																				
Capper's Lane overbridge satellite compound																																				
Broad Lane diversion																																				
Capper's Lane overbridge																																				
WCML overbridge (south/north) satellite compounds																																				
Streethay cutting																																				
WCML overbridge																																				
Streethay Footpath 6 (diversion and overbridge)																																				
A38 overbridges (south-east/north-east/south-west/north-west) satellite compounds																																				
SSL overbridge																																				
A38 overbridge																																				
Curborough diveunder satellite compound																																				
Curborough embankment																																				
Alrewas Footpath 31 underpass																																				

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
Curborough dive-under																																				
Fradley Wood embankment																																				
Wood End Lane underbridge																																				
Trent and Mersey Canal viaduct satellite compound																																				
Trent and Mersey Canal viaduct																																				
Brokendown Wood embankment																																				
Curborough Brook viaduct satellite compound																																				
Curborough Brook viaduct and road bridge																																				
Wood End Lane overbridge																																				
A515 Lichfield Road underbridge main compound																																				
Ravenshaw Wood embankment																																				
A515 Lichfield Road underbridge satellite compound																																				
Kings Bromley Footpath 0.392 underbridge																																				
A515 Lichfield Road underbridge																																				
Bourne Brook viaduct																																				
Shaw Lane embankment																																				
Lilac embankment																																				
Harvey's Rough flyover satellite compound																																				
Tuppenhurst Lane extension																																				
Harvey's Rough flyover																																				
Handsacre retaining wall																																				
Kings Bromley Footpath 6 underpass																																				
Railroad infrastructure and systems works																																				
Rail installation works (Enabling Works)																																				
WCML overbridge (west) satellite compound (railway systems)																																				
WCML overbridge (east) satellite compound (railway systems)																																				
SSL satellite compound (railway systems)																																				
Rail installation works (From Handsacre [A515] main compound)																																				
Capper's Lane ATS satellite compound																																				
Lyntus ATS satellite compound																																				

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
Shaw Lane satellite compound																																				
Mare Brook package substation satellite compound																																				
Kings Bromley package substation satellite compound																																				
Rail installation works (From Kingsbury Road Railhead)																																				
Rail systems installation works from Kingsbury Road Railhead in CFA22																																				
Commissioning																																				
Commissioning																																				

Key: Construction works Compound duration

6.4 Operation of the AP2 revised scheme

Operational specification

6.4.1 The main ES, Volume 1, Section 4.4 describes the envisaged operational characteristics of Phase One of HS2 as a whole and how they may change when Phase Two is also operational.

HS2 services

6.4.2 It is anticipated that initially, with Phase One operation, there will be eight trains per hour each way passing through the Whittington to Handsacre 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.

6.4.3 It is anticipated that with Phase Two in place the frequency could rise to 12 trains per hour each way during peak hours, with 11 trains per hour each way on the Manchester route and one train per hour each way on the link to the WCML at Handsacre. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two for the route as far as the junction for Phase Two western leg (Manchester spur), but the Phase One frequency for the Handsacre link.

6.4.4 In this area, trains will run at speeds up to 360kph (225mph). The Handsacre link would run at speeds up to 200kph (125mph) which is the same as the WCML in this area. The trains would be either single 200m-long trains, or two 200m-long trains coupled together, depending on demand and time of day.

Maintenance

6.4.5 The main ES Volume 1, Section 4.4 describes the maintenance regime for HS2.

Operational waste and material resources

6.4.6 Forecasts of the amount of operational waste that will be produced annually during operation of the AP2 revised scheme have been prepared and are presented in SES and AP2 Volume 5: Appendix WM-001-000.

6.4.7 Railway station and train waste refers to waste that would arise at each station and includes 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 would be located.

6.4.8 Rolling stock maintenance waste is that which would 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 would be located.

6.4.9 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.

6.4.10 The quantity of operational waste that will be reused, recycled and recovered (i.e. diverted from landfill) has been based on landfill diversion performance information from Network Rail and other sources as follows:

- railway station and trains: 60%;
- rolling stock maintenance: 80%;
- track maintenance: 85%; and
- ancillary infrastructure: 60%.

6.4.11 On this basis, approximately 219 tonnes of operational waste will be reused, recycled and recovered during each year of operation of the AP2 revised scheme in the Whittington to Handsacre area. Approximately 45 tonnes will require disposal to landfill (see Table 9).

Table 9: Operational waste forecast for the AP2 revised scheme in the Whittington to Handsacre area

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste going to off-site disposal per annum (tonnes)
Railway station and trains	0	0
Rolling stock maintenance	0	0
Track maintenance	244	37
Ancillary infrastructure	20	8
TOTAL	264	45

6.4.12 The assessment of the likely significant environmental effects associated with the disposal of operational waste has been undertaken for the AP2 revised scheme as a whole (see SES and AP2 ES, Volume 3, Section 20).

6.5 Community forum engagement

6.5.1 HS2 Ltd's approach to engagement is set out in the main ES, Volume 1, Section 3.

6.5.2 The engagement undertaken within this community forum area is summarised below.

Community forum engagement for the AP2 ES

6.5.3 A series of meetings and discussions with individual landowners, parish and district councils, as well as organisations, was undertaken from February to May 2015. Meetings were held with:

- Lichfield District Council, Staffordshire County Council;
- Canal and River Trust;
- Inland Waterways Association;
- Whittington and Fisherwick Parish Council;

- Kings Bromley Parish Council;
- Lichfield Cruising Club;
- Curborough businesses;
- Fradley and Streethay Parish Council;
- Armitage with Handsacre Parish Council;
- Lichfield and Hatherton Canals Restoration Trust;
- Staffordshire Wildlife Trust; and
- Lichfield District Council.

6.5.4 The main themes to emerge from these meetings were:

- noise assessment and mitigation;
- changes in baseline and cumulative impacts;
- impacts to ancient woodland;
- impacts to water resources;
- visual impacts and mitigation;
- impacts to landholdings;
- realignment of Wood End Lane;
- impacts from traffic; and
- future maintenance.

Community forum engagement for the main ES

6.5.5 A series of community forum meetings and discussions with individual landowners, organisations and action groups was undertaken. Community forum meetings were held on:

- 11 April 2012 at Armitage Village Hall;
- 28 June 2012 at Armitage Village Hall;
- 25 September 2012 at Armitage Village Hall;
- 8 November 2012 at Kings Bromley Village Hall;
- 28 February 2013 at Kings Bromley Village Hall; and
- 23 September 2013 at Kings Bromley Village Hall.

6.5.6 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.

6.5.7 The main themes to emerge from these meetings were:

- impacts to community;
- impacts on ecology and wildlife;
- impacts to farming and associated farming businesses;
- use, size and location of works sites, impacts, construction traffic and use of local roadways, haul routes;
- visual impacts and blighting;
- mitigation measures;
- listed buildings;
- potential for route changes at the Trent and Mersey Canal, Capper's Lane and the junction for Phase Two western leg (Manchester spur); potential for a tunnel between Whittington and Curborough;
- impacts to Handsacre and the mitigation proposed at the WCML junction;
- cumulative impacts with WCML in Armitage;
- impact to previously committed development at Fradley Park;
- noise/vibration effects, analysis of maximum noise rather than average levels;
- impacts on highways, traffic, traffic counts and public perception and access to Sandy Lane;
- total number of trains running through this area;
- connection to the existing Lichfield Trent Valley and Rugeley Trent Valley train service on WCML; and
- need for imported materials for embankment construction.

6.5.8 In addition to 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 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 original scheme. Details of the local consultation events were provided on the HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the original scheme. In the Whittington to Handsacre area, consultations on the draft Environmental Statement and on the Design Refinement were held on 11 June 2013 at The Guildhall, Lichfield.

6.5.9 HS2 Ltd staff attended the events, including engineers and environmental specialists, for members of the public to speak to.

6.5.10 Responses from the draft Environmental Statement consultation were analysed and an overview of those received and how the main Environmental Statement took

account of responses was contained in the Draft Environmental Statement Consultation Summary Report (Volume 5: Appendix CT-008-000 of the main ES).

6.6 Route section main alternatives

Alternative connection options for Wood End Lane

6.6.1 During the development of this additional provision local landowners in Curborough and other groups raised concerns about the alignment of Wood End Lane. A number of alternatives were put forward by groups and have been considered in the development of the AP2 revised scheme. The options considered looked to increase the length of Wood End Lane which would run to the west of the HS2 alignment to enable future development potential and reduce severance particularly in relation to Netherstowe Lane. Three options were considered:

- Option A considered a crossing for Wood End Lane to the south of the Trent & Mersey Canal. However this required a large skewed structure which would have been dominant in views from the Trent and Mersey Canal and required a very long diversion to Netherstowe Lane;
- Option B extended the diversion of Wood End Lane further south running from its existing alignment past Big Lyntus, to the west of HS2 before climbing to a height of approximately 10m to cross the HS2 alignment which is at grade and connecting into Nanscawen road. This option would have restricted the development of the land around Nanscawen Road which is a committed development and severed additional farmland to the west of the HS2 route; and
- Option C followed a similar route to option B, passing from the existing alignment near Big Lyntus to rise up to 19m above ground level to cross the HS2 route to the north of the development land around Nanscawen Road. Although this provided a direct connection to Netherstowe lane, this did not justify the additional environmental impacts or costs.

6.6.2 These options were not taken forward as the AP2 revised scheme presents a better balance of the factors considered.

Route section main alternatives considered in the original scheme

6.6.3 The main strategic alternatives considered in this area of the original scheme are presented in the main ES Volume 1 and in Volume 5: Appendix CT-002-000. The main local alternatives considered for the original scheme within this area are described in this section. Those local alternatives that have since been incorporated into the design of AP2 revised scheme are described first.

Route section main alternatives that have since been incorporated into the design of AP2 revised scheme

Community forum proposals south of the junction for Manchester

6.6.4 Five community proposals comprising long bored tunnels as well as tunnels or bridges under the A38 and WCML were assessed. These options were developed in combination with the options to mitigate Fradley Business Park Impact:

- Option I – This option would include a green tunnel from the A51 through Whittington Heath Golf Club, followed by a bored tunnel beneath the WCML, SSL and the A38 dual carriageway before resurfacing to provide the junction for Phase Two to Manchester;
- Options J, K and O – This group of options would pass beneath the WCML, SSL and A38 using overbridges and cuttings. Each option followed a different horizontal alignment; and
- Option P – This option considered the shortest bored tunnel viable under the WCML, SSL and A38. This was similar to Option I but with the green tunnel approaches removed.

6.6.5 Option I would provide substantial environmental benefits and would reduce the potential disruption to the existing roads and railways crossed by the route. However, this is outweighed by the very high cost of providing a tunnel.

6.6.6 Options J, K and O would provide a significant proportion of the benefits associated with Option I, but at a significantly reduced cost. The horizontal alignment of Option O would have the least environmental impact and cost of these options.

6.6.7 Although Option P would offer reduced costs over Option I, it would remain significantly more expensive than Option O.

6.6.8 The most cost-effective lowered option is Option O. This would mitigate much of the visual impact and reduce noise during operation. Option O was compared against Option M in greater detail. Although both options would require a level of disruption to the existing transport infrastructure, investigation into the nature of the geology and hydrology indicated that it would be difficult to construct the crossings of the A38, SSL and WCML for Option O. The construction of Option O would lead to an unacceptable level of disruption to these important railways and highway. Whilst the lowered options provide an overall reduction in environmental impacts, they would involve significant disruption to existing transport infrastructure and with increased construction costs. None of these options were taken forward in the development of the original scheme.

6.6.9 However, since the publication of the main ES, further stakeholder engagement has made it clear that there remains a strong preference for this option, and further technical work and subsequent ground investigations have shown that constructing this option is feasible. This additional work has also shown that a construction methodology can be adopted which would avoid having an unacceptable level of disruption on the A38, WCML and SSL. As a result, a revised scheme has been developed which lowers the HS2 route by a maximum of 23m from north of the A51 Tamworth Road to north of the A38, so that the route can run in cutting to the east of Lichfield and pass beneath the WCML, the SSL and the A38, instead of the original scheme alignment that ran on embankments and viaducts to cross above the existing transport infrastructure.

Community Proposals North of the A38

6.6.10 Several proposals were put forward by community groups to amend the design north of the A38. These alternatives were assessed against the AP2 revised scheme which was referred to as option A.

6.6.11 Option B considered a realignment of the Trent and Mersey Canal to the north of HS2. This would remove a constraint to the design of the vertical alignment that would have enabled the link between the mainline and Handsacre to be lowered.

6.6.12 Option C also considered a realignment of the Trent and Mersey Canal; however, the arrangement of the spur to Manchester included the link to Handsacre passing over the mainline to Manchester.

6.6.13 The two options B and C would have provided some localised environmental benefits, but would also have negative impacts on the ecology, heritage and setting of the canal and its associated listed structures, conservation area and local wildlife site. These options would not have had the support of key affected stakeholders. As no overall benefit was identified and as the canal realignment was likely to be opposed, the options were not taken forward.

6.6.14 An alternative that placed the alignment in a bored tunnel under the Trent and Mersey canal (option D) would have required the alignment to be lowered to approximately 20m below the lowest ground level (a rail level of approximately 45m above Ordnance Datum (AOD), 30m lower than existing). To achieve this, both the Handsacre link and the Manchester mainline would need to pass under the canal in tunnels. Due to the limited benefits that this proposal would provide, the significant realignment required and the additional cost, the option was not taken forward.

6.6.15 Option E considered a realignment of the Handsacre link to avoid a double crossing of the Trent and Mersey Canal. Although an alignment could have been developed, other constraints would mean the speed of the link would reduce to 170kph and would still pass close to the canal. As this alignment did not meet the original proposal to avoid impacts on the canal from the Handsacre link and required a speed reduction that was assessed to have a significant impact on the potential operation of HS2, the option was not taken forward.

6.6.16 Following further discussions with key stakeholders such as Staffordshire County Council and the Canals and Rivers Trust, it was evident that this option would be preferable despite still passing close to the Trent and Mersey Canal. As a result of these discussions, HS2 developed this option further by moving the route 250m towards the south-west, which balanced the operational performance of the railway with the proposals presented by the stakeholders.

6.6.17 As a result, the revised scheme has been developed which realigns the Handsacre link approximately 250m south-west of the original scheme to pass alongside the Trent and Mersey Canal with one crossing of the canal by the Manchester spur, instead of the original scheme alignment that crossed the canal three times.

Other route section main alternatives that were considered in the main ES

Configuration of connection to West Coast Main Line at Handsacre

6.6.18 The January 2012 announced route included the connection of HS2 to the inner pair (fast) of four tracks of the WCML at Handsacre. In order to implement this scheme, all the existing four tracks of the WCML would need to be relocated to provide adequate space for the HS2 connections. This would cause significant operational disruption to the WCML, as the majority of the junction construction works are adjacent to or within the WCML operating area.

6.6.19 Alternative options have been investigated to reduce the overall impact of the WCML connection, to reduce disruption to the WCML and, if possible, to provide a more cost-effective solution.

6.6.20 The following options were considered:

- Option A (January 2012 announced route) – HS2 would connect to the centre WCML (fast) tracks. It would be necessary to realign all four WCML tracks outwards to create sufficient space for the HS2 ramp and for construction. The realigned WCML lines would be lowered by approximately 1.5m in the area of the HS2 crossing;
- Option B – HS2 would connect to the central (fast) tracks of the WCML using an underpass. The WCML would be realigned asymmetrically, so only the two eastern tracks of the WCML would be moved horizontally by approximately 30m and raised. Most of the relocated WCML lines and the HS2 crossing could be constructed away from the operational railway before the tracks are realigned. In order to climb above the HS2 tracks, the new gradient for the WCML would prevent its use by freight;
- Option C – HS2 would connect to the central (fast) tracks of the WCML in a similar fashion to Option A. In this case the WCML would be realigned asymmetrically so only the two eastern up tracks of the WCML would be moved similar to Option B;
- Option D – HS2 would connect to the outer WCML (slow) tracks. No realignment of the WCML would be required. To achieve this, the northbound HS2 line would be required to cross all four WCML tracks on a skew crossing that would necessitate the construction of a bridge structure approximately 300m long. This structure would be constructed within the existing railway corridor during closures of the railway. This junction arrangement would require the link between HS2 Phase Two to Manchester and the WCML at Handsacre to be constructed on two separate embankments, rather than a pair of tracks on a single embankment, as in the announced route; and
- Option E – The layout of Option E would have direct HS2 connections to all four WCML tracks. This would allow the HS2 trains to join the slow and fast lines at 200kph without affecting the adjacent lines. The length of the structures over the WCML to achieve this would be approximately 350m. The WCML tracks would be realigned to allow construction of the structure which would have a major effect on WCML operations. The land required to

construct and operate the AP2 revised scheme would be significantly greater than the other options.

6.6.21 Option A would require the realignment of all four WCML tracks and would offer no other significant benefits over options which have less impact on the WCML.

6.6.22 Option B is not a viable option as it would restrict freight use on the WCML

6.6.23 Option C could be constructed with the least impact on the WCML. It would, however, have a greater land requirement on the east side of the route at the junction.

6.6.24 Option D would require a large structure to be constructed over the WCML and would require more railway night-time and weekend closures than Option C. The separation of the link between the main HS2 route and the WCML onto two separate viaducts would increase the environmental impacts on woodland affected by the Proposed Scheme.

6.6.25 Option E would provide the most flexibility for train routeing, but it would have the largest requirement for land and would cause the most disruption to WCML services and highest cost of all options.

6.6.26 Therefore Option C, with HS2 connecting to the inner (fast) tracks of the WCML and only the eastern WCML tracks being realigned, was taken forward for further development within the original scheme for the connection to the WCML at Handsacre.

Provision of grade-separated spur for Phase Two western leg to Manchester (Manchester spur)

6.6.27 The connection from London and Birmingham to Manchester and the North West requires a crossing over or under the HS2 main line to provide the required junction capacity and journey times. The January 2012 announced route for Phase One did not include details of the junction to Manchester. Phase Two work has developed the alignment for the Manchester spur.

6.6.28 The location is constrained by the line to the WCML at Handsacre, the proposed line of the Manchester spur, Fradley Park, the Trent and Mersey Canal and the grade-separated A38 Streethay junction.

6.6.29 The following options were considered for the horizontal alignment:

- Option A – The January 2012 announced route. This design would not include a fully coordinated grade-separated junction for Phase Two to Manchester. This option was developed with a junction at Handsacre connecting to the central lines of the WCML;
- Option H – This option would provide a grade-separated junction for Manchester as close as possible to the January 2012 announced route. The design would require two separate embankments for the tracks between the Phase Two Junction and the connection to the WCML; and
- Option L – This option would provide a grade-separated junction for Manchester using a single embankment on the link to the WCML and would require that the horizontal alignment was moved away from the January 2012

announced scheme by a maximum of about 200m.

6.6.30 Option A would not provide a fully coordinated grade-separated junction and was therefore discounted.

6.6.31 Option H would result in increased environmental impacts due to the increased width of the construction corridor for the twin embankments

6.6.32 Option L would provide the required grade-separated junction and would have less environmental impact than Option H.

6.6.33 Option L, using a single embankment on the link to the WCML, would have a lower capital cost and less of an impact on woodland and heritage conservation areas than the other options. Therefore, Option L was taken forward for further development within the original scheme for the grade-separated junction for Manchester.

Options to increase speed

6.6.34 The January 2012 announced scheme included approximately 12km of alignment with a running speed of 350kph. An opportunity was identified to reduce journey times between London and Manchester by increasing the running speed in this section. Other potential benefits were investigated within these options, including reducing the impact on businesses throughout the affected section.

6.6.35 A number of alternatives were considered by varying the horizontal alignment between the M42 crossing south of Middleton and the connection to the WCML. None of these options has been taken forward, on the basis of their provision of only marginal benefits in terms of speed gain against increased environmental and stakeholder/community impact and increased financial cost.

Options to mitigate Fradley business park impact

6.6.36 The aim of this options assessment was to reduce the environmental impacts and socio-economic effects on the existing and proposed commercial developments at Fradley Park. This family of options preserved the original January 2012 announced route up to the point where the AP2 revised scheme passes Rookery Lane at Hints, and varies thereafter:

- Option F – This option would realign the route away from Fradley Park, moving the alignment towards Streethay, and would require a raised crossing over the A38 and the demolition of Streethay Manor;
- Option G – This option would maintain the position of the crossing of the A38 but would continue to curve away from Fradley Park. This option would require a twin embankment between the junction for Phase Two and the WCML;
- Option M – Similar to Option G, with a modification to the alignment between the junction to the Manchester spur and Handsacre Junction to use a single embankment, in combination with a reduction in running speed for the link between the HS2 main line and the WCML; and
- Option N – A realignment that would avoid the Fradley Park existing and proposed developments while maintaining the location of the crossing of the A38 at the low point. This would also require an eastward realignment of the

route south of the A38.

6.6.37 Options F and G, which mitigate the business impacts at Fradley Park, were discounted due to their adverse impacts on Streethay community and the listed buildings and scheduled monument at Streethay Manor

6.6.38 Option N was discounted due to impacts and stakeholders concerns south of the A38.

6.6.39 Option M was subsequently compared against Option L from the alternatives considered in Provision of grade-separated spur for Phase Two western leg to Manchester (Manchester spur). Option M provides reduced impacts on woodland, listed structures and jobs compared to Option L and would be less expensive. These benefits outweighed the reduction in line speed on the link between HS2 and the WCML. Therefore, Option M, which maintains the position of the crossing of the A38 but would continue to curve away from the Fradley Park with the alignment between the junction to the Manchester spur and Handsacre Junction being modified to use a single embankment, in combination with a reduction in running speed for the link between the HS2 main line and the WCML, was taken forward for further development in the original scheme.

Arrangement of junction for Phase Two western leg to Manchester

6.6.40 The output from the route optioneering process described above resulted in Option M being taken forward for the development of the grade-separated junction work for Manchester. This option maintains the January 2012 announced route alignment for the crossing of the A38 but would continue to curve away from the Fradley Park. The alignment between the junction to Manchester and Handsacre Junction was modified to use a single embankment, in combination with a reduction in running speed for the link between the HS2 main line and the WCML.

6.6.41 The following sub-options were considered for the vertical profile of the junction:

- Sub-option (i) – Handsacre link over HS2 main line to Manchester. For this option the main line to Manchester would be lowered as much as practicable to achieve minimum clearance over the Trent and Mersey Canal; and
- Sub-option (ii) – Handsacre link under the HS2 main line to Manchester. The line from Handsacre would be lowered as much as practicable to achieve minimum clearance over the Trent and Mersey Canal. The main line to Manchester would be raised to pass over the link to Handsacre at a higher alignment.

6.6.42 Sub-option (i) would be less expensive and would provide environmental benefits over Sub option (ii), due to the reduced height of the high speed lines and was, therefore, taken forward for further development within the original scheme for the grade-separated junction for Manchester (Phase Two).

Extent of the Manchester spur

6.6.43 It would be very expensive and disruptive to make connections for Phase Two to the Phase One route after the railway becomes operational because the works would have to be undertaken in a combination of short night-time periods and more

extensive line closures. An interface point between the two phases was therefore investigated along the spur to Manchester.

6.6.44 The general principle behind the interface point was for it to be located in order to enable Phase Two to be constructed without adversely affecting the operation of Phase One.

6.6.45 In addition to the grade-separated bridge and lines through the junction, the junction spur would comprise an elevated section of the route, which would extend to a point around 150 metres north of the Trent and Mersey Canal crossing. Around 200 metres of embankment would be built between the Phase One line and the canal, because access to this area for construction would be difficult near the operational Phase One railway. The canal crossing would also be constructed, as the Phase One main line already involves two crossings of the canal nearby and it would avoid repeated disruption if the third crossing in the area for Phase Two is completed at the same time. Around a further 150 metres of the route would be constructed north of the canal to avoid repeated impacts to adjacent woodlands by both Phase One and Two.

6.6.46 Therefore, an interface point for the junction for the Manchester spur, which would extend to a point around 150 metres north of the Trent and Mersey Canal crossing, has been taken forward for further development within the original scheme for the grade-separated spur for Manchester (Phase Two).

7 Agriculture, forestry and soils

7.1 Introduction

7.1.1 This section of the report provides a description of the environmental baseline in relation to agriculture, forestry and soils and an assessment of the likely impacts and significant effects as a result of the construction and operation of the AP2 revised 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.

7.2 Scope, assumptions and limitations

7.2.1 The assessment scope, key assumptions and limitations for agriculture, forestry and soils are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES.

7.3 Environmental baseline

Existing baseline

7.3.1 This section sets out the main baseline features that influence the agricultural and forestry use of land within the Whittington to Handsacre 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

7.3.2 The main topographical features within the study area are described in detail in the landscape and visual assessment (Section 13). The proposed route through this area extends northwards from the A51 Tamworth Road at Whittington Heath over dissected sandstone country, falling from 100m AOD on the Whittington Heath Golf Club to 65m AOD on the floodplain of the River Trent near Huddlesford. From there, the route proceeds north-westwards across lowlands at 65m to 75m AOD before rising slightly west of Bourne Brook.

7.3.3 Drainage is served by north-east flowing brooks at Huddlesford and branches of the Mare Brook around Streethay which are tributaries of the River Tame. Further west, the Curborough and Bourne Brooks, fed by numerous smaller brooks and drains, flow towards the River Trent, to the north of Handsacre.

Geology and soil parent materials

7.3.4 The main geological features are described in detail in Land quality (Section 12) and summarised in SES and AP2 ES, Volume 5: Appendix AG-001-022.

7.3.5 Superficial deposits intermittently underlie the AP2 revised scheme. The AP2 revised scheme will pass through the following:

- River Terrace Deposits (sands and gravels) surround a surface watercourse to the south-west of Fradley Park;
- Glaciofluvial Sheet Deposits (comprising sand and gravel with lenses of clay, silt and organic material) underlie the AP2 revised scheme almost continuously, from Gorse Farm at Fradley to the northern end of the study area;
- narrow strips of alluvium (comprising clay, silt, sand and gravel) are present around the channel of an unnamed brook located between Mill Farm and the Wyrley and Essington Canal and also around Pyford/Curborough Brook situated to the north-west of Fradley Park; and
- Head Deposits, variably comprising clay, silt, sand and gravel resulting from downslope movement, are present to the north of Streethay.

7.3.6 Bedrock of the Triassic period underlies the AP2 revised scheme. The Sherwood Sandstone Group (comprising the Bromsgrove Sandstone Formation and Kidderminster Formation) comprises pebbly, gravelly sandstone and is present from the southern end of the study area to an area south of Hill Farm and Streethay. The Mercia Mudstone Group, described as red and green-grey mudstones and subordinate siltstones with widespread thin beds of gypsum/anhydrite, underlies the AP2 revised scheme from south of Hill Farm at Streethay to the northern end of the study area.

Description and distribution of soil types

7.3.7 The characteristics of the soils are described by the Soil Survey of England and Wales[7] and shown on the National Soil Map[8]. More detailed published information is also available for part of the area[9]. The soils are grouped into associations of a range of similar soil types. They are described in more detail in the main ES Volume 5 and their distribution is shown on Map AG-02-022 (Volume 5, Agriculture, Forestry and Soils Map Book of the main ES). The soils throughout this area are variable, according to the topography and geology.

7.3.8 The Bromsgrove association is mapped on part of the Bromsgrove Sandstone Formation between Darnford Lane, Whittington and the A38 at Streethay. The dominant soil type is a free-draining, reddish sandy loam topsoil over sandstone, at depth in places, i.e. Wetness Class[10] (WC) I. There are some sandy loams with slowly permeable subsoils of siltstone and sandstone that experience slight seasonal waterlogging (WC II).

7.3.9 The Bridgnorth association has well-drained (WC I), sandy loam and loamy sand soils over soft sandstone, at depth in some places. It occurs in the south of the area on Whittington Heath, on the Kidderminster Formation.

[7] Soil Survey of England and Wales (1984), Soils and their Use in Midland and Western England, Bulletin 12.
[8] Cranfield University (2001), The National Soil Map of England and Wales 1:250,000 scale, National Soil Resources Institute, Cranfield University, UK.
[9] Hollis, John (2001), Soils in Staffordshire IV Sheet SK00/10 (Lichfield); Rothamsted Experimental Station.
[10] The Wetness Class (WC) of a soil is classified in Appendix II of Hodgson, J.M. (1977), The Soil Survey Field Handbook. Soil Survey and Land Research Centre, Technical Monograph No.5, according to the depth and duration of waterlogging in the soil profile and has six bands ranging from Wetness Class I (well drained) to Wetness Class VI (permanently waterlogged).

7.3.10 Deep sandy loam and loamy sand soils of the Newport 1 association occur in glacial river sand and gravel deposits at the north-western end of the study area from Bourne Brook to Handsacre. The soils are described as well drained (WC I), but a soil survey for this project shows that there are some soils there with slowly permeable clay and clay loam layers in the subsoil that cause seasonal waterlogging (WC II).

7.3.11 Small parts of the area cross soils of the similar Brockhurst 1 and Clifton associations; the former developed on mudstones with thin superficial drift west of Huddlesford and the latter west of Hilliard's Cross in deep reddish light and medium loamy drift. Topsoils and upper subsoils tend to be medium clay loams or medium silty clay loams, but the slowly permeable clay or clay loam lower subsoil causes most soils to be seasonally waterlogged (WC III to IV).

7.3.12 On the low ground between Fradley and Bourne Brook, there are deep permeable sandy loams over loamy sands and sands of the Blackwood association. In their natural state these soils have high groundwater levels, but these are now largely controlled by ditches (WC II to III).

7.3.13 Soils on the river terrace deposits in the Mare Brook catchment north and east of Streethay include deep permeable sandy loams over loamy sands and sands of the Wigton Moor association. They are variably affected by groundwater (WC I to III).

7.3.14 Narrow strips of alluvial soils beside the brooks are too small in extent to be distinguished on the published soil maps.

Soil and land use interactions

Agricultural land quality

7.3.15 The principal soil/land use interaction in the study area is the quality of the agricultural land resource. The Agricultural Land Classification (ALC)[11] is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the site.

7.3.16 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. There are three distinct soil characteristics within the Whittington to Handsacre area. The main soil characteristics are sandy loams over loamy sands and sands, in some places stony, over sandstone of the Kidderminster and Bromsgrove Sandstone Formations (Bromsgrove, Bridgnorth and Newport 1 associations). Soil depth is a limitation where hard sandstone occurs at shallow depths. Poor soil structure occurs in slowly permeable subsoils that have developed on mudstones (Brockhurst 1 and Clifton associations). Finally, there are fluctuating groundwater levels in permeable soils in valleys and the extensive, low-lying spread of glaciofluvial deposits (Blackwood and Wigton Moor associations).

7.3.17 Climate in this part of England does not in itself place any limitation upon land quality but the interactions of climate with soil characteristics are important in determining the wetness and droughtiness limitations of the land. The influence of climate on soil

[11] Ministry of Agriculture, Fisheries and Food (1988), Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land.

wetness is assessed by reference to median field capacity days when the soil moisture deficit is zero, soil WC and topsoil texture. Droughtiness is determined by comparing the available water capacity of the soil, adjusted for the crop, with the moisture deficit for the locality for two crops: winter wheat and potatoes.

7.3.18 The local climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at two points within the community forum area, set out in SES and AP2 ES, Volume 5: Appendix AG-001-022. Field capacity days range from 154 to 166 days, which is slightly above the average for lowland England (150 days). This is considered to be quite favourable for providing opportunities for agricultural cultivations and soil handling.

7.3.19 The assessment of site factors is primarily concerned with the way in which topography influences the use of agricultural machinery and, hence, the cropping potential of land. Gradient and micro relief, with complex changes of slope angle or direction over short distances, are not considered limiting in the study area. Flooding may occur on some narrow floodplains of brooks (such as the Bourne Brook) but its very small extent and limited frequency means it is not significant in terms of ALC.

7.3.20 The principal limiting factors determining agricultural land quality in this area are soil wetness and soil droughtiness. Overall, the assessment of agricultural land required for constructing and operating the AP2 revised scheme in this CFA indicates that almost 88% is in the best and most versatile (BMV) category, predominantly in Subgrade 3a (60%) with a smaller proportion of Grade 2 (28%). Grade 2 mainly occurs south of Streethay and south-east of Handsacre, on sandy loam soils of the Bromsgrove and drained parts of the Blackwood associations.

7.3.21 The remaining 12% of agricultural land is lower quality Subgrade 3b, found on the heavier, more clayey land (Clifton and Brockhurst 1 associations) west of Huddlesford and Hilliard's Cross. Full details of the ALC are provided in SES and AP2 ES, Volume 5: Appendix AG-001-022 and the ALC grading is shown on SES and AP2 ES Map AG-01-061b to Map AG-01-65 (Volume 5).

7.3.22 Department for Environment, Food and Rural Affairs (Defra) mapping[12] shows that there is generally a high likelihood of encountering BMV land in the locality, which makes such land a resource of low sensitivity in this study area.

Other soil interactions

7.3.23 Soil fulfils a number of functions and services for society in addition to those of food and biomass production, which are central to social, economic and environmental sustainability. These are outlined in sources such as the Soil Strategy for England[13] and The Natural Choice: securing the value of nature[14], and include:

- the storage, filtration and transformation of water, carbon and nitrogen in the biosphere;
- support of ecological habitats, biodiversity and gene pools;

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

- support for the landscape;
- protection of cultural heritage;
- providing raw materials; and
- providing a platform for human activities, such as construction and recreation.

7.3.24 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 11, Ecology.

7.3.25 The Environment Agency Flood Zone mapping (Environment Agency website, 2015) indicates four main areas, within the land required for construction or operation of the AP2 revised scheme, to be at risk from river flooding. These are associated with the River Tame, Mare Brook, Curborough Brook and a tributary of Bourne Brook, as set out in Section 17 Water resources and flood risk assessment. Flood Zone mapping shows there to be a risk of flooding in this area, with the soils functioning as water stores for flood attenuation, as well providing a habitat for ecology.

7.3.26 The presence of soil-borne cultural assets is detailed in Section 10. The study area includes evidence of human occupation and activity from a range of periods, including cropmark evidence of settlement and farming from the later prehistoric to Roman periods; early medieval and medieval moated sites, mills and deserted villages; estates and farmsteads of the 18th and 19th centuries; and notable military sites of the 19th and 20th centuries.

Land use

Land use description

7.3.27 Agricultural land use is a mixture of combinable arable and grassland, but dominated by arable. The principal arable crop is wheat and there is one fruit growing enterprise. Livestock include sheep, beef and dairy cattle.

7.3.28 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone (NVZ), which is an area in which nitrate pollution is a potential problem. Statutory land management measures apply which seek to reduce nitrogen losses from agricultural sources to water. Some agricultural land is also subject to management prescriptions associated with the Environmental Stewardship Scheme which seeks either generally (the Entry Level Scheme) or specifically (the Higher Level Scheme) to retain and enhance the landscape and biodiversity qualities and features of farm land. Holdings which have land entered into an agri-environment scheme are identified in Table 10.

7.3.29 Stands of woodland include Fulfen Wood in the south, Big and Little Lyntus Woods just north of Curborough, and Brokendown Wood, Ravenshaw Woods, Black Slough and Vicar's Coppice in the north. Woodland is often situated on low ground affected by high groundwater (Blackwood association). Woodland covers 5% of land in occasional stands of small woods within the study area, compared to the national average of 10%. Therefore, the sensitivity of the forestry land resource is high.

Number, type and size of holdings

7.3.30 There are 38 holdings in the study area, as set out in Table 10. The boundaries of the holdings are shown on Maps AG-01-061B to AG-01-065 (Volume 5 of the SES and AP2 ES) along with the location of the main farm buildings. Ten are mixed arable and livestock, four are mainly livestock (sheep and cattle), eight are mainly arable and two are general cropping enterprises with potatoes in the rotation. There is one non-commercial equestrian-based holding. Seven holdings are woodland and four are given over to grassland. For the remainder, there is one dairy and one fruit farm (with irrigation and polytunnels). The holdings range in size from 0.7ha to 1618.8ha. The larger farms are either mixed arable with livestock, or mainly arable. The smallest holding is permanent grassland. The seven woodlands vary between 2.5ha and 43.5ha.

7.3.31 There is one agricultural holding called Freeford Manor (CFA21/15) which is affected by the original scheme as reported in the Volume 2 CFA report for Drayton Bassett, Hints and Weeford community forum area (CFA21). It is a mixed arable and livestock enterprise, including dairy, which extends to 402.7ha. It is assessed as being of high sensitivity. The main farm buildings are located in CFA21 but some of the land within this holding extends into CFA22.

7.3.32 Table 10 sets out the sensitivity of individual holdings to change, which is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, can better absorb impacts and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) and irrigation systems are less able to accommodate change and have a higher sensitivity. Smaller (less intensively used) units, such as pony paddocks associated with residential properties, have a low sensitivity.

Table 10: Summary of characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA22/1 Fulfen Farm	Mainly arable	71.6	Golf Course	ELS	Medium
CFA22/2 Land off Capper's Lane A	Grassland	18.7	Equestrian (commercial)	None	Medium
CFA22/3 Huddlesford House Farm	Mixed arable and livestock (including dairy)	323.8	None	ELS	High Dairy
CFA22/4 Hill Farm Streethay	Mixed arable and livestock	28.3	Residential let	ELS	Medium
CFA22/5 Streethay Farm*	Mixed arable and livestock	32.5	Equestrian (commercial); Airfield; Commercial and industrial building lets in the	ELS	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
			farm complex		
CFA22/6 Streethay House Farm*	Mainly arable	91.7	Not known	None	Medium
CFA22/7 Curborough House Farm	Mainly arable	172.0	Equestrian (commercial); storage; sporting: car sprint course; sporting: model airplane club	None	Medium
CFA22/8 Curborough Farm	Mixed arable and livestock (sheep and cattle)	272.0	Tea rooms; craft centre; sporting: fishing lakes (100 pegs); 27 non-agricultural business lets	ELS	High Irrigation
CFA22/9 Big Lyntus Wood*	Woodland	6.7	Not known	None	Medium
CFA22/10 Land around Fradley Wood	Mixed arable and livestock	1618.8	Residential let	ELS	High Irrigation
CFA22/12 Ravenshaw Wood (East)	Woodland	15.0	None	None	Low
CFA22/13 Black Slough Farm	Mainly livestock (dairy)	56.0	None	ELS	High Dairy
CFA22/14 Ravenshaw Wood (West)	Woodland	12.0	None	None	Low
CFA22/15 Hanchwood	Mixed arable and livestock	121.4	Commercial shoot	ELS and HLS	High Irrigation
CFA22/16 Brownfields Farm	Mixed arable and livestock	283.3	None	ELS	High Irrigation
CFA22/17 Hunts Farm	Mixed arable and livestock	32.4	None	ELS and HLS	Medium
CFA22/18 New Farm, Elmhurst	Horticulture - fruit grower	33.1	Processing and packing facility	ELS	High Horticulture
CFA22/19 Ashton Hayes Farm	Mixed arable and livestock	16.2	None	ELS	Medium
CFA22/20 Tuppenhurst Field	General cropping (cereals and	6.9	None	ELS	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
	potatoes)				
CFA22/21 Tuppenhurst Farm	Mainly arable	303.5	Agricultural contracting	ELS	Medium
CFA22/24 Brokendown Wood*	Woodland	4.8	Not known	None	Medium
CFA22/27 Land on NE side of Marsh Lane*	Mainly livestock (sheep)	1.9	Not known	None	Medium
CFA22/28 Whittington Hill Farm	Equestrian (non-commercial)	4.5	None	None	Low
CFA22/29 Vicar's Coppice	Woodland	7.7	Recreational: paintballing	None	Low
CFA22/30 Fradley Wood	Woodland	43.5	None	Woodland Grant, ELS	Low
CFA22/31 Land adjacent to Fulfen Farm*	Grassland	3.4	Not known	None	Medium
CFA22/32 Land adjacent to Easthill House*	Woodland	2.5	Not known	None	Medium
CFA22/36 Land adjacent to Rileyhill Farm*	General cropping (cereals and potatoes)	23.1	Not known	None	Medium
CFA22/40 Hanch Hall Farm*	Mainly livestock (cattle and sheep)	21.0	Not known	ELS	Medium
CFA22/41 Land off Capper's Lane B*	Mainly livestock (sheep)	7.2	Not known	None	Medium
CFA22/42 Land to the north and south of Mill Farm*	Grassland	2.8	Not known	None	Medium
CFA22/43 Land to the west of Mill Farm*	Grassland	0.7	Not known	None	Medium
CFA22/44	Mainly livestock	22.9	Equestrian (commercial)	ELS	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
Fulbrook Farm*	(cattle and sheep)				
CFA22/45 Corporation Farm*	Mainly arable	36.5	Not known	None	Medium
CFA22/46 Land on the east side of Lysways Lane (A)*	Mainly arable	5.3	Not known	None	Medium
CFA22/47 Land to the east of Stafford Road (A)*	Mixed arable and livestock (sheep and cattle)	208.8	Not known	ELS	Medium
CFA22/48 Land to the east of Stafford Road (B)*	Mainly arable	3.1	Not known	None	Medium
CFA22/49 Land on the east side of Lysways Lane (B)*	Mainly arable	2.4	Not known	None	Medium

* No farm impact assessment interview conducted; data estimated.

Future baseline

Construction (2017)

7.3.33 SES and AP2 ES, Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017, additional to those reported in the main ES (Volume 5: Appendix CT-004-000).

7.3.34 None of the identified developments (Streethay and Fradley) affect the assessment of the AP2 revised scheme's likely construction impacts on agriculture, forestry and soils.

7.3.35 Most existing Environmental Stewardship agreements will expire in 2015 and be replaced by a new environmental land management scheme (Countryside Stewardship) which is voluntary. It is more targeted than previous schemes, with its priorities being to protect and enhance biodiversity and water quality.

7.3.36 The widespread basic environmental management associated with Entry Level Stewardship will be replaced effectively by a new concept of greening introduced by Common Agricultural Policy reform, which will now be the main means by which farmers will provide environmental benefits in return for their direct support payments. Greening will encourage the retention of permanent grasslands, greater crop diversification and the creation of Ecological Focus Areas. These changes will affect the detailed management of individual farm holdings but are not expected to change fundamentally the baseline circumstances described.

Operation (2026)

7.3.37 SES and AP2, ES Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026, additional to those reported in the main ES (Volume 5: Appendix CT-004-000).

7.3.38 None of the identified developments affects the assessment of the AP2 revised scheme's likely operational impacts on agriculture, forestry and soils.

7.4 Effects arising during construction

Avoidance and mitigation measures

7.4.1 During the development of the design, the following measures have been incorporated to avoid or mitigate impacts on agriculture, forestry or soils during construction. Access across the Hs2 alignment for agricultural vehicles will be provided by:

- underbridges at Lichfield Road (182-S2) and A515 Lichfield Road (190-S2);
- overbridges at Darnford Lane (182-S4), realigned Capper's Lane (183-S4), Streethay Footpath 6 (184-S5) and Wood End Lane (188-S4); and
- viaduct at Capper's Lane (183-L2).

7.4.2 Additional access for agricultural vehicles will be provided by a new public highway (Tuppenhurst Lane) between A515 Lichfield Road and Shaw Lane.

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

7.4.4 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.

7.4.5 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 main ES, Volume 5: Appendix CT-003-000/1):

- the reinstatement of agricultural land which is used temporarily during construction to agriculture, where this is the agreed end use (draft CoCP, Section 6);
- the provision of a method statement for stripping, handling, storing and replacing agricultural and woodland soils to reduce risks associated with soil degradation on areas of land to be returned to agriculture and woodland following construction, based on detailed soil survey work to be undertaken prior to construction. This will include any remediation measures necessary following the completion of works (draft CoCP, Section 6);
- a requirement for contractors to monitor and manage flood risk and other extreme weather events which may affect agriculture, forestry and soil resources during construction (draft CoCP, Section 6);
- 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

7.4.6 The cessation of existing land uses will be required, not only on the land on which permanent works will be sited, but also on the land used temporarily to facilitate the construction of those permanent works.

7.4.7 The land required for the construction of the AP2 revised 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 loss of, or disruption to, buildings and operational infrastructure such as drainage. The scheme design seeks, however, to minimise this disruption, and to incorporate inaccessible severed land as part of environmental mitigation works.

7.4.8 The timing and duration of various construction elements are set out in Section 6.3. Where land is restored to agricultural use, it will be subject to a further period of five years of managed aftercare to ensure stabilisation of the soil structure, where appropriate.

7.4.9 Land used for the construction of the AP2 revised scheme will fall into a number of categories when work is complete, as follows:

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

Temporary effects during construction

Impacts on agricultural land

7.4.10 During the construction phase, the total area of agricultural land required will be 245.8ha as shown in Table 11. Of this total, 70.7ha will be restored and available for agricultural use following construction.

Table 11: Agricultural land required for the construction of the AP2 revised scheme

Agricultural land quality	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Grade 1	0.0	0%	0.0
Grade 2	69.3	28%	22.3
Subgrade 3a	148.5	60%	45.0
BMV SUBTOTAL	**217.8**	**89%**	**67.3**
Subgrade 3b	28.0	11%	0.2
Grade 4	0.0	0%	0.0
Grade 5	0.0	0%	0.0
TOTAL AGRICULTURAL LAND	245.8	100%	67.5

7.4.11 The disturbance during construction to 217.8ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% (in this case 89%) of the overall agricultural land requirement. Considering BMV land in this local area is a receptor of low sensitivity, the effect on BMV land is assessed as a moderate adverse effect of the AP2 revised scheme, which is significant.

7.4.12 Following completion of construction, all temporary facilities will be removed and the topsoil and subsoil will be reinstated in accordance with the agreed end use for the land. Overall, it is estimated that there will not be any significant surplus of topsoil or subsoil material arising from the AP2 revised scheme in the area.

Nature of the soil to be disturbed

7.4.13 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 AP2 revised 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.

7.4.14 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as Defra's Code of Practice for the Sustainable Use of Soils[15]. These principles will be

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

followed throughout the construction period. The heavier (clayey and silty) Brockhurst 1 association is least able to retain its structure when moved in wet conditions or by inappropriate equipment. The soils are susceptible to compaction and smearing, which could impede successful reinstatement.

Impacts on holdings

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

7.4.16 The effects of the AP2 revised scheme on individual agricultural and related interests during the construction period are summarised in Table 13. 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 and Appendix AG-001-022, Volume 5 of the main ES.

7.4.17 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-001-022 of the SES and AP2 ES. Where the total sum of the land required by ALC grade (as shown in Table 11) differs from the total sum of the land required by holding (as shown in Table 12), the difference is because some holdings are affected in more than one CFA and some holdings include non-agricultural land. The combined impact on holdings is reported once in the CFA where the main holding is located.

Table 12 Summary of temporary effects on holdings during construction

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22/1 Fulfen Farm	16.6ha - 23% High	Negligible	Low	Major/Moderate Adverse	11.5ha
CFA22/2 Land off Capper's Lane A	6.2ha - 33% High	Medium	Low	Major/Moderate Adverse	0.1ha
CFA22/3 Huddlesford House Farm	16.1ha - 5% Negligible	Negligible	Low	Moderate Adverse	9.1ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22/4 Hill Farm Streethay	10.8ha - 38% High	Low	Low	Major/Moderate Adverse	3.0ha
CFA22/5 Streethay Farm*	7.7ha - 24% High	Negligible	High	Major/Moderate Adverse	2.5ha
CFA22/6 Streethay House Farm*	10.4ha - 11% Medium	Medium	Low	Moderate Adverse	0.7ha
CFA22/7 Curborough House Farm*	37.5ha - 22% High	Medium	Low	Major/Moderate Adverse	0.2ha
CFA22/8 Curborough Farm	33.8ha - 12% Medium	Medium	Low	Major/Moderate Adverse	3.8ha
CFA22/9 Big Lyntus Wood	0.8ha - 12% Medium	Negligible	Low	Moderate Adverse	0.0ha
CFA22/10 Land around Fradley Wood	1.5ha - 0% Negligible	Negligible	Negligible	Minor Adverse	0.0ha
CFA22/12 Ravenshaw Wood (East)	1.7ha - 11% Medium	Medium	Low	Minor Adverse	0.0ha
CFA22/13 Black Slough Farm	26.1ha - 47% High	Medium	Medium	Major Adverse	5.4ha
CFA22/14 Ravenshaw Wood (West)	1.5ha - 12% Medium	Negligible	Low	Minor Adverse	0.0ha
CFA22/15 Hanchwood	15.4ha - 13% Medium	Medium	High	Major Adverse	3.9ha
CFA22/16 Brownfields Farm	20.1ha - 7% Low	Medium	Low	Major/Moderate Adverse	2.6ha
CFA22/17 Hunts Farm	17.7ha - 55% High	Negligible	Low	Major/Moderate Adverse	13.4ha
CFA22/18 New Farm, Elmhurst	4.4ha - 13% Medium	Negligible	Medium	Major/Moderate Adverse	0.6ha
CFA22/19 Ashton Hayes Farm	4.5ha - 28% High	Negligible	Low	Major/Moderate Adverse	0.1ha
CFA22/20 Tuppenhurst Field	5.5ha - 80% High	Negligible	Low	Major/Moderate Adverse	0.6ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22/21 Tuppenhurst Farm	1.1ha - 0% Negligible	Negligible	Low	Minor Adverse	1.1ha
CFA22/24 Brokendown Wood*	2.3ha - 47% High	Low	Low	Major/Moderate Adverse	0.0ha
CFA22/27 Land on NE side of Marsh Lane*	0.5ha - 26% High	Negligible	Low	Major/Moderate Adverse	0.2ha
CFA22/28 Whittington Hill Farm	2.7ha - 61% High	Medium	Medium	Moderate Adverse	0.0ha
CFA22/29 Vicar's Coppice	0.5ha - 6% Low	Negligible	Low	Negligible	0.2ha
CFA22/30 Fradley Wood	2.4ha - 6% Low	Negligible	Low	Negligible	0.0ha
CFA22/31 Land adjacent to Fulfen Farm*	0.3ha - 10% Low	Negligible	Negligible	Minor Adverse	0.0ha
CFA22/32 Land adjacent to Easthill House*	0.5ha - 21% High	Negligible	Low	Major/Moderate Adverse	0.0ha
CFA22/36 Land adjacent to Rileyhill Farm*	0.7ha - 3% Negligible	Low	Negligible	Minor Adverse	0.7ha
CFA22/40 Hanch Hall Farm*	3.9ha - 19% Medium	Low	Low	Moderate Adverse	3.8ha
CFA22/41 Land off Capper's Lane B*	4.8ha - 23% High	Negligible	Low	Major/Moderate Adverse	0.7ha
CFA22/42 Land to the north and south of Mill Farm*	2.1ha - 75% High	Negligible	Low	Major/Moderate Adverse	0.4ha
CFA22/43 Land to the west of Mill Farm*	0.7ha - 100% High	Low	Low	Major/Moderate Adverse	0.0ha
CFA22/44 Fulbrook Farm*	1.4ha - 6% Low	Negligible	Low	Minor Adverse	1.4ha
CFA22/45 Corporation Farm*	0.6ha - 2% Negligible	Negligible	Low	Minor Adverse	0.6ha
CFA22/46 Land on the east side of Lysways Lane (A)*	0.9ha - 18% Medium	Negligible	Low	Moderate Adverse	0.9ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22/47 Land to the east of Stafford Road (A)*	0.3ha - 0% Negligible	Negligible	Low	Minor Adverse	0.3ha
CFA22/48 Land to the east of Stafford Road (B)*	0.2ha - 6% Low	Negligible	Low	Minor Adverse	0.2ha
CFA22/49 Land on the east side of Lysways Lane (B)*	0.2ha - 10% Low	Negligible	Low	Minor Adverse	0.2ha

* No farm impact assessment interview conducted; data estimated.

7.4.18 Overall, it is considered that 25 holdings will experience major, major/moderate or moderate temporary adverse effects during construction, which are significant. Most of these enterprises experience a significant effect because a high proportion of the holding is required for construction. Severance or disruptive effects caused by construction trigger significant temporary adverse effects on the other holdings.

7.4.19 There are three farm enterprises which are potentially sensitive to noise or vibration emitted during the construction phase. These are Streethay Farm (CFA22/5), Black Slough Farm (CFA22/13) and Whittington Hill Farm (CFA22/28) where horse paddocks or stables are close to construction. Dust generated by construction could potentially affect high-value horticultural crops at New Farm Elmhurst (CFA22/18). There are potential safety issues associated with commercial shoot activities at Hanchwood (CFA22/15) which will require careful management during construction. Compliance with the CoCP will avoid or reduce such environmental impacts during construction.

7.4.20 The AP2 revised scheme requires 29.2 ha of land within CFA21/15 (7% of the holding) temporarily during construction. As a result of constructing the AP2 revised scheme, access to some agricultural land on the holding will be via a public highway rather than a private way. This is an impact of medium magnitude. Overall, the effect of the AP2 revised scheme on this holding is major / moderate adverse, which is significant.

Permanent effects from construction

7.4.21 Land used for the construction of the AP2 revised 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.

7.4.22 Following construction and restoration, the area of agricultural land that will remain permanently required will be 178.3ha, as shown in Table 13.

Table 13: Agricultural and forestry land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land
Grade 1	0.0	0%
Grade 2	47.0	26%
Subgrade 3a	103.5	58%
BMV SUBTOTAL	**150.5**	**84%**
Subgrade 3b	27.8	16%
Grade 4	0.0	0%
Grade 5	0.0	0%
TOTAL	178.3	n/a
Forestry land	19.7	n/a

7.4.23 The permanent loss of 150.5ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement. As stated previously, BMV land in this area is a receptor of low sensitivity so that the permanent effect on BMV land is assessed as a moderate adverse effect of the AP2 revised scheme, which is significant.

7.4.24 Areas proposed for ecological and landscape mitigation, which will be removed from mainstream agricultural production, include (from south to north): woodland habitat creation near the Darnford Lane overbridge and the Wyrley and Essington Canal (CFA22/2, CFA21/15, and CFA22/28); woodland habitat creation on CFA22/3 and grassland habitat creation on CF22/1 near the WCML (CFA22/3); woodland habitat creation near the A38 (CFA22/5 and CFA22/6); grassland habitat creation to the north of Curborough on CFA22/7; woodland habitat creation near Little Lyntus wood on CFA22/7; woodland habitat creation near Ravenshaw Wood on CFA22/8, CFA22/11 and CFA22/12; woodland habitat creation near Black Slough on CFA22/13; woodland habitat creation near Vicar's Coppice on CFA22/16; and woodland habitat creation near Shaw Lane on CFA22/15 and CFA22/19.

7.4.25 There will be no agricultural land engineered to provide flood compensation capacity in the Whittington to Handsacre area.

7.4.26 Areas of woodland that will be permanently affected include Fulfen Wood in the south, Big and Little Lyntus Wood just north of Curborough, and Brokendown Wood, Ravenshaw Wood, and Black Slough Wood in the north. Overall, the total amount of forestry land required to implement the AP2 revised scheme will be 19.7ha, out of the total permanent land area required for the operation of the AP2 revised scheme in this CFA of 341.0ha (6%). The extent of the forest cover in the study area is less than the average national woodland cover and so, quantitatively, the loss of this woodland is significant. The qualitative assessment of loss is addressed in the ecology (Section 11) and landscape and visual assessment (Section 13) sections.

Impacts on holdings

7.4.27 The permanent residual effects from the construction of the AP2 revised scheme on individual agricultural and related interests is summarised in Table 14. The 'land required' column refers to the area of land permanently required to operate the AP2 revised scheme (in absolute terms and as a percentage of the overall area farmed). The degree of impact is based on the proportion of land required. The effects of severance are judged on the ease and availability of access to severed land once construction is completed and the impact on farm infrastructure refers mainly to the loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises. Full details of the nature and scale of effects are set out in SES and AP2 ES, Volume 5: Appendix AG-001-022.

Table 14: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA22/1 Fulfen Farm	5.2ha - 7% Low	Medium	Negligible	Moderate Adverse
CFA22/2 Land off Capper's Lane A	6.1ha - 33% High	Low	Low	Major/Moderate Adverse
CFA22/3 Huddlesford House Farm	7.0ha - 2% Negligible	High	Negligible	Major Adverse
CFA22/4 Hill Farm Streethay	7.7ha - 27% High	Low	Low	Major/Moderate Adverse
CFA22/5 Streethay Farm*	5.2ha - 16% Medium	Low	Low	Moderate Adverse
CFA22/6 Streethay House Farm*	9.7ha - 11% Medium	Medium	Negligible	Moderate Adverse
CFA22/7 Curborough House Farm*	37.3ha - 22% High	Medium	Low	Major/Moderate Adverse
CFA22/8 Curborough Farm	30.0ha - 11% Medium	Medium	Negligible	Major/Moderate Adverse
CFA22/9 Big Lyntus Wood	0.8ha - 12% Medium	Negligible	Negligible	Moderate Adverse
CFA22/10 Land around Fradley Wood	1.5ha - 0% Negligible	Negligible	Negligible	Minor Adverse
CFA22/12 Ravenshaw Wood (East)	1.7ha - 11% Medium	Medium	Negligible	Minor Adverse
CFA22/13 Black Slough Farm	20.7ha - 37% High	Medium	Low	Major Adverse

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA22/14 Ravenshaw Wood (West)	1.5ha - 12% Medium	Negligible	Negligible	Minor Adverse
CFA22/15 Hanchwood	11.5ha - 9% Low	Medium	Low	Major/Moderate Adverse
CFA22/16 Brownfields Farm	17.5ha - 6% Low	Medium	Low	Major/Moderate Adverse
CFA22/17 Hunts Farm	4.3ha - 13% Medium	Negligible	Low	Moderate Adverse
CFA22/18 New Farm, Elmhurst	3.8ha - 11% Medium	Negligible	Medium	Major/Moderate Adverse
CFA22/19 Ashton Hayes Farm	4.4ha - 27% High	Negligible	Low	Major/Moderate Adverse
CFA22/20 Tuppenhurst Field	4.9ha - 71% High	Negligible	Low	Major/Moderate Adverse
CFA22/21 Tuppenhurst Farm	0.0ha - 0% Negligible	Negligible	Low	Minor Adverse-
CFA22/24 Brokendown Wood*	2.3ha - 47% High	Low	Negligible	Major/Moderate Adverse
CFA22/27 Land on NE side of Marsh Lane*	0.3ha - 16% Medium	Negligible	Negligible	Moderate Adverse
CFA22/28 Whittington Hill Farm	2.7ha - 61% High	Medium	Low	Moderate Adverse
CFA22/29 Vicar's Coppice	0.3ha - 3% Negligible	Negligible	Negligible	Negligible
CFA22/30 Fradley Wood	2.4ha - 6% Low	Negligible	Negligible	Negligible
CFA22/31 Land adjacent to Fulfen Farm*	0.3ha - 9% Low	Negligible	Negligible	Minor Adverse
CFA22/32 Land adjacent to Easthill House*	0.5ha - 21% High	Negligible	Negligible	Major/Moderate Adverse
CFA22/36 Land adjacent to Rileyhill Farm*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA22/40 Hanch Hall Farm*	0.1ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/41 Land off Capper's Lane B*	4.1ha - 20% Medium	Negligible	Negligible	Moderate Adverse
CFA22/42 Land to the north and south of Mill Farm*	1.7ha - 62% High	Negligible	Negligible	Major/Moderate Adverse
CFA22/43 Land to the west of Mill Farm*	0.7ha - 100% High	Low	Negligible	Major/Moderate Adverse
CFA22/44 Fulbrook Farm*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/45 Corporation Farm*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/46 Land on the east side of Lysways Lane (A)*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/47 Land to the east of Stafford Road (A)*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/48 Land to the east of Stafford Road (B)*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/49 Land on the east side of Lysways Lane (B)*	0.0ha - 0% Negligible	Negligible	Negligible	Negligible

* No farm impact assessment interview conducted; data estimated.

7.4.28 Overall, it is likely that 23 holdings will experience major, major/moderate or moderate permanent adverse effects from the construction of the AP2 revised scheme, which are significant. These effects principally result from a large part of the holding being required by the AP2 revised scheme, although adverse effect is also triggered by severance impacts at three holdings: Fulfen Farm (CFA22/1), Huddlesford House Farm (CFA22/3), Hanchwood (CFA22/15) and Brownfields Farm (CFA22/16).

7.4.29 The AP2 revised scheme requires 19.5 ha of land within CFA21/15 (5% of the holding) permanently. Following construction, access to some agricultural land on the holding will be via a public highway rather than a private way. This is an impact of medium magnitude. The overall permanent effect of the AP2 revised scheme on this holding is major / moderate adverse, which is significant.

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

Cumulative effects

7.4.31 No significant cumulative effects on agriculture, forestry and soils have been identified for the construction of the AP2 revised scheme.

Other mitigation measures

7.4.32 Other mitigation measures that are proposed include specific access provisions at Huddlesford House Farm (CFA22/3), Curborough Farm (CFA22/8), Ravenshaw Wood (East)(CFA22/12), Ravenshaw Wood (West) (CFA22/14), Hanchwood (CFA22/15), Brownfields Farm (CFA22/16), Hunts Farm (CFA22/17), Whittington Hill Farm (CFA22/28) and Land adjacent to Easthill House (CFA22/32); measures to ensure retention of drainage functionality at Brownfields Farm (CFA22/16), Ashton Hayes Farm (CFA22/19) and Tuppenhurst Field (CFA22/20), as well as provisions to secure irrigation water supplies at Huddlesford House Farm (CFA22/3), Hanchwood (CFA22/15) and Brownfields Farm (CFA22/16).

Summary of likely residual significant effects

7.4.33 Once the construction process is complete and land required temporarily has been restored, the residual permanent loss of agricultural land will be 178.3ha, of which 150.5 is BMV. This is assessed as a moderate adverse residual effect which is significant.

7.4.34 The likely residual effects will be major, major/moderate or moderate adverse, which is significant, for 23 holdings. These effects principally result from a large part of the holding being required by the AP2 revised scheme; although adverse effect is also triggered by severance impacts at three holdings: Fulfen Farm (CFA22/1), Huddlesford House Farm (CFA22/3), Hanchwood (CFA22/15) and Brownfields Farm (CFA22/16).

7.5 Effects arising from operation

Avoidance and mitigation measures

7.5.1 No measures are required to mitigate operational effects of the AP2 revised scheme on agriculture, forestry and soils.

Assessment of impacts and effects

7.5.2 Potential impacts arising from the operation of the AP2 revised scheme will include:

- noise emanating from moving trains affecting livestock; and
- the propensity of operational land to harbour noxious weeds.

7.5.3 The potential for significant effects on sensitive livestock receptors from noise has been assessed. No likely significant effects have been identified.

7.5.4 The propensity of linear transport infrastructure to harbour and spread noxious weeds is not only a consequence of the management of the highway and railway land, but also of the readiness of weed spread onto such land from adjoining land, which could be exacerbated with the effects of climate change. The presence of noxious weeds, ragwort in particular, will be controlled through the adoption of an appropriate management regime which identifies and remedies areas of weed growth which might threaten adjoining agricultural interests.

Summary of likely residual significant effects

7.5.5 No residual significant effects on agriculture, forestry and soils have been identified for the operation of the AP2 revised scheme.

8 Air quality

8.1 Introduction

8.1.1 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 AP2 revised scheme, covering nitrogen dioxide (NO_2), fine particulate matter (PM_{10} and $PM_{2.5}$)[16] and dust.

8.1.2 With regard to air quality, the main issues are anticipated to result from emissions of dust from demolition, the construction of new structures and earthworks and possible transfer of dust and mud onto public highways from vehicles travelling to and from construction areas. In addition, there may be changes in concentrations of NO2 and particulate matter due to changes in road traffic emissions during the construction and operation of the AP2 revised scheme.

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

- SES and AP2 ES, Appendix AQ-001-022;
- SES and AP2 ES, Volume 5: Map Book – Air quality, Map AQ-01-022; and
- SES and AP2 ES, Volume 5: Map Book – Air quality, Map AQ-02-022.

8.2 Scope, assumptions and limitations

8.2.1 The assessment scope, key assumptions and limitations for air quality are set out in Volume 1, the SMR (Volume 5: Appendix CT-001 -000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES as amended by the SMR Addendum 2 (SES and AP2 ES Volume 5: Appendix CT-001 -000/3) and appendices presented in SES and AP2 ES, Volume 5: AQ-001-022.

8.2.2 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.

8.2.3 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[17]. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on the approximate number of receptors within close proximity to the dust-generating activities. In doing so, it assigns a lower scale of effect to cases where the number of properties is small, e.g. fewer than 10 properties. Thus, a single property cannot experience a 'significant effect' as defined by this methodology. The assessment presented here reaches a conclusion that incorporates this concept of significance being proportional to the number of people affected. However, in cases where fewer

[16] PM2.5 and PM10 describe two size fractions of airborne particles that can be inhaled and therefore are of concern for human health. The designations refer to particles of size less than 2.5 and 10 micrometres in diameter.
[17] Institute of Air Quality Management, (2014), *Guidance on the assessment of dust from demolition and construction.*

than 10 properties are close to construction activity, it will still be the case that mitigation in accordance with the draft CoCP will be applied.

8.2.4 The assessment of construction traffic impacts has used traffic data that is based on the highest predicted monthly flows throughout the construction period. 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.

8.3 Environmental baseline

Existing baseline

8.3.1 The environmental baseline reported in this section represents the environmental conditions identified within the study area. The main sources of existing air pollution in the Whittington to Handsacre area are road traffic emissions from the A38 trunk road, as well as the A51 Tamworth Road and the A515 Lichfield Road.

8.3.2 Estimates for NO_2, PM_{10} and $PM_{2.5}$ concentrations have been obtained from UK-wide modelled pollution maps for 2012, published by the Department for Environment, Food and Rural Affairs (Defra) in 2014[18]. These data provide estimates of background concentrations of NO_2, PM_{10} and $PM_{2.5}$ for 1km grid squares across the UK.

8.3.3 The Whittington to Handsacre area lies within the West Midlands region, within the boundaries of the administrative area of Staffordshire County Council and the local authority area of Lichfield District Council (LDC).

8.3.4 There are currently no continuous monitoring sites within the Whittington to Handsacre area.

8.3.5 Annual mean NO_2 concentrations are measured by LDC using passive diffusion tubes at 22 locations. There are three measurement sites located within the Whittington to Handsacre area. These are roadside sites on the A38 at Fradley, 2.5km east of the centre line of the AP2 revised scheme. These locations are representative of roadside concentrations at the location where the A38 will be crossed by the AP2 revised scheme. Further details of these monitoring sites and the five year trend in concentrations are available in SES and AP2 ES Volume 5: Appendix AQ-001-022.

8.3.6 The background air quality maps produced by Defra are considered to be a more appropriate source of baseline air quality conditions along the AP2 revised scheme in the rural parts of the study area and indicate that the average background pollutant concentrations across the Whittington to Handsacre area are below the relevant air quality standards.

8.3.7 There are no AQMAs within the Whittington to Handsacre area.

[18] Defra; 2014 Based Background Maps for NOx, NO2, PM10 and PM2.5 with a 2011 base year ; http://uk-air.defra.gov.uk/?year=2011; Accessed: 01 04 2015.

8.3.8 Human receptors that could potentially be affected by changes in air quality as a result of the AP2 revised scheme have been identified. Air quality at these receptors could potentially be affected, due to their proximity to construction activities, to roads with vehicle flows that may change or to roads that will be subject to realignment during the construction or operational phases of the AP2 revised scheme. These locations are residential properties along Darnford Lane, west of Whittington; along Capper's Lane, east of Lichfield; on Broad Lane, east of Lichfield; around Ash Tree Lane, Streethay; Hill Farm, east of the A38, Streethay; Streethay Farm, Burton Road, east of Streethay; around The Manor House, Burton Road, north-east of Streethay; around Wood End Farm, Wood End Lane, Curborough; Wood End Lock Cottage, Wood End Lane, Curborough; Black Slough Farm and Woods Farm, Wood End Lane, Curborough; Ravenshaw Cottage, Wood End Lane, Curborough; along Shaw Lane, Hanch; Ashton Hayes Farm, Tuppenhurst Lane, southeast of Handsacre; on Chestnut Close, Handsacre and Hayes Meadow Primary School, Handsacre.

8.3.9 There are no ecological receptors with statutory designations within the Whittington to Handsacre area. There are nine non-statutory designated sites within the Whittington to Handsacre area that could potentially be affected by changes in air quality as a result of the AP2 revised scheme. These sites are Whittington Heath Golf Course Site of Biological Importance (SBI), north of the A51 Tamworth Road; Big Lyntus SBI, south of Wood End Lane, Curborough; Fradley Wood Biological Alert Site (BAS), north of Wood End Lane, Fradley; Wood End Lock (south-east of) SBI, north of Wood End Lane, Curborough; Ravenshaw Wood, Black Slough and Slaish SBI, north of Wood End Lane, Curborough; Tomhay Wood SBI, between the WCML and Wood End Lane; Vicar's Coppice BAS, adjacent to the A515 Lichfield Road; John's Gorse SBI, west of the A515 and Tuppenhurst Lane (west of) SBI, south-west of Tuppenhurst Lane. These are all sites with local wildlife site (LWS) status. Further details of these sites are provided under the ecology topic in Section 11.

Future baseline

8.3.10 SES and AP2 ES Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by the start of construction, additional to those identified in the main ES (Volume 5, Appendix: CT-004-000).

8.3.11 Developments with planning permission or sites allocated in adopted development plans, on or close to the AP2 revised scheme have been identified. These are termed 'committed developments' and will form part of the future baseline for the assessment of effects from the construction and operation of the AP2 revised scheme.

8.3.12 In the Whittington to Handsacre area, there are committed developments which will introduce new receptors requiring air quality assessment at: Hill Farm, east of the A38, Streethay where barn conversion works will introduce two new residential dwellings; and around Streethay Hill Farm, where urban extension of Lichfield will introduce new residential properties.

8.3.13 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 consented local schemes. In this way, the assessment accounts for cumulative effects.

Construction (2017)

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

Operation (2026)

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

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the CoCP, where appropriate. The draft CoCP presented in the main ES (Volume 5: Appendix CT-003-000) includes a range of mitigation measures that are accepted by the Institute of Air Quality Management 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, 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.

8.4.2 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP presented in the main ES (Volume 5: Appendix CT-003-000) will be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring after engagement with the local authorities to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of haul routes and designated vehicle waiting areas to suppress dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, and 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

8.4.3 Impacts from the construction of the AP2 revised scheme could arise from dust-generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for human receptors sensitive to dust and exposure to NO2 and PM10, as well as ecological receptors sensitive to dust.

8.4.4 An assessment of construction traffic emissions has also been undertaken for two scenarios in the construction period: a 'without scheme' scenario and a 'with the AP2 revised scheme' scenario.

8.4.5 In the Whittington to Handsacre area, dust-generating activities will comprise demolition of buildings on the A51 Tamworth Road, Whittington Heath; around the A38 and Burton Road, Streethay; and around Shaw Lane, Hanch; the construction of new structures; earthworks, including the movement of materials on the haul road along the line of the AP2 revised scheme; as well as dust and mud deposited onto public highways from vehicles travelling to and from construction areas.

8.4.6 A construction dust assessment was undertaken for receptors at 14 locations where residential properties, one school and nine LWS were present, due to their close proximity to the dust generating activities associated with the AP2 revised scheme. The residential locations are: on Darnford Lane, west of Whittington; on Capper's Lane, east of Lichfield; on Broad Lane, Huddlesford; on Ash Tree Lane, Streethay; at Hill Farm, east of the A38; at Streethay Farm on Burton Road, east of Streethay; around The Manor House on Burton Road, north-east of Streethay; around Wood End Farm on Wood End Lane, Curborough; at Wood End Lock Cottage on Wood End Lane, Curborough; at Black Slough Farm and Woods Farm, Wood End Lane, Curborough; at Ravenshaw Cottage on Wood End Lane, Curborough; on Shaw Lane, Hanch; at Ashton Hayes Farm on Tuppenhurst Lane, south-east of Handsacre; and on Chestnut Close, Handsacre. The school is Hayes Meadow Primary School, Spode Avenue, Rugeley. The LWS are: Whittington Heath Golf Course SBI; Big Lyntus SBI; Fradley Wood BAS; Wood End Lock (south-east of) SBI; Ravenshaw Wood, Black Slough and Slaish SBI; Tomhay Wood SBI; Vicar's Coppice BAS; John's Gorse SBI; and Tuppenhurst Lane (west of) SBI.

8.4.7 The construction dust assessment determined that for the locations where residential properties are present there will be a medium risk of dust soiling on Capper's Lane, east of Lichfield; on Broad Lane, Huddlesford; on Ash Tree Lane, Streethay; around The Manor House on Burton Road, north-east of Streethay; around Wood End Farm on Wood End Lane, Curborough; at Wood End Lock Cottage on Wood End Lane, Curborough; at Black Slough Farm and Woods Farm, Wood End Lane, Curborough; and on Shaw Lane, Hanch. There will be a low risk of dust soiling at other locations where residential properties are present. There would be a low risk of human health impacts from construction dust at all locations where residential properties are present. Without mitigation, at Hayes Meadow Primary School there would be a high risk of soiling and a medium risk of human health impacts from construction dust due to the construction of the permanent access road off Spode Avenue. However, the construction works at this location would be of a limited duration within the overall

construction programme. There will be a low risk of dust impacts at the ecological sites.

8.4.8 Given the application of mitigation measures contained within the draft CoCP and the expected duration of construction activities, the construction dust assessment has determined that overall air quality effects will not be significant. The basis for this conclusion is presented in full in the SES and AP2 ES, Volume 5: Appendix AQ-001-022.

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

8.4.10 Two locations within the Whittington to Handsacre area met the criteria for assessment of change in traffic emissions during the construction phase. These locations are around Broad Lane and Capper's Lane, east of Lichfield and the A38 east of Streethay. At both of these locations, the increase in construction traffic was sufficient to require an assessment of changes in concentrations at receptors around these roads and there will be temporary road realignments.

8.4.11 The assessment found that the magnitude of impact will be negligible for NO_2 and PM10 for all receptors assessed.

8.4.12 The effect on air quality due to construction traffic emissions will not be significant. The basis for this conclusion is presented in full in the SES and AP2 ES, Volume 5: Appendix AQ-001-022.

Permanent effects

8.4.13 There are no permanent effects anticipated to arise during construction of the AP2 revised scheme.

Other mitigation measures

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

Cumulative effects

8.4.15 There are no cumulative effects anticipated to arise during construction of the AP2 revised scheme.

Summary of likely residual significant effects

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

8.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

8.5.2 Impacts from the operation of the AP2 revised scheme will relate to changes in the volume, composition and distribution of road traffic. There are no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and these have therefore not been assessed. Indirect emissions from sources such as rail wear and brakes have been assumed to be negligible. The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026: a 'without scheme' scenario and a 'with the AP2 revised scheme' scenario.

8.5.3 Traffic data in the Whittington to Handsacre area have been screened to identify roads that require an assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026.

8.5.4 Three locations within the Whittington to Handsacre area met the criteria for an assessment of emissions from traffic during the operational stage, following completion of the AP2 revised scheme. These locations are Darnford Lane, west of Whittington, due to permanent realignment of Darnford Lane; around Broad Lane and Capper's Lane, east of Lichfield, due to permanent realignment of Broad Lane and stopping up of Capper's Lane and Wood End Lane, Curborough, due to permanent realignment of Wood End Lane.

8.5.5 The assessment at receptors around these roads found that the magnitude of impact will be negligible at all receptors assessed for NO_2 and PM_{10}. Therefore, the effect on air quality due to traffic following completion of the AP2 revised scheme will not be significant. The basis for this conclusion is presented in full in the SES and AP2 ES, Volume 5: Appendix AQ-001-022.

Other mitigation measures

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

Cumulative effects

8.5.7 There are no cumulative effects anticipated to arise during operation of the AP2 revised scheme.

Summary of likely residual significant effects

8.5.8 No residual significant effects are anticipated for receptors as a consequence of changes to air quality in this area during operation of the AP2 revised scheme.

9 Community

9.1 Introduction

9.1.1 This section reports the impacts and likely significant effects on local communities resulting from the construction and operation of the AP2 revised scheme.

9.1.2 Key issues concerning the community assessment for this area comprise:

- amenity impacts for residents living close to the line of the route, near to temporary construction compounds or construction traffic routes, including those living to the west of Whittington;
- the permanent loss of land from a number of recreation facilities and open spaces which lie within the area of land required for the construction and operation of the AP2 revised scheme, particularly in the Whittington/Huddlesford area; and
- impacts on access to day-to-day community facilities in the area, due to construction works and increased construction traffic in the area, particularly in the Fradley area.

9.1.3 Further details of the community assessments undertaken within the area are contained in the SES and AP2 ES, Volume 5: Appendix CM-001-022 and in the main ES Volume 5: Appendix CM-001-022. Community assessment maps are provided in the SES and AP2 ES, Volume 5: Maps CM-01-119 to CM-01-123.

9.1.4 The assessment draws upon information gathered from a combination of desktop studies, site surveys and through engagement with local organisations including Whittington Heath Golf Club and Lichfield Cruising Club.

9.2 Scope, assumptions and limitations

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

9.2.2 Construction worker accommodation would be located at the Capper's Lane and A515 Lichfield Road main compounds. Construction worker impacts on community resources are considered at a route-wide level in the main ES Volume 5, 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.

9.2.3 The construction and operation of the AP2 revised scheme requires access rights over land at a number of locations within the Whittington to Handsacre area, both temporarily and permanently. In these instances, it is assumed that no construction works will be required and that there will be no actual loss of land from any residential property or community resource.

9.2.4 Where the AP2 revised scheme requires works along public highways, it is also assumed that no loss of land will be required from adjacent residential properties unless specifically identified in this section of the report.

9.2.5 The construction of the AP2 revised scheme requires the diversion of some overhead power lines in the area. As a consequence, nearby sections of the power grid in the Curborough and Hanch areas will require tensioning and reinforcement works to cables and pylon towers. Corridors of land, approximately 100m wide, beneath the power lines have been identified as being required for these works. These corridors encompass a small number of residential properties; however, in these instances it is assumed that there will be no requirement to encroach directly into any of the domestic curtilages and that any effect will therefore be negligible.

9.2.6 There are a number of boat moorings and other outdoor recreational open spaces and facilities close to the route of the AP2 revised scheme within the Whittington to Handsacre area. These are described in the environmental baseline below and any effects due to loss of land from these facilities during construction are also assessed. However, as explained in Volume 5 (SV-001-000, Annex G) of the main ES, such facilities, given their transitory use, are not deemed to have a high sensitivity to noise impacts and on this basis the effects on the amenity of the users of these facilities are not addressed in this section of the report.

9.2.7 The A51 Tamworth Road is taken to represent the southern boundary of the Whittington to Handsacre area. The effects on residential properties and community resources on the south side of this road are addressed in the report for the neighbouring Drayton Bassett, Hints and Weeford area (CFA21).

9.3 Environmental baseline

Existing baseline

9.3.1 Baseline data on community resources was collected up to 1km from the centre line of the AP2 revised scheme and, additionally, up to 250m from the boundary of land required for construction.

9.3.2 The study area includes the area of land within the construction boundary comprising the land (both temporary and permanent) for the construction and operation of the AP2 revised scheme, together with a wider corridor within which receptors or resources could be affected by a combination of significant residual effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routeing of construction traffic and takes account of the catchment areas for community facilities that could be affected where crossed by the AP2 revised scheme. Overall, the study area is taken as the area of land which encompasses the likely significant effects of the AP2 revised scheme.

9.3.3 This area includes land within the parishes of Whittington, Fradley and Streethay, Kings Bromley and Armitage with Handsacre.

Whittington Heath

9.3.4 The community of Whittington Heath comprises a cluster of residential properties focused around the site of DMS Whittington, which is the headquarters for Defence Medical Services and was previously known as Whittington Barracks. A new medical

training facility and associated living accommodation have been built on the site recently, which became operational in 2014. The site now has the capacity to accommodate approximately 1,400 military and civilian personnel, together with about 7,000 students. The residential family living accommodation wraps around the northern and eastern side of the site. There is a children's day care nursery that is open to the general public, adjacent to which is a community hall for use by Ministry of Defence families. There are also recreational playing fields to the north and east of the site, which are used regularly by a local football club. The pitches have been improved recently to include a new all-weather pitch and floodlighting. The boundary of land required for the construction of the AP2 revised scheme encroaches upon the edge of these playing fields. The Staffordshire Regiment Museum is situated immediately north of DMS Whittington and to the east of the route of the AP2 revised scheme.

9.3.5 Facilities in the Whittington Heath area are very limited. The Whittington Arms public house is situated on the south side of the A51 Tamworth Road and is within the boundary of the neighbouring Drayton Bassett, Hints and Weeford area (CFA21) to the south. The Whittington Heath Golf Club lies on the east side of the road. Whittington Heath falls within the catchment of the primary school and branch GP surgery at Whittington village to the north, as well as the King Edward VI School (secondary) and other GP surgeries at Lichfield. The AP2 revised scheme crosses the A51 Tamworth Road which is the main route used to access facilities at Lichfield, including secondary schooling.

9.3.6 Within this area, the study area includes the sports pitches for DMS Whittington and the Whittington Heath Golf Club. The assessment also considers the potential implications for access to community facilities for the community of Whittington Heath generally.

Whittington

9.3.7 Whittington is one of the larger villages in the area. It has a range of shops for everyday needs, together with a primary school, a GP branch surgery, a church, a hospice, a recreation ground and a number of community halls. The village of Whittington falls within the catchment of the King Edward VI School (secondary) at Lichfield and routes between the village and this school will be crossed by the AP2 revised scheme. The catchment areas for some facilities located at Whittington, notably the primary school and the GP surgery, encompass much of the surrounding rural hinterland.

9.3.8 As the centre of Whittington is well beyond the area of land required for the construction of the AP2 revised scheme, the study area includes only those residential properties on the western outskirts of the village that are in close proximity to the route. The potential isolation effects on the overall community of Whittington are also assessed, given the dependency on routes which are crossed by the AP2 revised scheme for access to facilities at Lichfield on a day-to-day basis.

Huddlesford

9.3.9 The small village of Huddlesford is situated on the east bank of the Coventry Canal. It is approximately 450m to the east of the centre line of the route of the AP2 revised scheme and beyond the area of land required for its construction and operation. The village has few facilities and falls within the catchment area of the primary school and

GP branch surgery at Whittington and the King Edward VI School (secondary) at Lichfield. There is a public house in the village and the Lichfield Cruising Club has about 70 moorings along the Coventry Canal at Huddlesford together with the section of the Wyrley and Essington Canal extending to Capper's Lane in the south. The Coventry Canal and its associated towpath pass through Huddlesford, heading to Streethay and Fradley junction in the north and to Whittington to the south.

9.3.10 The assessment considers the potential isolation effects on the entire community of Huddlesford and the study area also includes the Lichfield Cruising Club site.

Streethay

9.3.11 The urban edge of Lichfield extends close to the route of the AP2 revised scheme at Streethay. There is a public house and a small play park at Streethay, both to the west of the AP2 revised scheme and beyond the area of land required for its construction. A number of residential properties on the edge of Streethay are situated within the boundary of land required for the AP2 revised scheme. Streethay falls within the catchment area for schools and health facilities at Lichfield which are beyond the study area for this assessment.

9.3.12 There are a number of recreational facilities to the east of the route of the AP2 revised scheme at Streethay, including Streethay Wharf and the recently opened Kings Orchard Marina on the banks of the Coventry Canal. The study area for the assessment includes the Horsepower Equestrian Centre and a small number of residential properties situated close to the route of the AP2 revised scheme, in the vicinity of the A38.

Fradley, Curborough and Hanch

9.3.13 Fradley is situated in the centre of the Whittington to Handsacre area and to the north-east of the AP2 revised scheme. Significant development has taken place at Fradley over recent years, and the community has a modest range of facilities, including a church, a community hall, a primary school and some convenience shops. Fradley falls within the catchment area for the Friary School (secondary) and GP surgeries at Lichfield. The assessment considers whether the construction of the AP2 revised scheme would affect access to these facilities on a day-to-day basis.

9.3.14 Curborough and Hanch are smaller and more dispersed communities, comprising a loose knit collection of farmsteads and residential properties, mostly beyond the area of land required for the construction and operation of the AP2 revised scheme. These communities have few community facilities and fall within the catchment area for schools and healthcare facilities at Lichfield. A small number of residential properties lie within or partly within the boundary of land required for the construction and operation of the AP2 revised scheme.

9.3.15 There are a number of recreational and visitor attractions in the Fradley, Curborough and Hanch area including the Curborough Sprint Course at Netherstowe Lane and the Delta Force Paintballing Centre at Wood End Lane, both of which lie partly within the area of land required for the construction and operation of the AP2 revised scheme. The Trent and Mersey Canal and its associated towpath are crossed by the route of the proposed Manchester spur for the AP2 revised scheme, between Wood End Lock and Shade House Lock, near Fradley Junction. There are a number of moorings in the

area at Wood End Lock and at Kings Bromley Marina to the north, but these lie outside of the boundary of the AP2 revised scheme.

9.3.16 The NCR No. 54 passes through the study area at Fradley and Curborough, running along Gorse Lane, Wood End Lane and Netherstowe Lane. The Midland Karting Track and the Dragonara Miniature Horse Stud and children's party venue, both situated at Wood End Lane, lie beyond the boundary of land required for the construction of the AP2 revised scheme.

Handsacre

9.3.17 Handsacre, which merges with the adjoining settlement of Armitage, has a small number of shops, halls, churches, open spaces and pubs, together with a local police station, GP surgery, day care nursery and primary school. Handsacre itself lies within the catchment area for the Hagley Park Academy at Rugely, which is beyond the Whittington to Handsacre study area.

9.3.18 The study area for the assessment includes residential properties on the south side of the town close to the route of the AP2 revised scheme, together with the Hayes Meadow Primary School (and nursery) which is situated alongside the existing west coast mainline.

Future baseline

Construction (2017)

9.3.19 At Streethay, planning permission has been granted for the conversion of farm buildings at Hill Farm, Ash Tree Lane (permission reference 14/00056/COU) to create two additional dwellings at the farm (see Volume 5 of the SES and AP2 ES Appendix CT-004-000 Reference CFA22/16). This is in addition to the permission granted in November 2009 for the conversion of a separate farm building to residential use (reference 09/01002), which appears to have been commenced but not yet completed. These permissions would bring the total number of dwellings at this location in the future baseline situation to four. The buildings at Hill Farm are situated immediately adjacent to the boundary of land required for the construction and operation of the AP2 revised scheme.

9.3.20 Land to the north of Streethay has been allocated by Lichfield District Council as a Strategic Development Area for approximately 750 new homes, a new primary school and public open space. Outline planning permission for this development (hereafter referred to as the Streethay Strategic Development) was granted in December 2014 (permission reference 12/00746OUTMEI, see Volume 5 of the SES and AP2 ES, Appendix CT-004-000, reference CFA22/17). The boundary of the Streethay Strategic Development Area extends to abut the boundary of land required for the construction of the AP2 revised scheme in the vicinity of Streethay House Farm, where a new access to the Strategic Development Area is proposed. It is anticipated that construction of this development will commence in 2015/16 and that it will continue to be built out at the same time as construction of the AP2 revised scheme is likely to be underway. The potential for cumulative effects on nearby residents and community resources is therefore addressed as part of the assessment of the construction phase of the AP2 revised scheme.

9.3.21 Also at Streethay, permission has been granted by Lichfield District Council (permission reference 11/00928) for the development of land south of the A5127 Burton Road and west of the A38, known as Lichfield Park. A separate planning permission has been granted for a haul road to accommodate construction traffic for this development (permission ref 14/00974, see Volume 5 of the SES and AP2 ES Appendix CT-004-000 reference CFA22/15)). The haul road runs from Broad Lane at Huddlesford, along the eastern side of the West Coast Mainline and accesses the Lichfield Park development site via an underpass beneath the A38 near Ash Tree Lane. Works have commenced to implement these planning permissions and they are therefore taken into account as part of the future baseline for the assessment of the AP2 revised scheme.

9.3.22 At Fradley, land between Fradley South and Fradley Wood has been allocated as a Strategic Development Area by Lichfield District Council. The site, which lies beyond the boundary of land required for the construction and operation of the AP2 revised scheme, is earmarked for the development of approximately 1,250 new homes, together with associated new community facilities and open space. In October 2013, Lichfield District Council granted planning permission for 750 homes and associated community facilities to be built on the site, including a new health centre and a new primary school (permission reference 10/01498/OUTMEI, see Volume 5 of the SES and AP2 ES Appendix CT-004-000 reference CFA22/19). Based on information contained in the adopted Lichfield District Local Plan, it is anticipated that construction of this Strategic Development is likely to commence in 2015/2016 and will continue to be built out at the same time as work on the construction of the AP2 revised scheme occurs. The potential for cumulative effects on the residents of Fradley is therefore addressed as part of the construction phase assessment of the AP2 revised scheme.

Operation (2026)

9.3.23 The adopted Lichfield District Local Plan indicates that both of the Strategic Development areas at Streethay and Fradley are likely to take approximately six years to build. On this basis, it is assumed that both developments will have been mostly completed by the time the AP2 revised scheme becomes operational in 2026. The Strategic Development areas are therefore assumed to form part of the future baseline of the area and, along with the Lichfield Park development, are taken into account in the assessment of operational effects.

9.4 Effects arising during construction

Avoidance and mitigation measures

9.4.1 The following measures have been incorporated into the AP2 revised scheme design to avoid or reduce environmental impacts during construction:

- aligning the height of the HS2 route in the Streethay-Fradley area to limit the likely adverse visual effects on nearby receptors, potential disruption due to the transportation of imported fill material via the local road network and other disruption that might arise during construction due to the diversion of utilities and other associated works;
- aligning the route of the HS2 Handsacre link to limit disruption to the Trent and Mersey Canal near Fradley and potential effects on this valued

recreational resource;

- making provision for a permanent realignment of the Wryley and Essington Canal near Whittington/Huddlesford, to facilitate future restoration proposals;
- including a permanent diversion for Capper's Lane at Whittington to avoid any permanent severance of this route;
- designing the profile of earthworks to limit the amount of land that will be required from residential properties and other community resources close to the route, including land that will be required temporarily during construction;
- incorporating a retaining wall structure to reduce or avoid the need for land required for the construction and operation of the AP2 revised scheme from adjoining properties, including from residential properties at Handsacre;
- making provision within the land required for construction of the AP2 revised scheme for the temporary re-routeing of local roads to limit disruption to traffic during the works, including for the Lichfield Road at Whittington, Broad Lane at Huddlesford and the A515 Lichfield Road in the Curborough and Hanch area;
- locating one of the proposed construction compounds to limit the amenity impact on Kings Bromley Marina; and
- providing hoardings alongside construction site boundaries to reduce noise effects on nearby residential properties during the works, including near Ellfield House at Lichfield Road, Whittington and at Handsacre, as well as beside the Hayes Meadow Primary School.

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

- appointment of community relations personnel (draft CoCP, Section 5);
- community helpline to handle enquires from the public (Section 5);
- sensitive layout of construction sites to reduce nuisance (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 (Section 5);
- monitoring and management of flood risk and other extreme weather events which may affect community resources during construction (Sections 5 & 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 re-housing (Sections 7 & 13); and
- where reasonably practicable, the avoidance of large goods vehicles operating adjacent to schools during drop-off and pick-up periods (Section 14).

Assessment of impacts and effects

9.4.3 Details of the revised assessments of community resources are included in Volume 5: Appendix CM-001-022 of the SES and AP2 ES. Each assessment form presents information that explains the rationale for determining the rating for sensitivity of the affected community resource, the magnitude of impact and the assessment of significance. Community assessment maps are provided in the SES and AP2 ES, Volume 5: Maps CM-01-119 to CM-01-123.

Whittington Heath

Temporary effects

9.4.4 No significant temporary effects have been identified on community resources in the Whittington Heath area. The slight temporary loss of land from the boundary of the sports fields to the north of DMS Whittington will have a negligible effect. Other community facilities in this area, including the Staffordshire Regiment Museum and the Whittington Pre-School will not be directly affected or be subject to a combination of significant amenity effects. Isolation effects on the community of Whittington Heath will be negligible, as the A51 Tamworth Road will be maintained to allow access to facilities at Lichfield and there will be no impact on Common Lane, which provides access to facilities at Whittington.

Permanent effects

Open space

9.4.5 The route of the AP2 revised scheme passes through the centre of the Whittington Heath Golf Club. Its construction will require the demolition of the clubhouse and the permanent loss of the car park. The railway itself will require the permanent loss of a 100m wide corridor of land through the centre of the course, effectively severing the course in two and resulting in the loss of fairways and greens within its footprint. Approximately five of the eighteen holes fall wholly or partly within the boundary of land required for the construction and operation of the AP2 revised scheme, leaving eight holes largely unaffected on the west side and five on the east side. This loss of land will completely compromise the function and quality of the course. Even with significant re-design, it is unlikely that there will be sufficient space to be able to reinstate 18 holes of comparable playing standard within the Golf Club's current boundary, together with replacement clubhouse and parking facilities.

9.4.6 In terms of the severance of the course, whilst the design of the AP2 revised scheme makes provision for a footpath underpass to accommodate golf buggies and small maintenance vehicles as part of the proposed Whittington Footpath 16 underpass, no further bridges or underpasses are proposed. On this basis, the course will remain largely severed with poor connectivity between the two parcels either side of the railway. Given the location of the proposed PRoW 16 underpass and the orientation of the fairways at present, it is also likely to be difficult to connect the two separate parcels on the course in a way that offers a coherent playing order and appropriate linkages with any replacement clubhouse facilities. For these reasons, it is considered that the construction of the AP2 revised scheme will effectively render continued play over 18 holes at the course impracticable, substantially diminishing its playing offer. Instead, it is assumed that only a 9-hole course can realistically be maintained on the

west side of the AP2 revised scheme, requiring only limited shortening or modifications to one or two fairways and assuming that a suitable site can be agreed for a replacement clubhouse and parking area. Overall, taking all factors into account, the severance of the golf course and the loss of land and buildings are assessed as giving rise to a major adverse effect on the Whittington Heath Golf Club and its users, which is therefore significant.

9.4.7 No other community resources in the Whittington Heath area will be permanently affected by construction of the AP2 revised scheme.

Whittington

Temporary and Permanent effects

9.4.8 Construction of the AP2 revised scheme will not give rise to any significant temporary or permanent effects on community resources in the Whittington area.

Residential properties

9.4.9 A small number of residential properties will be affected either by temporary or permanent loss of land from their boundaries; however, these effects are assessed as minor and not significant at a community level. The AP2 revised scheme will not require the demolition of any homes in this area, although one property, namely Ellfield House, will be affected by the demolition of an outbuilding. The properties that will be affected by either a temporary or permanent loss of land include: High View, Whittington Hill House and Whittington Hill Farm at Darnford Lane and Mill Farm, The Watermill, Brook House and Canal Cottage at Capper's Lane.

9.4.10 No significant temporary isolation effects on the community of Whittington or on the Whittington Primary School are likely to arise during construction. Temporary localised diversions will be provided to ensure that traffic routes remain operational during the construction period and significant disruption to journeys is therefore unlikely. The permanent realignment of Capper's Lane will add approximately 300m to journeys between Whittington and Lichfield, which is not considered to give rise to any significant permanent isolation effects on the community of Whittington.

Open space

9.4.11 The AP2 revised scheme will not require any land, either temporarily or permanently, from the Darnford Moors Golf Course.

Huddlesford

Temporary effects

Residential properties

9.4.12 The construction of the AP2 revised scheme will not give rise to any significant temporary effects on residential properties in the village of Huddlesford. Most properties are situated well beyond the area required for the construction of the scheme and will not be subject to a combination of significant residual adverse amenity effects.

9.4.13 Residents of Huddlesford will however be affected by works to Broad Lane, which will entail realigning the junction with Capper's Lane approximately 500m east of its

current position and the construction of a new overbridge to cross the route of the AP2 revised scheme. These works are anticipated to take about two years and eight months to complete, during which time a temporary diversion for Broad Lane is proposed which will connect with Capper's Lane, just west of the Wyrley and Essington Canal. Although no significant congestion is anticipated at this location, these works and the increase in HGV traffic are assessed as giving rise to a minor adverse temporary isolation effect on the community of Huddlesford. This assessment takes account of the duration of the works which will extend to two years and eight months and that Broad Lane is the principal route used by residents of Huddlesford to access secondary schools and other facilities at Lichfield.

Community facilities

9.4.14 The boundary of land required for the construction and operation of the AP2 revised scheme includes part of the site operated by Lichfield Cruising Club, which is based at Huddlesford. The Cruising Club's boatyard and maintenance area, situated off Capper's Lane, together with an adjacent slipway and approximately 150m of the Wyrley and Essington Canal, which is leased from the Canal and River Trust and provides recreational moorings for the Cruising Club's boat owners, will all be affected. The Lichfield Cruising Club has been based at Huddlesford for approximately 55 years. The club has about 165 members and has a strong social dimension, holding regular events throughout the year, based at its clubhouse on the banks of the Coventry Canal. The club also organises the Huddlesford Gathering, a popular and well-attended canal heritage event which is held every other year. The construction of the AP2 revised scheme will give rise to a combination of temporary and permanent effects on users of the club's facilities.

9.4.15 During construction, it will be necessary to temporarily close the club's moorings on that section of the Wryley and Essington Canal between Capper's Lane and Watery Lane Bridge. This will affect approximately 12 out of a total of 67 moorings used by the Cruising Club for recreational boat owners. Whilst there are some alternative mooring facilities nearby, including at the recently opened King's Orchard Marina at Streethay, the loss of these moorings for a period of up to 2.5 years is assessed as giving rise to a moderate adverse and significant temporary effect on the club and the users of these recreational facilities. The moorings will be reinstated upon completion of the construction works.

Permanent effects

Community facilities

9.4.16 The construction of the AP2 revised scheme will also affect the Lichfield Cruising Club permanently. The Club's boat maintenance area, winding arm and slipway at Capper's Lane are situated within an area of land required permanently for the construction and operation of the AP2 revised scheme. These facilities are typically used all year round by club members and are important for the overall functioning of the club. They allow members to remove boats from the water to carry out essential maintenance and repairs. The permanent loss of these facilities is therefore assessed as giving rise to a moderate adverse and significant effect on recreational users.

9.4.17 The earthworks and supporting structures for the proposed Capper's Lane viaduct in the AP2 revised scheme will be positioned directly in the channel of an abandoned

section of the Wyrley and Essington Canal, to the west of Capper's Lane. The AP2 revised scheme makes provision to realign approximately 300m of the channel to the south-west of Watery Lane Bridge, including beneath the realigned Capper's Lane and the Capper's Lane viaduct to a point in the vicinity of Canal Cottage, to the south of the existing Capper's Lane Bridge. This will avoid the permanent loss of this part of the channel and hence any permanent impact on recreational moorings. It will also ensure that plans by the Lichfield and Hatherton Canals Restoration Trust to restore this section of canal at some point in the future will not be prejudiced.

Residential properties

9.4.18 The construction of the AP2 revised scheme will not give rise to any significant permanent effects on residential properties in the Huddlesford area. One residential property near Huddlesford – namely Ivy Cottage, at Broad Lane – will be affected by a permanent loss of land due to the construction of the AP2 revised scheme, including the loss of two outbuildings. An effect on a single property is not considered to be significant at the community level.

Streethay

Temporary effects

9.4.19 Construction of the AP2 revised scheme will not give rise to any significant temporary effects on community resources in the Streethay area. Most resources lie beyond the boundary of land required for its construction and will not be affected by a combination of significant residual amenity effects during the works.

9.4.20 Construction of the AP2 revised scheme will result in the loss of land, both temporarily and permanently, from the Horsepower Equestrian Centre, located at Streethay Farm. The effects on the Equestrian Centre are considered under the heading 'Permanent effects' below, as most of the land that will be required from this recreational facility will be needed permanently.

Permanent effects

9.4.21 Construction of the AP2 revised scheme will not give rise to any significant permanent effects on community resources in the Streethay area.

Residential properties

9.4.22 The construction of the AP2 revised scheme will not give rise to significant permanent effects on residential properties. The construction will require the demolition of one residential property at Streethay, namely Field Cottage, which is situated close to the A38 and on the east side of the AP2 revised scheme. An additional three properties – namely Streethay Cottage, Elverceter and the Manor House – will be affected by a slight permanent loss of land. These effects are assessed as minor and not of significance at a community level.

Community facilities

9.4.23 As noted above, the boundary of land required for the construction and operation of the AP2 revised scheme includes part of the Horsepower Equestrian Centre at Streethay Farm. The Centre provides riding lessons to members of the public, including special activities for children during school holidays. It also includes a livery

business for horse owners. It encompasses land on both sides of the South Staffordshire Railway Line (SSL) and is bounded to the north by the A38. The realignment of the A38/A5127 slip road, required as part of the AP2 revised scheme, will result in the permanent loss of an area of grazing land, forming part of the centre, together with a strip along its frontage with the A38 Rykneld Street. This area represents about 12% of the centre's total site and grazing area and its permanent loss is unlikely to compromise the overall functioning of the centre. Access to the Equestrian Centre will be maintained. On this basis, the AP2 revised scheme is assessed as giving rise to a minor adverse permanent effect on the Horsepower Equestrian Centre and its users, which is not significant.

9.4.24 It is noted that some additional areas of land from the Centre will be required temporarily during construction, including use of the underpass beneath the SSL, in order to gain access to the A38 overbridge (southeast) satellite compound. However, these areas total no more than an additional 3% of the site and their temporary loss or use will not give rise to a significant effect on the Equestrian Centre during the construction period.

Fradley, Curborough and Hanch

Temporary effects

Residential properties

9.4.25 As explained in the traffic and transport section (Section 16) of this report, it is anticipated that the additional construction traffic generated by the works will cause a temporary major adverse and significant congestion effect at the junction between the A38 and Wood End Lane. This will affect residents travelling from Fradley to Lichfield to access secondary schools, healthcare and other facilities, and could last for a period of up to two years. The alternative route which is used by residents, via Wood End Lane, will also be affected by works to construct the Handsacre link, including the permanent realignment and diversion of the roads in this area. Given the lengthy duration of the impact, the construction works for the AP2 revised scheme are therefore assessed as giving rise to a temporary moderate adverse significant isolation effect on the community of Fradley.

9.4.26 The construction of the AP2 revised scheme will not give rise to any significant temporary effects on residential properties in the Fradley, Curborough and Hanch area due to temporary loss of land. Two residential properties in this area, namely Birch Ridings at Wood End Lane and Hanch Hall Farm at Lichfield Road, will be affected by a slight temporary loss of land from their boundaries during construction; however, the effects will be minor and not significant.

Community facilities and open space

9.4.27 Construction of the AP2 revised scheme will not give rise to any significant temporary effects on community facilities and public open spaces in the Fradley, Curborough and Hanch area.

9.4.28 Access to two electricity pylon towers, situated within the grounds of the Lichfield Golf and Country Club, will be required during construction of the AP2 revised scheme, to allow for reinforcement works associated with the diversion of cables in the Hanch area. The area of land required temporarily will encroach slightly into the

9th tee area, which may require some temporary modification. As works at this pylon are only likely to take place for a short period of time, the slight encroachment onto the golf course is assessed as a minor adverse effect, which is not significant.

9.4.29 The boundary of land required temporarily during the construction of the AP2 revised scheme will also encroach slightly into the edge of the Delta Force Paintballing Centre at Wood End Lane, but this will not give rise to any significant effects on the operation of this leisure facility or its users.

Recreational PRoW

9.4.30 Construction of the AP2 revised scheme will not give rise to any significant temporary effects on recreational public rights of way (PRoW) in the Fradley, Curborough and Hanch area.

9.4.31 The Trent and Mersey Canal and associated tow path will remain open during the construction of the Manchester spur. Only very minor localised adjustments to the alignment of the tow path are likely to be necessary at times during construction, which will have a negligible effect on users. There will be no requirement for moorings at Wood End Lock to be closed during construction of the AP2 revised scheme.

9.4.32 Part of the NCR No. 54, which runs along Netherstowe Lane and Wood End Lane at Fradley, lies within the limits of land required for the construction and operation of the AP2 revised scheme. Whilst Netherstowe Lane and Wood End Lane will be permanently realigned, the cycle route will be maintained during construction. The temporary effects on the function and use of the cycle route during construction will therefore be negligible.

Permanent effects

Residential properties

9.4.33 The construction of the AP2 revised scheme will not give rise to any significant or permanent effects on residential properties in the Fradley, Curborough and Hanch area. The construction of the AP2 revised scheme will require the demolition of one residential property in this area, namely Hanchwood House at Shaw Lane. A total of five properties in the Curborough and Hanch areas will also be affected by a slight permanent loss of land, namely The Cottage, Wood End Lock Cottage and Black Slough Farm at Wood End Lane and Shaw Lane Farm and Shaw House at Shaw Lane. These are all assessed as minor adverse effects, which are not significant at a community level.

9.4.34 Fradley, Curborough and Hanch fall within the catchment area for schools, health care and other facilities at Lichfield and many residents are therefore dependent upon using the A38, Wood End Lane and the A515 Lichfield Road on a daily basis to access these facilities. The construction of the Proposed Handsacre link in the AP2 revised scheme will require Wood End Lane to be realigned and Netherstowe Lane to be diverted permanently. These works will add approximately 2km to journeys between Fradley and Lichfield, which will therefore impact upon access to community facilities for the residents of Fradley. Whilst the A38 serves as the main route to Lichfield via Streethay, the assessment recognises that Wood End Lane is likely to be used by some people as an alternative route. As these journeys are made on a daily basis and

affect children, the AP2 revised scheme is assessed as giving rise to a minor adverse and permanent isolation effect on the community of Fradley which is not significant.

Community facilities

9.4.35 The construction of the AP2 revised scheme will not give rise to any significant permanent effects on community facilities and other recreational resources in the Fradley, Curborough and Hanch area.

9.4.36 Part of the Curborough Sprint Track at Netherstowe Lane and the Delta Force Paintballing Centre at Wood End Lane fall within the boundary of land required for the construction and operation of the AP2 revised scheme. In both cases, the amount of land that will be required permanently is small and the losses will not compromise the overall functioning of these facilities. The effects on users of these facilities are therefore assessed as minor and not significant overall. The Trent and Mersey Canal and associated towpath will pass beneath the viaduct for the proposed Manchester spur and no permanent loss of use will arise.

Recreational PRoW

9.4.37 The construction of the AP2 revised scheme will not give rise to any significant permanent effects on community facilities and other recreational resources in the Fradley, Curborough and Hanch area.

9.4.38 Part of the NCR No. 54, which runs along Netherstowe Lane and Wood End Lane at Fradley, will however be affected permanently by the diversion of Netherstowe Lane. The AP2 revised scheme makes provision to divert the cycleway along part of the realigned Wood End Lane passing beneath the Handsacre link via the Curborough Brook viaduct. This diversion will add approximately 1km to cycle journeys between Fradley and Lichfield. Whilst the extra distance will make the route less convenient for people commuting between Fradley and Lichfield, it is unlikely to affect recreational users of the cycleway route. For this reason, the permanent diversion of the cycle route is assessed as giving rise to a minor adverse and permanent effect on users of the route, which is not significant overall.

Handsacre

Temporary effects

9.4.39 Construction of the AP2 revised scheme will not give rise to any significant temporary effects on community resources in the Handsacre area.

Permanent effects

9.4.40 No significant permanent effects on community resources have been identified in the Handsacre area. The construction of the AP2 revised scheme at Handsacre will require the permanent loss of land from two residential properties, namely Ashton Hayes Farm and 29 Chestnut Close, the effects of which are assessed as minor and are not significant at a community level.

Cumulative effects

9.4.41 As noted earlier, significant development is likely to be taking place in the Streethay and Fradley areas at the same time as work to build the AP2 revised scheme.

However, no significant cumulative effects on community resources in the Streethay and Fradley areas have been identified. Whilst there is the potential for a small number of residents on the north-eastern edge of Streethay to experience significant adverse visual effects, with views over both sets of construction works, these residents are unlikely to be affected by a combination of significant amenity effects from both schemes. No significant residual construction noise effects have been identified in this area and construction traffic flows along the A5127 Burton Road are unlikely to exceed levels likely to give rise to significant adverse amenity effects on residents living along this route. Residents of Streethay are therefore unlikely to be affected by a combination of significant residual amenity effects from both sets of construction works.

9.4.42 As explained in Section 16, the traffic and transport assessment of the AP2 revised scheme already takes account of the background traffic growth predicted in this area and therefore no additional cumulative isolation effects, including on the residents of Fradley, are anticipated. No additional cumulative community effects associated with the construction of the Fradley Strategic Development Area have been identified.

Other mitigation measures

9.4.43 The assessment has concluded that construction of the AP2 revised scheme will give rise to a small number of significant adverse effects on community resources in the Whittington to Handsacre area. Whilst no further mitigation has been identified at this stage, HS2 Ltd will work closely with the owners of the following affected community resources to assist them to reconfigure their operations or to identify suitable compensatory land, on the basis that they will be eligible for financial compensation under the National Compensation Code:

- Whittington Heath Golf Club; and
- Lichfield Cruising Club.

9.4.44 There is a requirement for additional mitigation to address the temporary moderate adverse isolation effect on the community of Fradley, caused by major adverse traffic congestion at the A38/Wood End Lane junction. An appropriate junction improvement scheme is expected to be brought forward in a subsequent AP.

Summary of likely residual significant effects

9.4.45 Construction of the AP2 revised scheme will give rise to a small number of residual significant community effects in the Whittington to Handsacre area. These are shown in SES and AP2 ES, Volume 2: Maps CM 01-119 to CM-01-123.

9.4.46 In the south of the area, the loss of land and severance of the Whittington Heath Golf Club, will give rise to a permanent major adverse residual significant effect. At Huddlesford, the temporary loss of moorings and permanent loss of land from the Lichfield Cruising Club will give rise to moderate adverse residual significant effects, both temporarily and permanently. Major congestion at the A38/Wood End Lane junction, due to increased construction traffic, will also give rise to a temporary moderate adverse residual significant isolation effect on the community of Fradley.

9.5 Effects arising from operation

Avoidance and mitigation measures

9.5.1 A number of measures have been incorporated within the AP2 revised scheme to avoid or reduce effects on community receptors during operation, including:

- aligning the height of the AP2 revised scheme at Streethay, to limit the landscape effects on the surrounding area and visual impacts on residential properties;
- providing landscape earthworks and new planting to mitigate visual impacts on residential properties close to the route of the AP2 revised scheme; and
- incorporating noise barriers on viaduct structures, including over Capper's Lane at Whittington.

9.5.2 Further information on noise mitigation measures can be found in the sound, noise and vibration section of this report (Section 15).

Assessment of impacts and effects

9.5.3 The operation of the AP2 revised scheme will give rise to a combination of significant amenity effects on the residents of ten properties on the western outskirts of Whittington. The change in amenity for residents, due to a combination of significant operational noise and visual effects, is assessed as a major adverse and significant effect. The properties that will be affected are situated between Lichfield Road and Darnford Lane and are as follows:

- Ellfield Lodge, Ellfield House and Ellfield Cottage, together with an outbuilding at Ellfield House which is being converted to residential use (referred to as The Bothy), all situated to the east of the AP2 revised scheme, at Lichfield Road;
- Marsh Cottage, which is situated to the west of the AP2 revised scheme at Marsh Lane; and
- Marsh Farm, Whittington Hill House, Whittington Hill Farm, Rodrest and High View, which are situated on either side of the AP2 revised scheme at Darnford Lane.

9.5.4 No other residential properties or facilities in the Whittington to Handsacre area will be affected by a combination of significant residual amenity effects during the operation of the AP2 revised scheme.

9.5.5 The assessment has also considered the potential for operational amenity effects on occupiers of the Streethay Strategic Development Area, which is assumed to form part of the future baseline. No significant in-combination amenity effects on this development, due to the operation of the AP2 revised scheme, have been identified.

9.5.6 Further details of the revised community assessments for the operation of the AP2 revised scheme are provided in SES and AP2 ES, Volume 5: Appendix CM-001-022.

Cumulative effects

9.5.7 No significant cumulative effects have been identified within the Whittington to Handsacre area during operation of the AP2 revised scheme. Whilst there is the potential for a small number of residential properties on the north-east edge of Streethay to be affected by views to both the AP2 revised scheme and by views to the Streethay Strategic Development, the residents of these properties are unlikely to experience a combination of significant residual amenity effects from both schemes.

Other mitigation measures

9.5.8 No further mitigation has been identified.

Summary of likely residual significant effects

9.5.9 The assessment has concluded that approximately ten households on the western outskirts of Whittington will experience an adverse change in amenity due to a combination of significant noise and visual effects from the operation of the AP2 revised scheme. The change in amenity for these residents will give rise to a major adverse residual significant effect.

9.5.10 The location of the properties that will be significantly affected during operation of the AP2 revised scheme is shown in SES and AP2 ES, Volume 5 Map Book: CM-01-119 to CM-01-123.

10 Cultural heritage

10.1 Introduction

10.1.1 This section of the report provides a description of the current baseline for heritage assets and the likely impacts and significant effects resulting from the construction and operation of the AP2 revised scheme. Consideration is given to the extent and heritage value (significance) of assets including archaeological and palaeo-environmental remains; historic buildings and the built environment; and historic landscapes.

10.1.2 With regard to heritage assets, the main issue is the extent to which designated and non-designated assets are affected by the AP2 revised scheme. Impacts on assets as a result of the scheme will occur largely through the physical removal and alteration of assets and changes to their setting.

10.1.3 Maps showing the location of the key environmental features can be found in the SES and AP2 ES, Volume 2: Community Forum Area (CFA) map books. Maps showing the location of all designated and non-designated heritage assets can be found in SES and AP2 ES, Volume 5: Map Book – Cultural heritage. Detailed reports on the cultural heritage character and surveys undertaken within the local area are contained in the SES and AP2 ES, Volume 5 Appendices. These include:

- Appendix CH-002-022 – Gazetteer of heritage assets;
- Appendix CH-003-022 – Impact assessment table; and
- Appendix CH-004-022 – Survey reports.

10.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, WHAxxx; further details on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-022.

10.1.5 Engagement has been undertaken with Staffordshire County Council with regard to the nature of the cultural heritage assets within the local area.

10.2 Scope, assumptions and limitations

10.2.1 The assessment scope, assumptions and limitations for cultural heritage assessment are as set out in Volume 1, the SMR (Appendix CT-001-000/1) and the SMR Addendum (Appendix CT-001-000/2) of the main ES.

10.2.2 The setting of all designated heritage assets up to 2km of the centre line has been considered. The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out, is defined as the land required, temporarily or permanently, to construct the AP2 revised scheme plus 500m.

10.2.3 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.

10.2.4 In undertaking the assessment the following limitations were identified:

- the LiDAR[19] data examined did not encompass the full extent of the study area; and
- not all areas of survey as identified in the archaeological risk model[20] were available for survey.

10.3 Environmental baseline

Existing baseline

10.3.1 In compiling this assessment, documentary baseline data was collected from a variety of sources as set out in the main ES, Volume 5: Appendix CH-001-022.

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

- walk-over 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 SES and AP2 ES, Volume 5: Appendix CH-004-022); and
- a programme of non-intrusive surveys including geophysical surveys (see SES and AP2 ES, Volume 5: Appendix CH-004-022).

10.3.3 Further baseline information is included in this assessment where changes in the extent of land required to construct the AP2 revised scheme have resulted in changes to the extent of the cultural heritage study areas. This additional or altered baseline is described below.

Designated assets

10.3.4 The following designated heritage assets of high value are located partially or wholly within the land required, temporarily or permanently, for the construction of the AP2 revised scheme (see SES and AP2 ES, Volume 5: Map Book — Cultural heritage, Maps CH-01-061B to CH-01-065):

- ancient woodland at Ravenshaw Wood (asset reference WHA222);
- ancient woodland at John's Gorse (asset reference WHA226);
- ancient woodland at Big Lyntus (asset reference WHA221);
- Little Lyntus (asset reference WHA380), likely to meet the criteria for designation as ancient woodland;

[19] 'Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.
[20] 'The archaeological risk model is an approach that enables the identification of those areas of the AP2 revised scheme where archaeological assets.
are known or suspected and provides a mechanism for the prioritisation of the programme of survey.

- ancient woodland at Vicar's Coppice (asset reference WHA225); and
- Fulfen Wood (asset reference WHA379), likely to meet the criteria for designation as ancient woodland.

10.3.5 The following designated assets are located within the 2km study area for the AP2 revised scheme (see SES and AP2 ES, Volume 5, Map Book — Cultural heritage, Map CH-02-37 through CH-02-38):

- Streethay Manor and moated site (asset reference WHA132), a scheduled monument and listed building, with a further listed building (a 17th century plunge bath) in the grounds;
- Handsacre Hall moated site, a scheduled monument (part of asset reference WHA326);
- two Grade I listed buildings (both within the village of Mavesyn Ridware (asset reference WHA203));
- eight Grade II* listed buildings: two within the hamlet of Hill Top (asset reference WHA174), one in Longdon (asset reference WHA180), one in Armitage (asset reference WHA197), one in Mavesyn Ridware (asset reference WHA 203), High Bridge (asset reference WHA212), Whittington Old Hall (within asset reference WHA304) and Hanch Hall (asset reference WHA325);
- 91 Grade II listed buildings, predominantly within the settlements at Whittington (asset reference WHA304), Longdon Green (asset reference WHA165), on the Trent and Mersey/Coventry Canals at Fradley Junction (asset reference WHA150) and at Wood End Lock (asset reference WHA338), (asset reference WHA339) and within the city of Lichfield, as well as isolated rural farms at Huddlesford Grange Farm (asset reference WHA122), Streethay House Farm (asset reference WHA359), Curborough Farmhouse (asset reference WHA138), Hanch Hall Farm (asset reference WHA325), Tuppenhurst Farmhouse (asset reference WHA188) and a Grade II listed milepost on the Coventry Canal between King's Orchard Bridge and Stoney Step Bridge (asset reference WHA309);
- six conservation areas: the Trent and Mersey Canal (asset reference WHA340), Fradley Junction (asset reference WHA150), Longdon Green and Hill Top (asset reference WHA165), Mavesyn Ridware (asset reference WHA203), Kings Bromley (asset reference WHA218) and Whittington Village (asset reference WHA304); and
- three areas of ancient woodland: Slaish (asset reference WHA223), Tomhay Wood (asset reference WHA224) and Brookhay Wood (asset reference WHA376).

Non-designated assets

10.3.6 The following non-designated assets of moderate value lie wholly or partially within the land required, temporarily or permanently, for the construction of the AP2 revised scheme:

- Whittington Heath Golf Course clubhouse (asset reference WHA302);
- Coventry Canal including King's Orchard Bridge and Stoney Step Bridge (asset reference WHA309);
- four lengths of Important Hedgerow: Tamworth Road (asset reference WHA330), Streethay parish boundary (asset reference WHA331), Pyford Brook (asset reference WHA332) and Tewnals Lane (asset reference WHA334); and
- six archaeological assets: medieval moat and cropmarks (asset reference WHA310), medieval Streethay (asset reference WHA 314), Ravenshaw Wood relict fields (asset reference WHA321), Roman landscape at Streethay (asset reference WHA315), prehistoric landscape at Bourne Brook (asset reference WHA324), and medieval Handsacre (asset reference WHA326).

10.3.7 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 AP2 revised scheme:

- Whittington Heath Golf Course (asset reference WHA303);
- Hanchwood House (asset reference WHA080);
- Field Cottage, Streethay Cottage and Elverceter (asset reference WHA039);
- a milepost on the Tamworth Road (asset reference WHA 091); and
- eight archaeological sites: the disused Lichfield Canal (asset reference WHA308), ridge and furrow at Marsh Farm (asset reference WHA346), ridge and furrow at Huddlesford (asset reference WHA357), medieval Curborough (asset reference WHA 318), former RAF Lichfield (asset reference WHA316), Bunyan's Mill at Mill Farm (asset reference WHA306), archaeology at Fulfen Wood (asset reference WHA377) and Curborough piecemeal enclosure (asset reference WHA227).

10.3.8 All non-designated heritage assets within 500m of the land required, temporarily or permanently, for the construction of the AP2 revised scheme are listed in the gazetteer in SES and AP2 ES, Volume 5: Appendix CH-002-022 and identified on maps CH-01-061B to CH-01-065. Among these are 31 built heritage assets, the settings of which have been considered in terms of the contribution they make to the assets' value. They are:

- All the Winds (asset reference WHA009);
- Bailey's Beating (asset reference WHA010);
- Thimble Hall Cottage (asset reference WHA013);
- Marsh Farm (asset reference WHA024);
- Wren Cottage (asset reference WHA025);
- Darnford Lane Cottages (asset reference WHA026);
- Boot Farm Cottage (asset reference WHA027);

- Holly Cottage (asset reference WHA028);
- Ellfield House and Lodge (asset reference WHA018);
- Whittington Hill House and Hill Farm (asset reference WHA022);
- The Coventry Canal (asset reference WHA309);
- Fulfen Farm (asset reference WHA032);
- The Plough PH (asset reference WHA034);
- The Anchor PH (asset reference WHA038);
- Orchard Farm (asset reference WHA045);
- Ravenshaw Cottage (asset reference WHA067);
- Cranberry (asset reference WHA068);
- Common Farm (asset reference WHA364);
- Woodend Common Barn (asset reference WHA065);
- Woodend Farm (asset reference WHA062);
- Black Slough Farm (asset reference WHA066);
- Vicar's Coppice House (asset reference WHA072);
- Shaw House (asset reference WHA079);
- Ashton Hayes (asset reference WHA082);
- Westview Cottages (asset reference WHA085);
- Newtown (asset reference WHA083);
- Barn (asset reference WHA089);
- Willow Cottage (asset reference WHA064);
- The cottage called 'Rough Stockings' (asset reference WHA046);
- Ravenshaw Cottage (asset reference WHA067); and
- Hill Farm, Streethay (asset reference WHA 090).

Cultural heritage overview

10.3.9 The geology of the study area is predominantly mudstone with some sandstone deposits around Whittington Heath. This geology, which is typical of central Staffordshire and the upper part of the River Trent catchment, forms neutral clay-rich soils which often support woodland and pasture, common to the study area. The study area lies 4km from the River Tame at Whittington Heath, and only 2km from the River Tame at Streethay, running between 3km and 2km from the River Tame for the remainder of the route. The River Trent is 1km north of the northern end of the AP2

revised scheme. Further details of the geology of the area are contained in Section 12, land quality.

10.3.10 The study area is relatively low-lying, around or below 100m AOD. Whittington Heath lies on relatively high ground at approximately 100m AOD, but heading north the AP2 revised scheme corridor drops away to approximately 60m AOD at Mill Farm. Sandstone outcrops give rise to some low hills such as at Whittington Hill Farm and Hill Farm at Streethay (both approximately 85m AOD). The AP2 revised scheme runs at approximately 65m AOD from Streethay towards Wood End Farm, where it rises to run along a 75m AOD terrace for the remainder of the route.

10.3.11 Running east across the AP2 revised scheme from the Tame and Trent Valleys, three alluvial channels represent former and current river and stream beds. The first runs from Huddlesford across the scheme to the mills on the brook at Mill Farm (asset reference WHA306) and Darnford (asset reference WHA305), in the area of the Mare, Darnford and Fulfen Brooks. The second follows the old course of the Curborough/Pyford Brook near Wood End Lock (asset reference WHA344, WHA345). The third crosses the scheme at Seedy Mill, running east from Kings Bromley Marina (the Bourne Brook) (asset reference WHA324). The potential for as yet unknown palaeo-environmental or other archaeological evidence to survive on or near these watercourses is considered to be high. For this reason the extended areas around these watercourses are considered to be heritage assets (Mare Brook prehistoric landscape asset reference WHA320, Bourne Brook prehistoric landscape asset reference WHA324, and asset references WHA344 and 345 on the Pyford Brook).

10.3.12 The landscape of the Whittington to Handsacre area is predominantly an 18th and 19th century rural landscape with isolated examples of earlier (medieval) buildings. Apart from the canals and associated structures, the built heritage of the area is largely represented by dispersed settlement between villages – predominantly farmsteads and rural buildings, as well as the remains of the estates and grounds of some grander houses such as Freeford Manor (asset reference WHA300), Hanch Hall (asset reference WHA325), Elmhurst Hall (asset reference WHA323) and the Manor House at Streethay (asset reference WHA132).

10.3.13 The centre line of the route passes within 1km of Whittington (asset reference WHA304) and ends at Handsacre (asset reference WHA326), both of which are settlements of medieval origin with modern development on their outer edges near to the AP2 revised scheme. The centre of Lichfield is less than 2km from the scheme, and its modern built-up area extends through Streethay to the scheme itself. North and south of Streethay, the AP2 revised scheme runs well away from any concentrations of historic settlement until it reaches Handsacre.

10.3.14 The soils and natural resources of the study area have made it attractive for human habitation for thousands of years (see SES and main ES, Volume 5: Appendix CH-001-022). Settlement appears to have focused in the prehistoric and Roman periods around the valleys and tributaries of the rivers Trent and Tame. There is no evidence in the study area for activity dating from the Palaeolithic or Mesolithic periods, but evidence of the later prehistoric periods has been found within the study area: the Neolithic causewayed enclosure at Mavesyn Ridware (a scheduled monument) lies 1.5km from the area of land required for the AP2 revised scheme, and sites with a

possible Neolithic origin are found to the east of the Coventry Canal (asset reference WHA312) and north of Streethay Manor (asset reference WHA315).

10.3.15 Evidence of possibly later bronze age or iron age activity has been identified in the study area: an enclosure and pit alignment near Tuppenhurst Farm (asset reference WHA327), enclosures or other landscape features at Wood End (asset reference WHA344) and near Brokendown Wood (asset reference WHA345), enclosures and other features at near Riley Hill Farm (asset reference WHA361), an enclosure on the Fulfen Brook (asset reference WHA312) and the site at the Bourne Brook (asset reference WHA324); all most likely date to this period.

10.3.16 Likely Roman sites, represented by crop marks, are located in the study area at the Mare Brook and Bourne Brook. Sites which may provide evidence of Roman activity have been identified in the study area at Streethay Manor (asset reference WHA315), where a large area of crop marks just north of Ryknield Street (asset reference WHA328) may represent Roman settlement or at least intensive farming. The landscape around the Bourne Brook (asset reference WHA324) contains features which represent a complex agricultural landscape, probably originating much earlier but possibly still occupied in the Roman period.

10.3.17 There is no evidence for early medieval settlement in the study area, in common with much of the broader region and indeed the United Kingdom as a whole, with many sites going on to be developed and occupied in later periods. By the medieval period, settlement had become focused on centres at Lichfield, Streethay, Whittington and Handsacre. Evidence for habitation in the rural surrounds of these centres has been found in the study area in the form of recorded sites and objects. Two of these sites are scheduled monuments – medieval moated sites at Streethay (asset reference WHA132) and at Handsacre (asset reference WHA326).

10.3.18 From the early medieval period onwards, the countryside around these settlements was organised and demarcated with hedges and boundaries; some of these boundaries still survive in the form of ancient hedgerows (asset reference WHA330-334). Patches of ancient woodland also survive between and within the demarcated fields, including at Ravenshaw Wood (asset reference WHA222) and John's Gorse (asset reference WHA226). Scattered areas of ridge and furrow cultivation are seen within the study area, and while these have not been definitively dated to the medieval period, they may represent the small scale cultivation associated with dispersed settlement of the period (asset references WHA326, WHA357 and WHA321).

10.3.19 From the 18th century onwards, Whittington Heath (asset reference WHA303) was used as a racecourse, later becoming Whittington Heath Golf Club from the latter part of the 19th century.

10.3.20 A major change in the landscape of the post-medieval period was in the construction of the canals. The Trent and Mersey Canal (asset reference WHA320), or Grand Trunk Canal, was the second of this country's arterial canals, authorised in 1766. The need to link Liverpool with London led to the building of the Oxford and Coventry Canals, the Coventry Canal (asset reference WHA309) joining the Grand Trunk Canal at Fradley Junction (asset reference WHA150). The Wyrley and Essington Canal (asset reference WHA308) joined the Coventry Canal at Huddlesford Junction in the study area.

10.3.21 The most significant changes in landscape pattern of the study area in the late 19th and early 20th century were in the development of military establishments at DMS Whittington (Whittington Barracks) (asset reference WHA301) and RAF Lichfield (asset reference WHA316).

Future baseline

Construction (2017)

10.3.22 No committed developments have been identified in this local area that will materially alter the baseline conditions in 2017.

Operation (2026)

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

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 The draft CoCP sets out the provisions that will be adopted to control effects on cultural heritage assets. The provisions of Section 8 include the following (main ES Volume 5: Appendix CT-003-000):

- management measures to be implemented for assets that are to be retained within the land required for the construction of the AP2 revised scheme;
- the preparation of project-wide principles, standards and techniques for works affecting heritage assets;
- a programme of archaeological investigation and recording to be undertaken prior to/or during construction works affecting the assets; and
- a programme of historic building investigation and recording to be undertaken prior to modification or demolition of the assets.

10.4.2 The following measures have been incorporated into the design of the AP2 revised scheme to reduce impacts on assets:

- alignment avoids all village centred conservation areas such as Whittington (asset reference WHA304) and Kings Bromley (asset reference WHA218);
- alignment does not have a physical impact on any listed structures or scheduled monuments;
- alignment avoids the scheduled monument and listed buildings at Streethay Manor (asset reference WHA132), passing these assets in cutting;
- the undesignated milepost (asset reference WHA091), an asset of low value, will be temporarily removed to facilitate realignment of the A51 Tamworth Road and construction of a new roundabout and will be reinstated as close as possible to its original position; and
- landscape design has softened the visual appearance of the AP2 revised

scheme, particularly in the vicinity of designated assets on the Trent and Mersey Canal (asset reference WHA340).

Assessment of impacts and effects

Temporary effects

10.4.3 The construction works, comprising excavations and earthworks and including temporary works such as construction compounds, storage areas, and diversion of existing roads and services, have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required for the construction of the AP2 revised scheme and assets in the wider study area due to the visibility of plant, cranes and equipment; and other construction factors.

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

- Ellfield House and Lodge (asset reference WHA018), an asset of low value, will experience temporary disruption of its setting during earth moving for construction of the scheme adjacent to the boundary of the asset and there will be a noise impact for approximately two years. This will constitute a high adverse impact and moderate adverse effect;
- Whittington Hill House and Hill Farm (asset reference WHA022), an asset of low value, will experience temporary disruption of its setting during earth moving for construction of the scheme less than 50m from the boundary of the asset, and there will be a noise impact for approximately two years. This will constitute a high adverse impact and moderate adverse effect;
- Fulfen Wood (asset reference WHA379) likely to meet the criteria for designation as ancient woodland, an asset of high value, will be affected during construction by the presence of the WCML overbridge (south) satellite compound for approximately two years, which will alter the experience of approaching and entering the woodland. There will be disturbance during removal of part of the woodland itself, and there will also be construction-related noise within the woodland. This will constitute a medium adverse impact and major adverse effect;
- Hill Farm (asset reference WHA090), an asset of low value, will experience temporary disruption of its setting during earth moving for construction of the scheme and there will be a noise impact for approximately two years. This will constitute a high adverse impact and moderate adverse effect;
- Streethay Manor and moated site (asset reference WHA132), an asset of high value, will experience disruption to the asset's historic access and setting during construction. There will be noise during construction of the scheme cutting and during construction of the A38 overbridge for approximately one year and six months. This will constitute a high adverse impact and major adverse effect;
- Streethay House Farm (asset reference WHA359), an asset of moderate value, will experience temporary disruption of its setting and historic access during

construction. There will also be a noise impact during construction. This will constitute a medium adverse impact and moderate adverse effect;

- the cottage called 'Rough Stockings' (asset reference WHA046), an asset of low value, will experience temporary disruption of its setting during earth moving for construction of the scheme along the boundary of the asset, and there will be a noise impact for approximately two years. This will constitute a high adverse impact and moderate adverse effect;
- remaining buildings at Field Cottage, Streethay Cottage and Elverceter (asset reference WHA039), an asset of low value, will experience temporary disruption of setting during earth moving for construction of the scheme along the boundary of the asset and demolition of Field Cottage. There will be a noise impact for approximately two years. This will constitute a high adverse impact and moderate adverse effect;
- ancient woodland at Big Lyntus (asset reference WHA221), an asset of high value, will be affected during construction by the presence of the adjacent Curborough Brook viaduct satellite compound for approximately two years and a material storage area, which will alter the experience of approaching and entering the woodland. There will be disturbance during removal of part of the woodland itself, and there will also be construction-related noise within the woodland. This will constitute a medium adverse impact and major adverse effect;
- ancient woodland at Ravenshaw Wood (asset reference WHA222), an asset of high value, will experience disruption to its character and setting, and the experience of approaching and entering the woodland. There will be disturbance during removal of part of the woodland itself, and there will also be construction-related noise within the woodland. This will constitute a medium adverse impact and major adverse effect;
- ancient woodland at Vicar's Coppice (asset reference WHA225) an asset of high value, will be affected during construction along its boundary for approximately one year and six months, which will alter the experience of approaching and entering the woodland. There will be disturbance during removal of trees along the boundary of the woodland itself, and there will also be construction-related noise within the woodland for approximately two years. This will constitute a low adverse impact and moderate adverse effect;
- Willow Cottage (asset reference WHA064) an asset of low value, will experience temporary disruption of its setting during earth moving for construction of the scheme less along the boundary of the asset, and there will be a noise impact for approximately two years. This will constitute a high adverse impact and moderate adverse effect;
- Shaw House (asset reference WHA079), an asset of low value, will experience noise and disruption to access during construction of the scheme embankment for approximately three years. This will constitute a high adverse impact and moderate adverse effect;

- the Trent and Mersey Canal Bridge 53 and Wood End Lock (asset reference WHA 338), an asset of moderate value, will experience noise during landscaping and construction for approximately one year and three months and loss of the ability to appreciate the asset in its historic landscape setting. This will constitute a medium adverse impact and moderate adverse effect; and
- Wood End Lock Cottage (asset reference WHA 339), an asset of moderate value, will experience noise during construction and loss of the ability to appreciate the building in its historic setting. Historic access will be disrupted by landscaping adjacent to the asset and use of its access road for approximately one year and six months. This will constitute a medium adverse impact and moderate adverse effect.

Permanent effects

10.4.5 The following significant effects will occur as a result of physical impacts on heritage assets within the land required for the construction of AP2 revised scheme:

- part of the ancient woodland at Ravenshaw Wood (asset reference WHA222), an asset of high value, will be removed for construction of the scheme. This will constitute a medium adverse impact and major adverse effect;
- the majority of ancient woodland at John's Gorse (asset reference WHA226), an asset of high value, will be removed for construction of the embankment for the scheme. This will constitute a high adverse impact and major adverse effect;
- part of the ancient woodland at Big Lyntus (asset reference WHA221), an asset of high value, will be removed for construction of the scheme. This will constitute a low adverse impact and moderate adverse effect;
- Little Lyntus (asset reference WHA380) likely to meet the criteria for designation as ancient woodland, an asset of high value, will be removed for construction of the scheme. This will constitute a high adverse impact and major adverse effect;
- part of the ancient woodland at Vicar's Coppice (asset reference WHA225); an asset of high value, will be removed for construction of the scheme. This will constitute a low adverse impact and moderate adverse effect;
- approximately half of Fulfen Wood (asset reference WHA379) likely to meet the criteria for designation as ancient woodland, an asset of high value, will be removed for construction of the scheme. This will constitute a high adverse impact and major adverse effect; Whittington Heath Golf Course clubhouse (asset reference WHA302), an asset of moderate value, will be demolished for construction of the scheme cutting and earthworks. This will constitute a high adverse impact and major adverse effect;
- archaeological deposits related to medieval Streethay (asset reference WHA314), an asset of moderate value, will be removed for scheme construction, compounds, and a new access for The Manor House. This will

constitute a medium adverse impact and moderate adverse effect;

- archaeological deposits related to the prehistoric landscape at Bourne Brook (asset reference WHA324), an asset of moderate value, will be removed for construction of scheme embankments, temporary workers' accommodation, materials stockpile and the A515 Lichfield Road underbridge main compound and compound access. This will constitute a medium adverse impact and moderate adverse effect;
- archaeological features - a boundary bank and earthworks (asset reference WHA319) at Woodend, an asset of low value, will be removed for construction of the scheme. This will constitute a high adverse impact and moderate adverse effect;
- an important hedgerow along Tamworth Road (asset reference WHA330), an asset of moderate value, will be partially removed by a cutting and landscaping. This will constitute a medium adverse impact and moderate adverse effect;
- an important hedgerow along the Streethay parish boundary (asset reference WHA331), an asset of moderate value, will be partially removed by a cutting and landscaping. This will constitute a medium adverse impact and moderate adverse effect;
- an important hedgerow along the boundary of Vicar's Coppice (asset reference WHA334), an asset of moderate value, will be partly removed at four locations. This will constitute a medium adverse impact and moderate adverse effect;
- part of Whittington Heath Golf Course (asset reference WHA303), an asset of low heritage value, will be removed. The AP2 revised scheme bisects the course in cutting and on embankment, visually intruding on the designed historic landscape of the course, interrupting its quiet heathland setting and destroying its early 20th century design. This will constitute a high adverse impact and moderate adverse effect;
- Hanchwood House (asset reference WHA080), an asset of low value, will be demolished for construction of the embankment at Shaw Lane. This will constitute a high adverse impact and moderate adverse effect;
- archaeological deposits in the location of Bunyan's Mill at Mill Farm (asset reference WHA306), an asset of low value, will be removed for construction of the earthworks for the Capper's Lane viaduct. This will constitute a high adverse impact and moderate adverse effect;
- archaeological deposits at Fulfen Wood (asset reference WHA377), an asset of low value, will be removed for landscaping. This will constitute a high adverse impact and moderate adverse effect;
- archaeological deposits relating to a medieval moated site and cropmarks (asset reference WHA310), an asset of moderate value, will be removed for earthworks storage. This will constitute a high adverse impact and major adverse effect; and

- an area of Ridge and Furrow at Marsh Farm (asset reference WHA346), an asset of low value, will be largely removed by the AP2 revised scheme. This will constitute a high adverse impact and moderate adverse effect.

10.4.6 The following significant effects will occur as a result of permanent impacts due to changes to the setting of heritage assets:

- Streethay Manor House and moated site (asset reference WHA132), an asset of high value, will be subject to a comprehensive change in setting: the AP2 revised scheme will be constructed in cutting approximately 20m from the asset through what were historically open fields. Historic views towards Rough Stockings will be altered by the scheme landscaping and connection with other parts of medieval Streethay will be severed. There will also be a change to the historic access to the site. This will constitute a medium adverse impact and major adverse effect;
- Ellfield House and Lodge (asset reference WHA018), an asset of low value, will be subject to a change in its setting: the AP2 revised scheme will be in permanent view, curtailing historic views to Whittington Hill Farm and to open fields. This will constitute a high adverse impact and moderate adverse effect;
- Whittington Hill House and Hill Farm (asset reference WHA022), an asset of low value, will be subject to a change in its setting: the cutting for the AP2 revised scheme will be approximately 80m away, and historic access will be altered with the realignment of Darnford Lane. Historic views to Ellfield House will be affected. This will constitute a high adverse impact and moderate adverse effect;
- ancient woodland at Slaish (asset reference WHA223), an asset of high value, will be effectively severed from its historic landscape context to the south, changing its setting, which contributes to its significance as a feature of the local historic landscape. This will constitute a low adverse impact and moderate adverse effect;
- remaining ancient woodland at Ravenshaw Wood (asset reference WHA222), an asset of high value, will be severed by the AP2 revised scheme, altering the ability to appreciate the woodland approach, within its historic landscape setting. The combined impact as a result of severing the wood and changes to its setting will result in a permanent medium adverse impact and a major adverse effect;
- remaining ancient woodland at Vicar's Coppice (asset reference WHA225), an asset of high value, will be immediately adjacent to the AP2 revised scheme, altering the ability to appreciate the woodland within its historic landscape setting. This will constitute a low adverse impact and moderate adverse effect;
- remaining ancient woodland at Big Lyntus (asset reference WHA221), an asset of high value, will be immediately adjacent to the AP2 revised scheme, altering the ability to appreciate the woodland within its historic landscape setting. This will constitute a low adverse impact and moderate adverse effect;

- remaining woodland at Fulfen Wood (asset reference WHA379) likely to meet the criteria for designation as ancient woodland, an asset of high value, will be immediately adjacent to the AP2 revised scheme, altering the ability to appreciate the woodland within its historic landscape setting. The combined impact as a result of its partial removal and changes to its setting will result in a permanent high adverse impact and major adverse effect;
- Wood End Lock Cottage (asset reference WHA 339), an asset of moderate value, will be subject to a change in setting: the AP2 revised scheme will be 150m away, but the historic approach to the cottage will be very different, through a planted landscape, not open fields, and via a different access road which will cross the constructed scheme. This will constitute a medium adverse impact and moderate adverse effect;
- Willow Cottage (asset reference WHA064) an asset of low value, will experience disruption of its setting during earth moving for construction of the scheme along the boundary of the asset, and there will be a noise impact for approximately two years. The asset will be within 50m of the scheme, and its setting will be altered considerably by the scheme landscaping and infrastructure. This will constitute a high adverse impact and moderate adverse effect; and
- The cottage called 'Rough Stockings' (asset reference WHA046), an asset of low value, will be permanently effected by the scheme landscaping to the south through previously open fields. This will constitute a medium adverse impact resulting in a permanent moderate adverse effect.

Other mitigation measures

10.4.7 Refinements to the mitigation measures incorporated into the design of the AP2 revised 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.

Cumulative effects

10.4.8 No significant cumulative effects have been identified in relation to cultural heritage.

Summary of likely residual significant effects

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

10.5 Effects arising from operation

Avoidance and mitigation measures

10.5.1 The following measures have been incorporated into the design of the AP2 revised scheme to reduce the impacts and effects on assets:

- noise mitigation measures have been included within the scheme design to reduce potential impacts on identified assets; and
- landscape planting will increasingly reduce impacts on the setting of the designated assets within the study area as it matures during the operational phase.

Assessment of impacts and effects

10.5.2 The assessment considers the AP2 revised 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 scheme. Impacts due to changes to the setting of heritage assets arising from the physical presence of the AP2 revised scheme are described as permanent occurring within the construction phase and are not repeated in detail here, although they will endure through the operation of the 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.

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

- Ellfield House and Lodge (asset reference WHA018), an asset of low value, will be less than 50m from the AP2 revised scheme. Taking account of the reduction in sound levels provided by the cutting, there will be a major adverse noise impact (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-02-62). This will result in a high adverse impact as the asset's current quiet rural setting contributes to its significance. The combined presence and operation of the AP2 revised scheme will adversely alter the setting of this asset, resulting in a high adverse impact and moderate adverse effect;
- Whittington Hill House and Hill Farm (asset reference WHA022), an asset of low value, is less than 500m from the AP2 revised scheme. Taking account of the reduction in sound levels provided by the cutting, there will be a high adverse noise impact (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-02-62). This will result in a high adverse impact as the asset's current quiet rural setting contributes to its significance. The combined presence and operation of the AP2 revised scheme will adversely alter the setting of this asset, resulting in a high adverse impact and moderate adverse effect;
- ancient woodland at Slaish (asset reference WHA223), an asset of high value, will have its rural character affected by noise (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-01-64). This will result in a low

adverse impact. The combined presence and operation of the AP2 revised scheme will result in a low adverse impact and moderate adverse effect;

- ancient woodland at Vicar's Coppice (asset reference WHA225), an asset of high value, will have its rural character affected by noise (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-01-64). This will result in a low adverse impact. The combined presence and operation of the AP2 revised scheme will result in a low adverse impact and moderate adverse effect;
- ancient woodland at John's Gorse (asset reference WHA226), an asset of high value, will have its rural character affected by noise (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-01-64. The combined presence and operation of the AP2 revised scheme will result in a high adverse impact and major adverse effect;
- Whittington Heath Golf Course (asset reference WHA303), an asset of low value, will be subject to noise (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-01-61/2). The combined presence and operation of the AP2 revised scheme will result in a high adverse impact and moderate adverse effect;
- Trent and Mersey Bridge 53 and Wood End Lock (asset reference WHA338), a Grade II listed asset of moderate value, will be subject to noise (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-01-64) affecting the asset's rural setting. This will result in a medium adverse impact. The combined presence and operation of the AP2 revised scheme will adversely alter the setting of this asset, resulting in a medium adverse impact and moderate adverse effect;
- Wood End Lock Cottage (asset reference WHA339), a Grade II listed asset of moderate value, will be subject to noise (SES and AP2 ES, Volume 5: Map Book - sound, noise and vibration, Map SV-02-64) affecting the asset's rural setting. This will result in a medium adverse impact. The combined presence and operation of the AP2 revised scheme will adversely alter the setting of this asset, resulting in a medium adverse impact and moderate adverse effect;
- Trent and Mersey Canal conservation area (asset reference WHA340), an asset of moderate value, will be subject to noise (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-01-64) affecting the asset's rural setting. This will result in a medium adverse impact. The combined presence and operation of the AP2 revised scheme will adversely alter the significance of the setting of this asset, resulting in a medium adverse impact and moderate adverse effect;
- Streethay Manor and moated site (asset reference WHA132), an asset of high value, will be subject to a change in noise levels (SES and AP2 ES, Volume 5: Map Book - Sound, noise and vibration, Map SV-02-62). This will affect the general rural setting of the asset but its overall impact on setting and significance is lessened by the fact that the asset lies close to a major road, consequently noise is already a factor in its setting. The combined presence

and operation of the AP2 revised scheme will adversely alter the setting of this asset resulting in a high adverse impact and major adverse effect;

- ancient woodland at Ravenshaw Wood (asset reference WHA222), an asset of high value, will be subject to noise detracting from its quiet character and the setting of the remaining woodland. The combined presence and operation of the AP2 revised scheme will result in a high adverse impact and major adverse effect;
- ancient woodland at Fulfen Wood (asset reference WHA379) likely to meet the criteria for designation as ancient woodland, an asset of high value, will have its rural character affected by noise. The combined presence and operation of the AP2 revised scheme will result in a medium adverse impact and major adverse effect;
- ancient woodland at Big Lyntus (asset reference WHA221), an asset of high value, will have its rural character affected by noise. The combined presence and operation of the AP2 revised scheme will result in a medium adverse impact and major adverse effect; and
- Willow Cottage (WHA064), an asset of low value, will be subject to noise and the presence and operation of the AP2 revised scheme within 50m of the cottage will adversely alter key characteristics of its setting. This will result in a medium adverse impact resulting in a moderate adverse effect.

Other mitigation measures

10.5.4 The AP2 revised scheme includes a number of design measures to address potential impacts and significant effects. No additional operational mitigation measures are required.

Cumulative effects

10.5.5 During the operational phase of the AP2 revised scheme, cumulative development projects described in Section 6.1 and SES and AP2 ES Volume 5: Appendix CT-004-000 include construction of HS2 Phase Two. Assessment of inter-project effects on cultural heritage assets arising from the interaction of the AP2 revised scheme with cumulative development projects has been undertaken. No significant cumulative effects have been identified in relation to cultural heritage.

Summary of likely residual significant effects

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

11 Ecology

11.1 Introduction

11.1.1 This section describes the ecological baseline and identifies likely impacts and significant ecological effects that will arise from the construction and operation of the AP2 revised scheme. These include impacts on species, habitats and sites designated for their importance for nature conservation.

11.1.2 The principal ecological issues in this area include: loss of habitat where the route of the AP2 revised scheme passes through Whittington Heath Golf Course Site of Biological Importance (SBI); Fulfen Wood, Little Lyntus, Big Lyntus SBI and ancient woodland, John's Gorse SBI and ancient woodland; Ravenshaw Wood, Black Slough and Slaish SBI (part of Ravenshaw Wood is ancient woodland); Vicar's Coppice Biodiversity Alert Site (BAS) and ancient woodland; and impacts on the assemblage of bats using the Trent and Mersey Canal and associated woodland.

11.2 Scope, assumptions and limitations

11.2.1 The scope and methodology of the ecological assessment are introduced in the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES. Further detail, including the study area for individual surveys, is provided within the SMR Addendum within the main ES. The assessment methodology is summarised in Section 8 of Volume 1 of the main ES, along with route-wide assumptions and limitations.

11.2.2 Limitations associated with particular surveys are reported in the main ES, Volume 5: Appendices EC-001-003, EC-002-003, EC-003-003 and EC-004-003 and in the Volume 5 appendices of the SES and AP2 ES.

11.2.3 A Water Framework Directive (WFD) assessment was undertaken in conjunction with the original environmental assessment. Details of this assessment are presented in the main ES, Volume 5: Appendix WR-001-000. In addition, the WFD assessment has been updated. Details of the revised assessment are presented in SES and AP2 ES, Volume 5: Appendix WR-001-000.

11.2.4 Access was not obtained to all of the land area where general habitat survey (Phase 1 habitat survey) was proposed. Locations with the potential to support key ecological receptors where access could not be gained for survey include Vicar's Coppice, Fulfen Wood, Tuppenhurst Lane (west of) SBI and the Mare Brook. There was lack of access to some ponds for amphibian surveys; and the Wyrley and Essington Canal, and an unnamed tributary of the Mare Brook were only partially accessible. Further details are provided in the main ES, Volume 5: Appendices EC-001-003, EC-002-003, EC-003-003, and EC-004-003 and in the Volume 5 appendices of the SES and AP2 ES.

11.2.5 Where data are limited, a precautionary baseline has been built up according to the guidance provided in the SMR Addendum (main ES, Volume 5: Appendix CT-001-000/2). This constitutes a 'reasonable worst-case' basis for the subsequent assessment. The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the AP2 revised scheme in this area.

11.3 Environmental baseline

Existing baseline

11.3.1 The ecological baseline for the assessment takes into account baseline information collected in support of the main ES, which included field survey data, aerial photography and relevant existing information gathered from national organisations and from regional and local sources including: Staffordshire Wildlife Trust and Staffordshire Ecological Record (Biological Records Centre).

11.3.2 The assessment also takes into account additional desk-study and survey information collected since production of the main ES (September 2013). Supplementary information relevant to the assessment in this CFA includes: additional survey work for great crested newt, bats and otter; habitat survey at Big Lyntus and a review of historic records relating to Fulfen Wood. In addition, further information has been obtained from the following organisations: Staffordshire Ecological Record (Staffordshire Biological Record Centre) and Staffordshire Wildlife Trust.

11.3.3 A summary of the baseline information relevant to the assessment of significant effects is provided below. Further details of baseline information obtained to support the main ES is provided in Volume 2, CFA22, Section 7 of the main ES and in the main ES Volume 5: Appendix EC-001-003 and maps EC-01 to EC-12. Additional baseline information obtained since the main ES is provided in the SES and AP2 ES, Volume 5: Appendix EC-001-003 and Appendix EC-004-003 and on maps EC-01, EC-04, EC-05, EC-11 and EC-12.

11.3.4 Land required for the construction of the AP2 revised scheme and that adjacent to it consists mainly of arable land, bounded by open hedgerows and tree lines. Lichfield is a major settlement to the west of the AP2 revised scheme, but along the length of the route in CFA22, the area is relatively sparsely populated with the main development areas being the villages of Whittington Heath, Huddlesford and Streethay. There is a concentration of ancient woodland in the northern part of the area, whilst broadleaved semi-natural woodland and improved grassland make up the majority of the remaining land use types. The Trent and Mersey Canal, the Wyrley and Essington Canal, Curborough Brook and Bourne Brook are all crossed by the route of the AP2 revised scheme.

Designated sites

11.3.5 There are no statutory designated sites located within 500m of the land required for the AP2 revised scheme.

11.3.6 There are 36 LWS within 500m of the AP2 revised scheme. LWS are named as either SBI or BAS in Staffordshire. For the purposes of assessment each of these sites is of county/metropolitan value. Fourteen LWS are relevant to the assessment in this area; they are:

- Whittington Heath Golf Course SBI – formerly a single block of heathland known as Whittington Heath. Much of the unmanaged areas of the site support immature woodland of common oak or mixed oak/silver birch with some developing understorey of holly and rowan, along with bracken. There are some patches dominated by heather but much of the site is a mosaic of

remnant heath, with heather dominating only in the less managed areas. Damp acid and drier acid grassland patches are also present and the site supports breeding birds and terrestrial invertebrates. The SBI is partially within the land required for the construction of the AP2 revised scheme;

- Curborough House Hedgerows SBI – consists of Curborough House (hedge 1) and Curborough House (hedge 4). Both hedges are valued for the high number of woody species and standard trees along their length; mature pedunculate oak standards up to 20m being noted approximately every 50m. The northern section of the SBI lies within the land required for the construction of the AP2 revised scheme;
- Big Lyntus SBI – the woodland mainly comprises mixed plantation trees with a small area of broadleaved woodland. The northern part of the woodland is replanted ancient woodland with a high canopy (up to 30m) dominated by semi-mature beech and Scots pine trees. Ground flora is limited to the edges of the woodland or patches where there are gaps in the canopy, where bluebell, wood sage, greater stitchwort and yellow archangel are present, with common nettle and cleavers being frequent species. The SBI is located partially within the land required for the construction of the AP2 revised scheme off Wood End Lane;
- Fradley Wood BAS – this includes Fradley Gorse, Brokendown Wood and secondary woodland adjacent to the banks of the Trent and Mersey Canal. The site is made up of blocks of both coniferous and broadleaved plantation. Large areas of woodland from within the BAS have been felled and the land returned to agriculture. The BAS lies partially within the land required for the construction of the AP2 revised scheme (the Manchester spur);
- Wood End Lock (south-east of) SBI – is a small deciduous wood, beside the Trent and Mersey Canal, that is bordered by Curborough Brook and containing a steep-sided pond. The woodland canopy comprises mature common oak with alders abundant near the pond and on the brook margins. There is a well-developed shrub layer and a number of plants (yellow archangel, bluebell, dog's mercury) indicative of ancient woodland. This site lies entirely within the land required for the construction of the AP2 revised scheme;
- Trent and Mersey Canal and Coventry Canal, Kings Bromley Wharf to Fradley Junction and from Fradley Junction to Fradley Bridge SBI – comprises two lengths of canal. Generally both canals support a similar range of emergent species, although the amount of marginal vegetation differs from place to place. It is usually comprises reed sweet-grass, branched bur-reed and sweet-flag. Additional species occur at various localities including flowering rush, arrowhead and greater tussock-sedge, which are rare or uncommon in the county. The diverse marginal and emergent vegetation supports a range of invertebrates including butterflies, dragonflies and damselflies. The SBI is crossed by the AP2 revised scheme (the Manchester spur);
- Curborough Hall Farm hedgerows BAS – contains hedgerows known as hedge 1, 2 and 6. Hedgerow 1, on the eastern boundary of Watery Lane off Wood End

Lane and adjacent to the sewage works, has 15 hedge canopy species and 16 standard trees as well as a small ditch and a bank. Hedge 2 is on the western boundary of Watery Lane off Wood End Lane, opposite the sewage works and has 13 canopy species and 10 standard trees as well as a small bank. Hedge 6 is on the eastern boundary of Watery Lane off Wood End Lane near Curborough Hall Farm. This hedge has 13 canopy species, six standard trees and a small ditch and a grass verge of over two metres on one side. This BAS is within the land required for the AP2 revised scheme;

- Woodend Lane (hedge 1) BAS – is situated on Wood End Lane opposite Black Slough Farm. The hedge has a species rich canopy with 14 species including gorse, hazel, crab apple and both black and white bryony and has standard trees along its length. The hedge also has a small ditch adjacent. This BAS is within the land required for construction of the AP2 revised scheme;
- Ravenshaw Wood, Black Slough and Slaish SBI – is adjacent to the Trent and Mersey Canal, and consists of three contiguous woodlands: Ravenshaw Wood, Black Slough and the Slaish. Part of the SBI is ancient semi-natural woodland and part ancient replanted woodland with an even-aged canopy of pedunculate oak. The sites are locally waterlogged and soils noticeably acidic, with the vegetation communities being typical for these soil conditions. Rhododendron is established in the woodland and, in the southern and more eastern parts, now forms a dense understorey. In the remainder of the site, the ground layer comprises areas dominated by bramble or by bracken, with some localised patches of wavy hair-grass on the most acidic soils. Accompanying species include broad buckler fern, wood sage and bluebell, all of which are confined to the most westerly block where honeysuckle is also most abundant. The SBI is within the land required for the construction of the AP2 revised scheme;
- Vicar's Coppice BAS – lies adjacent to the A515 (Lichfield Road) and consists of 7ha of ancient semi-natural broadleaved woodland, the canopy dominated by common oak with some birch. However, the ground flora has become degraded through its use as a venue for paintballing and the remaining scrub layer is dominated by rhododendron. The BAS is partially within the land required for the construction of the AP2 revised scheme;
- Tomhay Wood SBI – lying between Wood End Lane and the WCML. The site consists of a remnant area of ancient woodland with some planted areas of larch, spruce and the non-native species Turkey oak. The wood is in a degraded state with rhododendron, Himalayan balsam and bracken becoming dominant in places. The SBI lies immediately adjacent to the land required for the construction of the AP2 revised scheme;
- Tuppenhurst Lane (west of) SBI – supports a range of habitats that are uncommon in the Lichfield District area including marshy grassland, unimproved grassland and swamp, and is dissected by a narrow stream which joins a tributary of the River Trent. The wooded canopy adjacent to the stream is dominated by alder with hawthorn, grey willow and goat willow. This SBI lies partly within the land required for the construction of the AP2 revised scheme;

- John's Gorse SBI – consists of two areas of ancient and semi-natural broadleaved woodland, with canopy species of sycamore, hazel, rowan, elder, birch and alder. The more northerly woodland block is heavily grazed with the southern block fenced off and less affected by cattle. The SBI is located within the land required for the construction of the AP2 revised scheme; and
- Riley Hill BAS – comprises old sand and gravel pits close to Handsacre reservoir. The site contains pools, mature woodland and short grassland. The BAS is approximately 15m from land required for construction of the AP2 revised scheme for proposed utilities works.

11.3.7 In addition to the areas of ancient woodland which fall within designated sites, one area of woodland which appears on the ancient woodland inventory occurs within the extent of the AP2 revised scheme: Hanch Wood. Hanch Wood is adjacent to John's Gorse SBI, is similar in its composition and was originally part of the SBI designation. However, its inclusion in the SBI designation appears to have been rescinded when the Staffordshire Ecological Record unit resurveyed John's Gorse in 2011.

11.3.8 Further work carried out since publication of the main ES indicates that Fulfen Wood and Little Lyntus wood are likely to be ancient and are currently being considered for inclusion on the ancient woodland inventory. Both are within the land required for construction of the AP2 revised scheme. Ancient woodland is considered to be an irreplaceable resource.

Habitats

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

Woodland

11.3.10 Fulfen Wood, adjacent to the WCML, is just over 1ha in area, comprising a 0.43ha western part and a 0.61ha eastern part, which are separated by agricultural fields. Fulfen Wood is likely to be ancient and will likely be added to the ancient woodland inventory. Fulfen Wood has not been surveyed due to access restrictions but is considered likely to support lowland mixed deciduous woodland, habitat of principal importance and is, as a precaution, considered as being of up to county/ metropolitan value.

11.3.11 Within Big Lyntus woodland, which is within the land required for the AP2 revised scheme, the northern part of the site is ancient replanted woodland with a high canopy (up to 30m) dominated by semi-mature beech and Scots pine trees. A National Vegetation Classification (NVC)[21] survey identified the beech woodland community W15 *Fagus sylvatica-Deschampsia flexuosa* woodland which is lowland mixed deciduous woodland, a habitat of principal importance, and identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[22]. Between the northern part of the woodland and a strip of semi-natural woodland on the southern boundary of the site is a more recent plantation dominated by pedunculate oak with occasional ash. The strip of ancient semi-natural woodland in the south of the site is

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

structurally and botanically more diverse than the plantation areas. This woodland is of county/metropolitan value.

11.3.12 Little Lyntus, which is within the land required for the AP2 revised scheme, is a 1.4ha block of woodland within an arable field which is not listed on the ancient woodland inventory or as lowland deciduous woodland on the Natural England Inventory of habitats of principal importance. Surveys of the woodland were not carried out in support of the main ES due to access restrictions. A survey was carried out in May 2014 and identified a number of ancient woodland indicator species including: small-leaved lime, moschatel, wood anemone, pignut, yellow archangel and dog's mercury. Ancient or veteran trees and evidence of past coppicing were also recorded during the site visit, together with an old ditch bank. Based on the survey and subsequent detailed heritage review, the woodland supports habitat of principle importance and has some characteristics of ancient woodland. The woodland is as a precaution considered as being of up to county/metropolitan value.

11.3.13 Ravenshaw Wood, Black Slough and the Slaish are individually named woodlands which form part of a larger woodland; Ravenshaw Wood and Black Slough, which are both within the land required for the AP2 revised scheme. Ravenshaw Wood and the Slaish contain ancient semi-natural woodland; Ravenshaw Wood also contains replanted ancient woodland. NVC surveys identified most of Ravenshaw Wood as the oak woodland community W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, characteristic of woods on base poor soils and widespread over the lowlands of England and Wales. The area in the north-west of the woodland is on waterlogged ground and has a birch community identified as W4 *Betula pubescens-Molinia caerulea* woodland. The majority of Black Slough is similar to Ravenshaw Wood. Further north, towards the Trent and Mersey Canal, the area of woodland known as the Slaish has very wet ground conditions and the canopy changes to a low shrub layer of grey willow with scattered crack willow. Alder is present alongside the canal. Rhododendron is also present. There are small pools and raised areas forming a mosaic of wet and drier conditions with stands of tall herbaceous plants such as yellow iris, lesser pond-sedge and soft rush. The most noticeable characteristic of this habitat are cushions of bog mosses. Ravenshaw Wood, Black Slough and the Slaish are considered as a single large woodland, which is of county/metropolitan value.

11.3.14 Vicar's Coppice, which is within the land required for the AP2 revised scheme, is ancient semi-natural woodland and lowland mixed deciduous woodland habitat of principal importance. Although access was not available for survey, details from the citation for Vicar's Coppice BAS indicate that the woodland is unmanaged and degrading, with areas of either rhododendron dominating the shrub layer or areas of bare ground where the woodland is used for paintballing. However, given the woodland's size and designated status, using a precautionary approach the woodland is considered to be of up to county/metropolitan value.

11.3.15 Tomhay Wood, which is adjacent to the land required for the AP2 revised scheme, is a remnant area of ancient semi-natural woodland. Access was not available for survey; therefore, taking a precautionary approach the woodland is assumed to be of up to county/ metropolitan value.

11.3.16 John's Gorse, which is within the land required for the AP2 revised scheme, is split into two main areas which are heavily grazed but are also ancient semi-natural woodland.

The canopy of the northern area (John's Gorse) consists mainly of oak and some birch, now dying back, above a grassy field layer. The very sparse understorey contains hawthorn, holly and sweet chestnut. Fox Covert, the southern section of John's Gorse, appears to have once been much larger and has been reduced by felling and wayleave maintenance to accommodate an overhead power line. This woodland has been extensively planted with conifers including Norway spruce, Scots pine and common larch. The canopy is open with relatively few mature broadleaved trees. Cherry and birch are present, but more than half the area consists of hawthorn and elder scrub, with some hazel. Hanch Wood, a remnant of former ancient woodland which is present on the 1884 Ordnance Survey map, is lowland mixed deciduous woodland, which is a habitat of principal importance. Access to the area was not obtained. These woodlands are fragmented and show no evidence of traditional management such as coppicing. Due to the proximity of these woodlands, which were likely to be contiguous in the past, they are evaluated collectively as being of up to county/metropolitan value.

11.3.17 Fradley Wood, which is within the land required for the AP2 revised scheme, was not surveyed in its entirety due to access restrictions. A NVC survey was carried out within the compartment of Fradley Wood known as Fradley Gorse, adjacent to the eastern bank of the Trent and Mersey Canal. This survey identified the oak woodland community W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, a habitat of principal importance. The woodland sub-community identified (W10d) is typical of disturbed and secondary woodlands. The woodland is of district/borough value.

11.3.18 Brokendown Wood, which is part of Fradley Wood BAS and within the land required for the AP2 revised scheme, was not accessible for survey, but appears to be broadleaved plantation adjacent to the Trent and Mersey Canal and is likely to support lowland mixed deciduous woodland, a habitat of principal importance. The woodland is assumed to have district/borough value.

11.3.19 The woodland near Wood End Lock (within Wood End Lock (south-east of) SBI), which is within the land required for the AP2 revised scheme, contains wet woodland, a habitat of principal importance, dominated by alder and ash surrounding a pond. Wetter depressions to the north-west of the pond contain crack willow up to 10m in height and large bitter-cress, which is locally abundant with ground ivy. NVC survey identified the alder woodland community W6 *Alnus glutinosa- Urtica dioica* woodland. The remaining woodland is drier and was identified as the ash woodland community W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, a habitat of principal importance (lowland mixed deciduous woodland). This woodland is of district/borough value.

11.3.20 Harvey's Rough, which is within the land required for the AP2 revised scheme, is a small woodland surrounded by arable land and bisected by the existing WCML railway. This woodland is not on the ancient woodland inventory and is not recognised as lowland mixed deciduous woodland on the Natural England inventory of habitats of principal importance. Surveys of the woodland were not carried out in support of the main ES due to access restrictions. A survey was carried out after publication of the main ES, following access permission, and recorded a canopy of pendunculate oak, sycamore, silver birch, willow, hazel and elder with a shrub layer/ground flora

comprising bramble and common nettle. Based on survey evidence, this woodland is well established but not ancient and supports habitat of principal importance. The value of the woodland was given as local/parish in the main ES. Given the small size of the woodland and its bisection by the WCML railway, the woodland is considered to have local/parish value.

11.3.21 A block of secondary woodland to the south of John's Gorse and Hanch Wood, alongside Bourne Brook, is wet woodland, a habitat of principal importance. It has a canopy of alder and predominantly even-aged pedunculate oak with some conifers (probably planted approximately 50 to 60 years ago). The woodland is subject to seasonal flooding and most closely resembles the alder woodland community W6 *Alnus glutinosa-Urtica dioica* with a sub-community which is a widespread but localised community, found on damp and periodically flooded sites. A single veteran field maple is present at the northern tip of the site, adjacent to a pond. This woodland lies immediately adjacent to the land required for the construction of the AP2 revised scheme and is of local/parish value.

11.3.22 There are areas of lowland mixed deciduous woodland within or immediately adjacent to the AP2 revised scheme at DMS Whittington. These small areas of woodland were not surveyed due to access restrictions, but they are likely to support lowland mixed deciduous woodland, habitat of principal importance. It is considered that each is of up to local/parish value.

Hedgerows

11.3.23 There are at least six hedgerows partly within the land required for construction of the AP2 revised scheme, which meet the wildlife and landscape criteria under the Hedgerows Regulations 1997[23], qualify as a habitat of principal importance and which are also designated. These hedgerows are each of county/metropolitan value:

- Curborough House Hedgerow SBI (hedge 1 and hedge 4);
- Curborough Hall Farm hedgerows BAS (hedge 1, 2 and 6); and
- Woodend Lane (hedge 1) BAS.

11.3.24 The remaining hedgerows surveyed and assessed are generally dense with few gaps, although they are very species poor, with few mature trees. Most are dominated by common hawthorn, with some blackthorn and beech; these hedgerows each have local/parish value. However, due to the wildlife corridors created by hedgerows, the hedgerow network within the land required for construction of the AP2 revised scheme is considered to be of district/borough value.

Watercourses

11.3.25 The following watercourses will be crossed by the route of the AP2 revised scheme: Wyrley and Essington Canal (under restoration); Trent and Mersey Canal; Mare Brook (tributary of the River Tame) and two unnamed tributaries of the Mare Brook; an unnamed tributary of Fisherwick Brook; Curborough Brook and Bourne Brook. The Coventry Canal is adjacent to the land required for construction of the AP2 revised

[23] The Hedgerows Regulations 1997 (No. 1160), Her Majesty's Stationery Office, London.

scheme. Construction works would span the canal in two places, one for access and one for utility works.

11.3.26 The Trent and Mersey Canal, the Wyrley and Essington Canal and the Coventry Canal are all heavily engineered with artificial banks. NVC surveys on the Trent and Mersey Canal recorded the mire community M27 *Filipendula ulmaria-Angelica sylvestris* mire. However, most of the canal supports only commonly occurring aquatic plants which occur sporadically along the watercourse including the non-native plant monkeyflower. The Wyrley and Essington Canal and Coventry Canal support commonly occurring aquatic plants and have poor habitat availability for fish as a result of a limited range of aquatic habitats. The AP2 revised scheme crossing point of the Wyrley and Essington Canal is coincident with an in-filled part of the canal (under restoration). All these canals support eutrophic standing water, at least along some of their length, which is a habitat of principal importance declining at a national level. They also provide wildlife corridors through the landscape and are considered, in each case, to be of district/borough value.

11.3.27 The Bourne Brook has engineered sections with a weir present, although the channel has sinuous sections supporting a diverse range of in-channel habitats. Common aquatic plants are present in unshaded sections and the channel has the potential to support spawning coarse and salmonid fish. The complex nature of the river corridor provides a wildlife corridor within a predominantly agricultural setting. This watercourse is of district/borough value.

11.3.28 The Curborough Brook is severely modified due to over-deepening with a straightened channel and evidence of desilting works. Aquatic plants noted during surveys were limited to the west bank, which was unaffected by desilting. Some good in-channel habitats dominated by gravel are present, which provide habitat for spawning fish. The watercourse also provides a wildlife corridor and is of local/parish value.

11.3.29 The unnamed tributary watercourse of Mare Brook near Fradley Business Park is severely modified by engineering, oil pollution was observed during surveys and the watercourse has poor fish habitat quality on account of high silt levels. However, the watercourse channel supports a range of habitats and is of local/parish value.

11.3.30 The unnamed tributary of the Fisherwick Brook, which was surveyed after publication of the main ES to support WFD assessments, has a severely modified channel having been historically realigned and over-deepened. A lack of riparian shading has allowed a densely vegetated channel to establish, with encroachment from marginal species (predominantly branched bur-reed and reedmace species). Sparse in-channel vegetation was recorded but was almost exclusively non-native Canadian pondweed. Sand/gravel reaches and silt dominated reaches were both recorded during survey. The watercourse supports a limited range of habitats, provides a wildlife corridor through the landscape and is of local/parish value.

11.3.31 No survey data is available for the other watercourses due to access restrictions. Although obviously modified, the second unnamed tributary of the Mare Brook does have some varied channel habitat, although it is straightened throughout much of its length. The Mare Brook has a sinuous channel in the vicinity of the AP2 revised scheme crossing point and is likely to support a variety of in-channel habitat features.

Each of these watercourses provides wildlife corridors through the landscape and is each considered to be of local/parish value.

Water bodies

11.3.32 There are 62 ponds within the land required for the construction of the AP2 revised scheme, mostly near Streethay, Fradley Business Park and adjacent to Fradley Wood. Of these, 23 have been surveyed for amphibians, 17 were scoped out as not requiring detailed amphibian surveys, and two have had detailed habitat surveys. The two ponds which have had detailed habitat surveys, have poor species diversity but provide a habitat resource in an otherwise arable landscape. The remainder of the 62 ponds, which were not dry at the time of survey, include garden ponds which are often ornamental and surrounded by amenity grassland, field ponds with shallow margins and woodland ponds, the most notable of which is within Wood End Lock (south-east of) SBI, which is within the land required for construction of the AP2 revised scheme. The ponds that have been surveyed are individually of local/parish value.

11.3.33 As a precautionary assessment, those ponds that have not been surveyed due to access restrictions, are assumed to have up to district/borough value.

Grassland

11.3.34 Tuppenhurst Lane (west of) SBI, which is within the land required for the AP2 revised scheme, contains wet areas with marshy grassland, swamp and unimproved grassland communities. These habitats were not surveyed due to access restrictions. However, these habitat types are within an SBI and are therefore assumed to be of county/metropolitan value.

11.3.35 Of the remaining small areas of improved and semi-improved grassland that were surveyed, none were found to be notable and these habitats are of up to local/parish value.

Heathland

11.3.36 The heathland within Whittington Heath Golf Course SBI, which is within the land required for the AP2 revised scheme, was formerly a single block of heathland known as Whittington Heath. NVC surveys identified a range of communities, from purely open communities that require regular cutting through to unmanaged woodland. There is further variation due to slight changes in moisture content of the soil caused by position and aspect. Some patches of pure heath vegetation are present, identified as the heath community H9 *Calluna vulgaris-Deschampsia flexuosa* heath, as are patches and strips of dry and damp acid grassland, in particular at the edges of the fairways (the 'rough'), below the trees and in clearings. This damp acid grassland community was identified as U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland. Much of the unmanaged areas of the site support immature woodland of pedunculate oak, with silver birch only occasionally recorded, which is recognised as lowland deciduous woodland on the Natural England inventory of habitats of principal importance. The mosaic of habitats, including heathland, within Whittington Heath Golf Course is of county/metropolitan value.

Other habitats

11.3.37 Scrub is found mostly around field edges, damp ditches and ponds. These features individually are of up to local/parish value.

11.3.38 Arable land is found across the study area and in the wider countryside. The Phase 1 habitat data from aerial photography and surveys show that the area is dominated by arable fields with occasional hedgerows and trees. The arable land largely comprises heavily managed large fields with few features of interest to wildlife. In general, this habitat is considered to have negligible nature conservation value.

Protected and/or notable species

11.3.39 A summary of the species relevant to the assessment is provided in Table 15.

Table 15: Protected and/or notable species

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Bats	Up to regional	Population of Daubenton's bat and Brandt's bat using a roost at a residential building (Wood End Lock Cottage), east of Ravenshaw Wood, adjacent to the Trent and Mersey Canal.	Possible small maternity roost of Daubenton's bat with a peak emergence count of eight individuals recorded in 2012-2013. Individual male Brandt's bat recorded roosting in the building during radio-tracking in 2014. High levels of Myotis bat activity recorded during surveys along the corridor of the Trent and Mersey Canal in 2012-13 and in 2014. Daubenton's and Brandt's bats are 'rarer'[24] bat species within England based on distribution and population size. The roost is directly adjacent to land required for construction of the AP2 revised scheme.
	Regional	Assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood).	Moderate to high levels of activity and a diverse assemblage of bat species including: common pipistrelle, soprano pipistrelle, brown long-eared bat, Daubenton's bat, Natterer's bat, Leisler's bat, noctule, whiskered bat and Brandt's bat. A low number of calls of serotine and Nathusius's pipistrelle were recorded during static surveys in 2012-13, but neither species was recorded during radio-tracking work in 2014. Bat activity was primarily associated with the woodland edges (where the woodland meets pasture), interlinking hedgerows between woodland, and along the route of the canal. Several tree roosts have been confirmed within Ravenshaw Wood, Black Slough and the Slaish. These roosts were found by work in 2012-13 with a number of new roosts identified during radio-tracking work in 2014. These roosts may be summer (non-breeding) roosts, with peak counts of 1 or 2 bats, although the status of some of these roosts identified through radio-tracking or from the presence of droppings cannot be confirmed. In addition to the tree roosts within the woodland and immediate surrounds, roosts

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

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			were identified within several buildings and a tree in the wider area. Roosts have been confirmed for common pipistrelle, Natterer's bat, brown long-eared bat, noctule, Brandt's bat, noctule and Daubenton's bat. A high density of trees with high and moderate potential to support roosting bats was found within Ravenshaw Wood, Black Slough and the Slaish. Noctule, Daubenton's bat, Natterer's bat, Leisler's bat, whiskered bat, Brandt's bat and Nathusius's pipistrelle are 'rarer' bats within England. Soprano pipistrelle, noctule and brown long-eared bat are species of principal importance identified in Section 41 of the NERC Act (2006). Some of the roosting, foraging and commuting habitat used by this assemblage is within the land required for construction of the AP2 revised scheme.
	Regional	Population of whiskered bat, Brandt's bat, common and soprano pipistrelle using a roost at a residential cottage at Fradley Junction, adjacent to the Trent and Mersey Canal.	A peak count of 427 bats, predominantly soprano pipistrelle with up to seven Myotis bats (including whiskered and Brandt's bat) and two to three common pipistrelle. It is likely that the cottage is used as a maternity roost by both soprano pipistrelle and Myotis bats. Due to the low number of common pipistrelle recorded, it is likely this species use the cottage as a summer (non-breeding) roost. This roost is over 500m north-east of the land required for construction of the AP2 revised scheme.
	County/metropolitan	Population of Daubenton's bat using a brick lined culvert (Curborough Brook) under the Trent and Mersey Canal and using habitats associated with Fradley Reservoir.	Up to six Daubenton's bats were observed using a night roost within the culvert (free hanging from the ceiling) during radio-tracking work in 2014. These observations were an incidental part of the radio-tracking work; bats were observed by looking down the culvert from the entrance and no emergence surveys were carried out. However, given the structure of the conduit it is unlikely that the culvert is used for mating or hibernation, although it could be used as an autumn swarming site. This roost (a culvert) is directly adjacent to the land required for construction of the AP2 revised scheme.
	District/borough	Population of soprano pipistrelle and Daubenton's bat using habitats associated with Fradley reservoir.	During a check of 29 bat boxes in woodland around Fradley Reservoir in 2014, nine bats were found in six boxes, all soprano pipistrelle. Eight other bat boxes contained bat droppings but no bats. A Daubenton's bat roost was recorded during radio-tracking work in 2014 in a mature tree overhanging. Fradley Reservoir, which was one of the core foraging areas recorded for this species. Fradley Reservoir is over 500m north-east of the land

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			required for construction of the AP2 revised scheme.
	District/borough	Assemblage of bats using commuting and foraging habitats adjacent to Fradley Business Park, west of Wood End Lane.	Surveys found moderate levels of activity of the more common bat species including common pipistrelle, soprano pipistrelle, brown long-eared and noctule. Calls by Leisler's were recorded during static surveys. The habitats support a particularly high level of activity by noctule. Foraging activity was concentrated close to small fragments of woodland, watercourses and small water bodies. A summer (non-breeding) roost, probably used by males and/or non-breeding females with a peak emergence count of six individuals for common pipistrelle, one brown long-eared and two soprano pipistrelle was found at a residential house, near Streethay. It is likely that foraging habitats adjacent to Fradley Business Park will support bats using this roost due to the proximity of the roost. A low density of trees with moderate potential to support roosting bats is present along hedgerows. Habitats used by this bat assemblage are within the land required for construction of the AP2 revised scheme.
	District/borough	Assemblage of bats using commuting habitats along the Wyrley and Essington Canal.	Surveys found low levels of activity of the more common bat species including common pipistrelle, soprano pipistrelle and brown long-eared. A low number of calls by Leisler's and noctule were recorded each month during static surveys. The Wyrley and Essington Canal is crossed by the route of the AP2 revised scheme.
	District/borough	Assemblage of bats using habitats fronting Shaw Lane and Tuppenhurst Lane including Bourne Brook, John's Gorse and Harvey's Rough.	A diverse assemblage of bats including: common pipistrelle, soprano pipistrelle, brown long-eared bats, Myotis species, noctule, Nathusius's pipistrelle was recorded foraging and commuting along Bourne Brook, woodland habitat and interconnecting hedgerows. Noctule bat was recorded in relatively low numbers during transect and static surveys particularly associated with woodland habitat. A very small number of passes by Nathusius's pipistrelle, a rarer bat species, was recorded during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for this species. Low levels of Leisler's and serotine were recorded during

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			static surveys indicative of passage or transient use rather than core foraging or commuting habitat for this species. A residential building within land required for the construction of the AP2 revised scheme was found to support a transient summer (non-breeding) roost, probably used by males and/or non-breeding females with a peak emergence count of one and two individuals for common pipistrelle and brown long-eared bats. One barn and one converted barn along Shaw Lane within 100m of land required for the construction of the AP2 revised scheme were found to support transient summer (non-breeding) roosts, probably used by males and/or non-breeding females with a peak emergence/re-entry count of two individuals for common pipistrelle. A moderate density of trees with moderate and high potential to support roosting bats was recorded in hedgerows and within woodland habitat associated with Bourne Brook and Harvey's Rough. Habitats used by this assemblage of bats are within the land required for construction of the AP2 revised scheme.
	District/borough	Assemblage of bats using Whittington Heath Golf Course SBI and buildings south of Darnford Lane.	A diverse assemblage of bats including: common pipistrelle, soprano pipistrelle, brown long-eared bats, *Myotis* species and noctule. Nathusius's pipistrelle, a rarer bat species, was recorded during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for this species. Low levels of Leisler's and serotine were recorded during static surveys indicative of passage or transient use. A low density of trees with moderate potential to support roosting bats is present. One residential building south of Darnford Lane was found to support a brown long-eared summer, transient, non-breeding roost, with a peak emergence count of one. A second building was found to support a common pipistrelle summer (non-breeding) roost probably used by males and/or non-breeding females with a peak emergence count of two individual common pipistrelle. It is considered likely that habitats within Whittington Heath Golf Course support bats using these building roosts. Habitats used for foraging by this assemblage of bats are within the land required for construction of the AP2 revised scheme, although the two roosts are not within the land required for the construction of the AP2 revised scheme.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Bat assemblage using habitats associated with Fulfen Wood, Coventry Canal and Watery Bridge.	Surveys found overall low levels of activity by common pipistrelle and soprano pipistrelle, both of these are commoner species. Individual passes by noctule, Leisler's, serotine, and *Myotis* species were also recorded occasionally throughout the survey period; indicative of passage or transient use rather than core foraging or commuting habitat for these species, which are rarer within the UK. Habitats used by this assemblage of bats are within the land required for construction of the AP2 revised scheme.
	Local/parish	Assemblage of bats using habitats associated with the urban and arable habitats south-east of Handsacre between Lichfield Road and Tuppenhurst Road.	Survey found low levels of activity of common and soprano pipistrelle and Myotis species associated with arable field boundaries. Individual passes by noctule, Leisler's and serotine were recorded occasionally during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for these species. A brown long-eared bat summer (non-breeding) roost was found at a residential building along the outskirts of Handsacre, probably used by males and/or non-breeding females with a peak emergence of one. Droppings from brown long-eared bats (100+ droppings) were identified during the inspection survey. A number of residential buildings associated with Handsacre were found to have moderate potential to support roosting bats but no evidence of a roost was found. Habitats used by this assemblage of bats are within the land required for construction of the AP2 revised scheme.
Amphibians	County/ metropolitan	Assumed great crested newt metapopulation[25] AMP29 south-west of Fradley.	Metapopulation AMP29 has a total of 12 water bodies, eight of which have been surveyed (four complete and four incomplete). It has a medium population size class of great crested newts and also supports other amphibians (smooth newt, common frog and common toad). This metapopulation lies partially within the land required for construction of the AP2 revised scheme. Given the records provided from Staffordshire Ecological Record, great crested newts appear to be abundant within Staffordshire and, given the results collated to date for CFA22, it is likely that great crested newts are widespread within the area. In

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

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			alignment with the Staffordshire LWS selection criteria[26], metapopulations that support a medium population of great crested newt are of county/metropolitan value. Great crested newt and common toad are species of principal importance.
	County/ metropolitan	AMP30 at Fradley Wood	AMP30 has a total of eight water bodies, six of which have been surveyed (three complete and three incomplete) and two have received a habitat suitability index survey only. This metapopulation has a medium population size class of great crested newt. This metapopulation also supports other amphibian species (smooth newt, common frog and common toad). This metapopulation lies outside of the land required for construction of the AP2 revised scheme.
	County/ metropolitan	AMP32 near Hanch Reservoir	AMP32 has a total of nine water bodies, four of which have been surveyed (three complete and one incomplete) and the remaining five have not been surveyed due to lack of access. This metapopulation has a medium population size class of great crested newt. This metapopulation also supports other amphibian species (smooth newt, common frog and common toad). This metapopulation lies within the land required for construction of the AP2 revised scheme.
	County/metropolitan	Great crested newt population centred on Fullbrook Farm.	Records from Staffordshire Biological Records Centre of three ponds supporting great crested newt from 2004-2005 (one pond containing 11 adults and the other two ponds containing unspecified numbers). It is assumed that the metapopulation supports a cumulative medium population size class. The metapopulation is just outside of the land required for the AP2 revised scheme (for utility works).
	Up to county/ metropolitan	Great crested newt populations in all water bodies not subject to full survey.	Using a precautionary approach, water bodies which have not been surveyed could support moderate breeding populations of great crested newt of medium size class.
	District/borough	Great crested newt population near Curborough Cottages.	Records from Staffordshire Biological Records Centre of two ponds supporting great crested newt from 2003 and 2014 (maximum counts of one and two adults in each pond). It is assumed that the metapopulation supports a cumulative small

[26] Staffordshire Wildlife Trust (2011), Guidelines for the selection of Sites of County Biological Importance in Staffordshire Version 4.02.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			population size class. The metapopulation is within the land required for the AP2 revised scheme (for utility works).
	District/borough	AMP31 west of Fradley Lock	AMP31 has a total of two water bodies, both of which have received surveys (one complete and one incomplete). This metapopulation has a small population size class (peak count of 1). This metapopulation also supports smooth newt, common frog and common toad. This metapopulation lies outside of the land required for the construction of the AP2 revised scheme.
	District/borough	Palmate newt population in a water body, west of Fradley Park.	This water body supports a small population size class of palmate newt; given the lack of records of this species within Staffordshire or within the local area, this is considered to be of district/borough value. This pond lies outside of the land required for the construction of the AP2 revised scheme.
	Up to district/ borough	Great crested newt population in a single pond in Tomhay Wood.	Record from Staffordshire Biological Records Centre from 1998 of one pond supporting a single great crested newt within the woodland (exact location unspecified). Tomhay Wood is adjacent to the land required for the AP2 revised scheme (required for access along Wood End Lane).
	Up to district/ borough	Great crested newt population in a single pond near Fradley Auction Centre.	Record from Staffordshire Biological Records Centre from 2013 of one pond supporting a single great crested newt. The pond is within 50m of the land required for the AP2 revised scheme.
	Local/parish	Common amphibian populations in 26 water bodies which lie outside of the four assumed great crested newt metapopulations identified.	Eleven of these water bodies (surveys complete) do not contain great crested newt but support three common amphibian species (smooth newt, common frog and common toad). Fifteen also have great crested newt. All of these species are considered to be widespread within Staffordshire and within the Whittington to Handsacre area.
Birds	County/ metropolitan	Breeding barn owl at arable and grass farmland site to the south-east of Handsacre, near Kings Bromley Marina.	A foraging and occasional roost site was identified within arable and grass farmland to the south-east of Handsacre. A nest site was not located, but the barn owl breeding territory falls within the land required for the construction of the AP2 revised scheme. Each pair of barn owl constitutes more than 1% of the

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			estimated county breeding population. Barn owl is a Schedule 1 species[27].
	County/ metropolitan	Breeding tree sparrow within arable fields to the south of Fradley Business Centre.	Up to six pairs of tree sparrow were recorded breeding within these arable fields. This population is thought to constitute more than 1% of the estimated county breeding population. Tree sparrow is a species of principal importance.
	County/ metropolitan	Breeding and wintering tree sparrow within arable fields to immediate west of Kings Bromley Marina.	Up to five pairs of tree sparrow were recorded breeding within these arable fields. This population is thought to constitute more than 1% of the estimated county breeding population. Tree sparrow is a resident species and numbers recorded in the winter also constitute more than 1% of the estimated county population.
	County/metropolitan	Population of breeding corn bunting to north and west of Whittington Heath Golf Course, Whittington Heath.	Up to three pairs of corn bunting were recorded breeding in fields adjacent to Whittington Heath Golf Course. This population is thought to constitute more than 1% of the estimated county breeding population. Corn bunting is a species of principal importance.
	District/borough	Breeding lapwing within arable fields to the south of Fradley Business Centre.	Up to three pairs of lapwing were recorded breeding within these arable fields. This population is thought to constitute just less than 1% of the estimated county breeding population. Lapwing is a species of principal importance.
	District/borough	Wintering lesser redpoll within Ravenshaw Wood and Black Slough.	A maximum count of 22 lesser redpoll was recorded during the winter surveys. This species is thought to be widespread in the region during the winter months. Lesser redpoll is a species of principal importance.
	Local/parish	Breeding birds within Whittington Heath Golf Course, Whittington Heath.	Breeding bird surveys recorded 43 bird species within this area of which 17 are notable. Ten notable species are thought to have bred on site, including species such yellowhammer, a species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed and/or no large or important populations were recorded.
	Local/parish	Breeding birds along Coventry Canal, to the east of Lichfield.	Field surveys recorded 45 bird species in this area of which 18 are notable. Fourteen notable species are thought to have bred along the canal, such as lapwing and reed bunting, a species of principal importance. Species recorded are considered common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.

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

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Breeding birds within arable fields to the south of Fradley Business Centre.	Field surveys recorded 53 bird species within this area of which 27 are notable. Seventeen notable species are thought to have bred on site, including species such as reed bunting and yellowhammer, a species of principal importance. Species recorded (with the exception of tree sparrow and lapwing, whose populations at the site are of county/metropolitan and district/borough importance respectively) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable fields adjacent to Fradley Wood, to the west of Fradley.	Field surveys recorded 26 bird species within this area of which 12 are notable. Seven notable species are thought to have bred on site, including species such as lapwing and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within Fradley Wood, to the west of Fradley.	Field surveys recorded 41 bird species within this area of which 17 are notable. Fourteen notable species are thought to have bred on site, including species such as bullfinch and spotted flycatcher, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable fields adjacent to Trent and Mersey Canal, to the west of Fradley.	Field surveys recorded 39 bird species within this area of which 16 are notable. Thirteen notable species are thought to have bred on site, including species such as linnet and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within Ravenshaw Wood, Black Slough and Black Slough Farm, to the west of Fradley.	Field surveys recorded 36 bird species within this area of which 16 are notable. Eleven notable species are thought to have bred on-site, including species such as grey partridge and skylark. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within Fradley Gorse, to the west of Fradley.	Field surveys recorded 28 bird species within this area of which five are notable. Four notable species are thought to have bred on site, including species such as kestrel and song thrush, a species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Wintering birds within Ravenshaw Wood and Black Slough.	Field surveys recorded 28 bird species within this area of which five are notable, including species such as bullfinch and woodcock. Species recorded (with the exception of lesser redpoll whose population at the site is of district/borough importance) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable fields to the south of Kings Bromley Marina.	Field surveys recorded 33 bird species within this area of which 13 are notable, including species such as lesser redpoll and peregrine falcon. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable fields to the immediate west of Kings Bromley Marina.	Field surveys recorded 41 bird species within this area of which 18 are notable, including species such as lesser redpoll and peregrine falcon. Species recorded (with the exception of tree sparrow whose population at the site is of county/metropolitan importance) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable field to the immediate south of Handsacre.	Field surveys recorded 25 bird species within this area of which eight are notable, including species such as meadow pipit and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
Terrestrial invertebrates	County/ metropolitan	Assemblage at Whittington Heath Golf Course.	Habitats with bare ground, short turf and flower foraging of high quality for invertebrates were identified. Species of interest recorded during surveys include a nationally scarce hoverfly, and a nationally scarce nomad bee of which there is only one other known population in Staffordshire (Highgate Common SSSI). The site also supports ground nesting bees and wasps which are a Staffordshire Biodiversity Action Plan (BAP) priority species group.
	County/ metropolitan	Assemblage using habitats at Fradley Business Park South.	Habitats with bare ground, short turf and flower foraging of high quality for invertebrates including bunds offering high quality habitat for nesting solitary bees and wasps were identified. Species of interest recorded during surveys include small heath butterfly and cinnabar moth, both species of principal importance, and a nationally rare cuckoo bee.
	District/borough	Assemblage at Ravenshaw Wood, Black Slough and the Slaish.	Deadwood features present such as rot holes and deadwood which are scarce across the landscape and are sustaining a low density of deadwood associated invertebrates including a nationally scarce beetle.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	District/borough	Assemblage at Black Slough Farm.	Pasture fields and hedgerows with mature trees, some of which exhibit small levels of decay such as rot holes and deadwood, which are scarce across the landscape and are sustaining a low density assemblage of deadwood associated invertebrates including a nationally scarce soldier beetle were identified.
	District/borough	Assemblage at Black Slough, north of Lichfield Road near John's Gorse.	A series of arable fields with a flower-rich headland, stream and ley fields lined with mature trees including oak and ash were identified. A nationally vulnerable[28] hoverfly was recorded from a hedgerow ash tree with a rot hole. This is a locally rare species with only one other known locality in Staffordshire, south of Uttoxeter at Brankley Pastures Staffordshire Wildlife Trust Reserve.
	District/borough	Assemblage at Shaw Lane	This site is a series of arable fields with a flower-rich headland, stream and fields lined with mature trees including oak and ash. Surveys found the rare spider-hunting wasp.
	Local/parish	Assemblage at Fradley Wood	The site is dense woodland, scrub and semi- improved grassland. There is some limited deadwood and the invertebrate assemblage is represented by common woodland species. However, the grassland could be of higher quality to invertebrates than the results suggest due to damp and flower-rich areas, which is of interest to flies and therefore has local/parish value.
Otter	District/borough	Population of otter using watercourses in the area.	Evidence of otter was found during surveys of the Trent and Mersey Canal and Bourne Brook (new and old spraints and footprints). There are also numerous desk study records of otter on the Mare Brook, Bourne Brook and Coventry Canal. A potential holt was identified on an unnamed watercourse in Ravenshaw Wood over 700m from the land required for construction of the AP2 revised scheme as well as along the Trent and Mersey Canal, although these showed no evidence of otter use. Otter has a large home range, and has increasing populations nationally and in Staffordshire. Otter is a species of principal importance.

[28] Red Data Book category 2 – Vulnerable, as defined in Shirt, David (1987); British Red data Books: 2. Insects; Nature Conservancy Council; Peterborough.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Badger	Local/parish	At least eight badger social groups with territories located wholly or partly within the land required for the construction of the AP2 revised scheme.	Total of 29 setts identified within the Whittington to Handsacre area; of which one main and 15 outliers are disused. Within the land required for the construction of the AP2 revised scheme there are two main setts and seven outlier setts. Badger is widespread in the UK and Staffordshire. The badger social groups within the study area are not likely to form a critical part of the county or of the district population.
Reptiles	Local/parish	Population of common lizard found on Whittington Heath Golf Course.	Low population size class of common lizard recorded during surveys. Common lizard is a species of principal importance and is likely to be common in suitable habitats in Staffordshire.
	Up to local/parish	Other areas of suitable habitat for reptiles not subject to survey.	The overall majority of land affected by the AP2 revised scheme is close grazed pasture and arable fields and only limited and isolated patches of suitable habitat have been identified as suitable for reptiles, and if present, reptiles would likely be in low numbers. There were very few desk study records of common reptiles from the surrounding area, apart from grass snake and slow worm and a record of common lizard over 1km from the land required for construction of the AP2 revised scheme. Grass snake, common lizard and slow-worm are all species of principal importance. Given the distribution of adder within Staffordshire and the species' preferred habitats, and the lack of records in the area, it is unlikely that adder is present within the land required for construction of the AP2 revised scheme.
Aquatic macro-invertebrates	Local/parish	Assemblage from an unnamed tributary of the Fisherwick Brook (downstream of Capper's Lane Viaduct).	Aquatic surveys of the unnamed tributary of the Fisherwick Brook identified community assemblages of limited taxon richness, although still indicative of good biological water quality. No species of conservation importance were identified.
	Local/parish	Assemblage from the Bourne Brook (downstream of Bourne Brook viaduct).	Autumn and spring surveys on the Bourne Brook identified taxon-rich assemblages indicative of good biological water quality with a high proportion of pollution sensitive taxa. No species of conservation importance were noted.
	Up to local/ parish	Assemblage in all other watercourses in this area.	In discussion with the Environment Agency, no other watercourses were identified as requiring survey although they may provide suitable habitat for commonly occurring species. Using a precautionary approach, the macro-invertebrate communities within these watercourses are assumed to have up to the highest value achieved for watercourses sampled in this area.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Fish	Local/parish	Population in the Bourne Brook.	The fish assemblage within the Bourne Brook is notable for this area on account of the numerous bullhead recorded, a species of conservation interest, and the presence of brown trout reflecting the potential of the watercourse as a valuable fishery. However, current recruitment of brown trout appears to be limited with only three individuals recorded during surveys.
	Local/parish	Population in the unnamed tributary of the Fisherwick Brook (downstream of Capper's Lane Viaduct). Population in the Curborough Brook (downstream of Pyford Brook viaduct).	Survey results from these watercourses have identified that they both support larger cyprinids at low abundance e.g. roach and chub, as well as common species. As a result of the presence of larger cyprinids, within an otherwise species poor assemblage, the fisheries of these watercourses are assessed as local/parish value.
	Up to local/parish	Populations in all other watercourses in this area.	In discussion with the Environment Agency, no other watercourses were identified as requiring survey although they may provide suitable habitat for commonly occurring species. Using a precautionary approach, the fish populations within watercourses where no access was available are assumed to have up to the highest value achieved for watercourses sampled in this area.
Notable plants	Local/parish	Assemblage of plants within Whittington Heath Golf Course SBI.	Plants recorded during field surveys include early hair grass, heath grass, pill sedge and narrow buckler-fern. These species are all classified as uncommon in Staffordshire[29] and are associated with the heathland habitat. These areas lie within the land required for construction of the AP2 revised scheme.
	Local/parish	Small-leaved lime within Big Lyntus SBI and within Little Lyntus wood.	Two small-leaved lime coppice stools were found during surveys in Big Lyntus SBI and within Little Lyntus wood. The species is uncommon in Staffordshire. The coppice stools within Big Lyntus SBI are not within the land required for construction of the AP2 revised scheme, although Little Lyntus is entirely within the land required.
	Local/parish	Populations of soft-shield fern within Ravenshaw, Black Slough and the Slaish.	This plant, found during survey, is uncommon in Staffordshire. The plant was not recorded within the land required for construction of the AP2 revised scheme.
	Local/parish	Veteran field maple on the field boundary of Hanch Wood.	Veteran trees are uncommon in Staffordshire. This example stands on the boundary of the land required for construction of the AP2 revised scheme.

[29] Hawksford, J.E. (2013), "A Checklist of the Flora of Staffordshire". Online at www.bsbi.org.uk/staffordshire.html. Accessed September 2013.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Water vole	Negligible	Potential populations using watercourses in the area.	No confirmed evidence of water vole, a species of principal importance. Although no direct evidence of water voles has been found during field surveys, the presence of water vole remains within an otter spraint on the Bourne Brook suggests that there is a water vole population beyond the surveyed areas. There are no supporting records of water vole presence on the Bourne Brook. There was evidence of feeding on a pond adjacent to the Mare Brook, but signs of mink have also been noted in that area which can predate water voles and out-compete water vole for resources. The presence of mink recorded on this reach of the Mare Brook reduces the likelihood of water voles being present within the land required for the construction of the AP2 revised scheme and current absence is assumed.
Hazel dormouse	Negligible	Potential populations using suitable woody habitats in the area.	No evidence has been found for the presence of hazel dormouse during surveys at each of six areas identified with potential for the species. A report from the Staffordshire Mammal Group indicates that no live dormouse has been found in the county for over three years. It is therefore unlikely that any populations exist within the land required for construction of the AP2 revised scheme.
White-clawed crayfish	Negligible	Potential populations using suitable watercourses in the area.	No white-clawed crayfish have been found during surveys and poor habitat suitability was identified on the remaining watercourses. Surveys have identified the presence of signal crayfish in the Trent and Mersey Canal and Coventry Canal at the confluence with the Wyrley and Essington Canal. Both of these watercourses are crossed by the AP2 revised scheme. Due to the declining status of white-clawed crayfish within Staffordshire, together with the recorded presence of non-indigenous signal crayfish, it is assumed that native white-clawed crayfish are absent from the area.

Future baseline

Construction (2017)

11.3.40 A summary of the known developments which are assumed to be mostly built and occupied prior to construction of the AP2 revised scheme is provided in Section 6.1 of this report, with further details provided in SES and AP2 ES, Volume 5: Appendix CT-004-000. It is not expected that the Streethay or Fradley developments will significantly affect the character and value of ecological resources within the area.

Operation (2026)

11.3.41 There are no known committed developments in the Whittington to Handsacre area that will affect the operational baseline.

11.4 Effects arising during construction

Avoidance and mitigation measures

11.4.1 The following measures are included as part of the design of the AP2 revised scheme to avoid or reduce impacts to features of ecological value:

- alignment of the route to reduce loss within Ravenshaw Wood, Black Slough and the Slaish woodlands (also an SBI);
- alignment of the route to the west to result in a single crossing of the Trent and Mersey Canal SBI;
- alignment of the route to the west to avoid Curborough House Hedgerows SBI;
- providing an underpass to maintain Whittington Footpath 16 which will also provide connectivity for animals under the route of the AP2 revised scheme; and
- alignment of the Manchester spur close to the main line of the route to reduce the land required for the AP2 revised scheme within Fradley Wood BAS.

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

Assessment of impacts and effects

Designated sites

11.4.3 There will be permanent loss of 8.3ha from Whittington Heath Golf Course SBI, consisting of a mixture of acid grassland, heather and semi-mature oak/birch woodland, which is approximately 13% of the 65ha SBI. The remaining habitat will be severed and the retained areas either side of the land required for construction of the AP2 revised scheme will be smaller in size (approximately 30ha and 26ha respectively, west and east) and more vulnerable to long-term degradation through edge effects. Heathland is not widespread in the local area and is a habitat of principal importance and a Staffordshire BAP priority habitat. It also provides an important habitat for invertebrates, so the reduction in habitat resource could also result in an adverse effect on the conservation status of invertebrate assemblages within the SBI, which are a reason for designation. These impacts will lead to an adverse effect on site integrity, which will be significant at a county/metropolitan level.

11.4.4 Wood End Lock (south-east of) SBI will be entirely lost to the AP2 revised scheme. The SBI is 1ha in area. Loss of the SBI would result in a permanent adverse effect on the integrity of the SBI that would be significant at a county/metropolitan level.

11.4.5 Approximately 0.77ha of Big Lyntus SBI (11.5% of the 6.7ha SBI) is within the land required for construction of the AP2 revised scheme due to the realignment of the route to the west along with realignment of Wood End Lane. The habitat within the north-eastern section of Big Lyntus is predominantly Scot's pine and beech plantation, which is fairly uniform and species-poor, although this habitat is mentioned as such within the site citation. There will be no fragmentation or severance of the remaining woodland. However, the citation for the SBI mentions the

connection between Big Lyntus and Wood End Lock (south-east of) SBI which adjoins the Trent and Mersey Canal (and the Curborough Brook) and the fact that the canal provides a link between these areas of woodland and the Fradley Wood complex to the east and Ravenshaw Wood and the Slaish to the west. The AP2 revised scheme will sever these connections between designated areas. The loss of more than 10% of the woodland area, in addition to the severance of linkages to other designated sites, will have an adverse effect on the integrity of the SBI, which will be significant at a county/metropolitan level.

11.4.6 There will be 3.7ha of habitat loss within Fradley Wood BAS, which is 13% of the 29.15ha area within the BAS. The woodland comprises blocks of both conifer and broadleaved plantation, some of which has recently been cleared and altered through forestry operations. However, the parcel of Fradley Wood that will be lost to the AP2 revised scheme, Fradley Gorse, is deciduous woodland which has not been altered as severely through clearance or silviculture as parcels of the BAS to the east, and is one of only two blocks of original woodland within the BAS. There are also some ancient woodland indicator species present in this section including bilberry, holly, sessile oak and honeysuckle, although these woodlands lay either side of the Trent and Mersey Canal and are likely to have been planted at a similar time to the canal construction.

11.4.7 The majority of the habitat lost from the edge of Brokendown Wood, which is part of Fradley Wood BAS, will be coniferous woodland (pine plantation). There will be some fragmentation of Brokendown Wood with a smaller fragment isolated to the west of the Manchester spur, although the majority of remaining woodland within the BAS will be on the eastern side of the spur. Although there will be permanent loss of habitat within Fradley Gorse, the majority of loss would be from pine plantation (Brokendown Wood) or from replanted and open habitats which have been degraded due to previous planting, felling, grazing and conversion to arable (Fradley Wood). There would be no effect on other blocks of the BAS to the east of the AP2 revised scheme. These impacts are not expected to have an adverse effect on the integrity of the BAS and will not be significant.

11.4.8 Although the Trent and Mersey Canal and Coventry Canal, Kings Bromley Wharf to Fradley Junction and from Fradley Junction to Fradley Bridge SBI will be crossed by the Manchester spur, there will be no habitat loss and no loss of the functioning of the canal as a wildlife corridor. There could be shading effects created by the viaducts on the marginal and emergent vegetation, one of the reasons for designation, as a stretch of approximately 16m of the SBI will be directly underneath the viaduct decks (less than 1% of the entire 3.4km stretch of the SBI). An NVC survey in 2012 on the section of the canal which will be beneath the viaducts identified that there were no notable plant species. It is not expected that shading of this small section of the SBI will result in an adverse effect on the integrity of the SBI and will not be significant.

11.4.9 Woodend Lane (hedge 1) SBI is mostly within the land required for construction of the AP2 revised scheme as it is along Wood End Lane and within land required for construction of the AP2 revised scheme. Works within the highways boundary of Wood End Lane will be required for highways and utility works, which may result in damage to or loss of the majority of the hedgerow. As a precaution, the construction works would result in an adverse effect on the integrity of the SBI, which would be significant at a country/metropolitan level.

11.4.10 The AP2 revised scheme will result in permanent loss of 5.8ha from Ravenshaw Wood, Black Slough and Slaish SBI, together with severance of the woodland blocks. This will amount to approximately 26% of the 22.3ha SBI. Habitat lost within Ravenshaw Wood affects both semi-natural and replanted ancient woodland, although the semi-natural ancient woodland within the Slaish will not be directly affected. The woodland habitat lost within the SBI will be from the eastern edge and there will be no fragmentation or severance of woodland habitat. Ancient woodland is considered to be an irreplaceable resource. These impacts will lead to an adverse effect on site integrity that will be significant at a county/metropolitan level.

11.4.11 A narrow strip on the northern edge of Vicar's Coppice BAS (0.4ha, which represents 6% of the 7.1 BAS) will be permanently lost due to a minor realignment of the A515 (Lichfield Road) and telecommunications utilities works. Although the woodland appears as semi-natural ancient woodland on the ancient woodland inventory, the citation indicates that the woodland was clear-felled in 1914-18 and selectively cleared in the 1970s. The site is also degraded, and there is abundant rhododendron within the roadside habitat that lies within the land required for construction of the AP2 revised scheme. There would be no fragmentation or severance of the woodland and this small loss of already degraded edge habitat is not expected to result in an adverse effect on the integrity of the BAS and will not be significant.

11.4.12 The majority of John's Gorse SBI lies within the extent of land required for construction of the AP2 revised scheme (1.7ha or 71% of the 2.4ha SBI). This habitat loss will result in a permanent adverse effect on site integrity that will be significant at the county/metropolitan level.

11.4.13 There will be loss of 0.13ha of habitat from the edge of Tuppenhurst Lane (west of) SBI (approximately 4% of the 3.18ha SBI). There would be no severance or fragmentation of the habitat. It is not expected that this loss will have a significant effect on the integrity of the SBI.

11.4.14 No impacts are expected on Curborough House Hedgerows SBI, Curborough Hall Farm hedgerows BAS, Tomhay Wood SBI or Riley Hill BAS which form part of the baseline.

Habitats

11.4.15 There will be approximately 8.5ha of ancient woodland habitat lost within this area from Fulfen Wood, Big Lyntus, Little Lyntus, Ravenshaw Wood, Vicar's Coppice, and from John's Gorse and Hanch Wood. This loss will result in a permanent adverse effect on the conservation status of ancient woodland which will be significant, in each case, at up to a county/metropolitan level.

11.4.16 There will be 22.9ha of woodland habitat lost within the area (including the ancient woodland losses reported above). This includes loss from Fulfen Wood, Big Lyntus, Little Lyntus, Fradley Wood, Brokendown Wood, woodland within Wood End Lock (south-east of) SBI, Ravenshaw Wood, Black Slough, Vicar's Coppice, John's Gorse and Hanch Wood, and Harvey's Rough. The woodland losses within Fulfen Wood, Ravenshaw Wood and Black Slough, Little Lyntus, Big Lyntus, John's Gorse and Hanch Wood will result in an adverse effect on the conservation status of woodland that would be significant in each case at up to a county/metropolitan level. Loss of woodland within Wood End Lock (south-east of) SBI and Brokendown Wood will

result in an adverse effect on the conservation status of woodland that would be significant in each case at a district/borough level. Loss within Fradley Wood and Vicar's Coppice is not expected to result in significant adverse effects on the conservation status of these woodlands. Losses of woodland that will be significant at a local/parish level are reported in the SES and AP2 ES, Volume 5: Appendix EC-003-003.

11.4.17 There are 29.5km of hedgerows within the land required for the construction of the AP2 revised scheme. This includes 154m from four individual hedgerows that meet the wildlife and landscape criteria of the Hedgerows Regulations 1997. The final length of hedgerow to be lost will depend on the detailed design and they will be retained where practical, but as a precautionary approach for the purposes of assessment, it is assumed that all of the hedgerows would be lost. The majority of hedgerows that will be lost are species-poor. Hedgerows form wildlife corridors within a largely arable landscape and are therefore important for habitat connectivity.

11.4.18 The two hedgerows within Curborough House Hedgerow SBI are on the very edge of the land required for woodland habitat creation and landscape planting. The construction works can be carried out without loss of these hedgerows and consequently no impacts are anticipated.

11.4.19 Woodend Lane (hedge 1) SBI is mostly within the land required for construction of the AP2 revised scheme as it is along Wood End Lane and within land required for construction of the AP2 revised scheme. Works within the highways boundary of Wood End Lane will be required for highways and utility works which may result in damage to or loss of the majority of the hedgerow. As a precaution, the construction works would result in an adverse effect on the integrity of the SBI, which would be significant at a country/metropolitan level.

11.4.20 The combined loss and severance of other hedgerows within the AP2 revised scheme will cause an adverse impact on the conservation status of the network of hedgerows, which will be significant at the district/borough level.

11.4.21 Taking a precautionary approach to assessment, the loss of ponds within the land required for the construction of the AP2 revised scheme, which have not been surveyed, could result in a permanent adverse effect on the conservation status of water bodies that would be significant at up to the district/borough level.

11.4.22 It is considered unlikely that any other effects on habitat receptors at more than the local/parish level will occur. Effects significant at the local/parish level are listed in the SES and AP2 ES, Volume 5: Appendix EC-003-003.

Species

11.4.23 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.

11.4.24 The impact of disturbance on bat populations will generally be localised and limited to the period of construction. Bats utilising retained habitats may be subject to irregular

and localised disturbance from lighting and noise during the construction period where works in autumn, winter and spring may be carried out for short periods after dusk or prior to dawn. These impacts would only temporarily deter bats from using foraging and commuting habitats.

11.4.25 One confirmed transient building roost for common pipistrelle and brown long-eared bat will be affected within the land required for construction of the AP2 revised scheme due to demolition of a residential building along Shaw Lane (part of the assemblage of bats using habitats fronting Shaw Lane and Tuppenhurst Lane including Bourne Brook, John's Gorse and Harvey's Rough). Given that only individual bats were found to use the building as a transient non-breeding roost, the loss of the building will not significantly affect the conservation status of common pipistrelle or brown long-eared bat.

11.4.26 There is a Daubenton's and Brandt's roost at a residential building east of Ravenshaw Wood, adjacent to the Trent and Mersey Canal, which is a potential maternity roost. Noise arising during construction of the Wood End Lane overbridge and associated access tracks will result in disturbance and could lead to temporary displacement of bats from the roost. The adoption of measures within the draft CoCP will provide controls to reduce the risk of displacement of bats and the loss of this roost. It is likely that the habitats associated with the Trent and Mersey Canal will support commuting and foraging activity by bats using this roost. Activity by Myotis bats was confirmed along the canal during transect surveys and during radio-tracking surveys carried out in 2014. The bats using this roost will not become isolated from key commuting and foraging provided along the canal and connectivity along the watercourse will be retained both during and following construction. With these measures in place, there are no significant effects expected on the conservation status of the population of Daubenton's bat or Brandt's bat using the roost.

11.4.27 Daubenton's bats using the roost within the culvert of the Curborough Brook beneath the Trent and Mersey Canal are likely to be heavily disturbed during construction of the Curborough Brook dive-under and Curborough viaduct which is adjacent (within 10m) of the culvert. As well as disturbance from construction works there is also likely to be a temporary reduction in foraging habitat available, particularly from the wet woodland and ponded areas within Woodend Lock (south-east of) SBI. These impacts could lead to abandonment of the roost. There are no other known Daubenton's night or swarming sites identified in the vicinity. Therefore, as a precaution, loss of this roost is considered to have the potential to result in an adverse impact on the conservation status of the population of Daubenton's bats using the roost, which would be significant at a county/metropolitan level.

11.4.28 Habitats within Whittington Heath Golf Course SBI that lie within land required for the construction of the AP2 revised scheme support a diverse assemblage of bats including rarer bat species: noctule, Nathusius's pipistrelle, Leisler's, serotine and Myotis species. A small number of trees with moderate potential to support bats will be lost although no known building or tree roosts would be removed. Key commuting and foraging habitat will be permanently lost from the golf course. However, these impacts will be localised. Two confirmed transient building roosts for common pipistrelle and brown long-eared bat along Darnford Lane, likely to be associated with this assemblage, lie within 100m of land required for the construction of the AP2

revised scheme. The route would separate these two roosts, one roost being on either side of the railway line. The majority of habitats within the golf course used by foraging and commuting bats lie outside of land required for the construction of the AP2 revised scheme and will still be available for commuting and foraging during and following construction, including for species using the confirmed building roosts along Darnford Lane. Whittington Footpath 16 Accommodation Underpass will be available for bats to use to move from east to west side of habitats within the golf course. These impacts are unlikely to lead to a significant adverse effect on the conservation status of the assemblage of bats concerned.

11.4.29 Habitats associated with the Wyrley and Essington Canal are used by a diverse assemblage of bats including common pipistrelle, soprano pipistrelle, *Myotis*., noctule and Leisler's. The Wyrley and Essington Canal will still be available as a commuting and foraging corridor during and following construction. The installation of Capper's Lane viaduct will retain connectivity along the canal, and impacts are unlikely to lead to a significant adverse effect on the conservation status of the assemblage of bats concerned.

11.4.30 Habitats adjacent to Fradley Business Park, west of Wood End Lane, are used by a diverse assemblage of bats including: common pipistrelle, soprano pipistrelle, brown long-eared bat, Myotis sp., noctule and Nathusius's pipistrelle. The mosaic of grassland habitat, watercourses, water bodies and network of hedgerows on the western edge of Fradley Park forms key commuting and foraging habitats within a predominantly arable landscape. The network of hedgerows is likely to provide links between foraging habitats and buildings within Fradley, which may support roosting bats. The wider countryside north of Streethay is dominated by large arable fields with low-gapped hedgerows which limits the potential for habitats within the wider countryside to support high densities of foraging/commuting bats. The AP2 revised scheme will result in the permanent loss and severance of key commuting and foraging habitat. While the losses of habitat will be localised, this loss will increase the fragmentation of commuting and foraging habitats and reduce the foraging resource for the assemblage of bats. The installation of Alrewas Footpath 31 underpass will minimise impacts of habitat severance for low-flying species. Whilst the inclusion of Mare Brook North and South culvert (approximately 2m x 2m) will reduce the impact of habitat severance along the watercourse for some species of bat, including Myotis sp., other species recorded using habitats surrounding the watercourse, including common and soprano pipistrelles and noctule, are less likely to use the culvert due to its small dimensions. These impacts will lead to an adverse effect on the conservation status on the assemblage of bats concerned that will be significant at a district/borough level.

11.4.31 The assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) is diverse and includes common pipistrelle, soprano pipistrelle, brown long-eared bat, Daubenton's bat, Natterer's bat, Leisler's bat, whiskered bat, Brandt's bat, noctule, Nathusius's pipistrelle and serotine. Construction will result in the permanent loss of habitats within Ravenshaw Wood and Black Slough used by roosting, foraging and commuting bats.

11.4.32 Six tree roosts used by species which are part of the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) including brown long-eared and Natterer's bat would be lost within Ravenshaw and Black Slough and two tree roosts used by noctule would be lost within Wood End Lock (south-east of) SBI. Construction of the scheme would also result in loss of a large number of trees with high and moderate potential within Ravenshaw Wood, Black Slough and surrounding field boundaries. These trees could support individuals of rarer bat species, which have been confirmed using the woodland habitats as bats have a tendency to move regularly between tree roosts. Given the number of trees to be removed and the low cover of woodland within the immediate area, this could remove a large proportion of the available roosting resource for the bat assemblage. Bats within the assemblage using any tree roosts within retained remnants of woodland are also likely to be subject to disturbance during construction.

11.4.33 A whiskered/Brandt's bat roost at Black Slough Farm, which is part of the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood), will become isolated on the western side of the route from the retained woodland habitats and canal to the east of the route, which have been identified as key foraging and commuting habitats for these species.

11.4.34 Connectivity along the Trent and Mersey Canal will be retained and the majority of Ravenshaw Wood will be retained on the eastern side of the route. However, woodland clearance will result in the loss of key bat foraging habitat and the severance of commuting routes along woodland edges and connecting hedgerows used by the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood). This may discourage bat species which avoid commuting and foraging in open habitats such as some Myotis species and brown long-eared bat. This would restrict the foraging and commuting resource available for some species.

11.4.35 The combination of these impacts on the assemblage of bats using the Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) will result in an adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a regional level.

11.4.36 Woodland habitat is to be lost at John's Gorse, Harvey's Rough and along Bourne Brook, which is used by the assemblage of bats recorded within habitats fronting Shaw Lane and Tuppenhurst Lane including: common pipistrelle, soprano pipistrelle, Myotis species, Nathusius's pipistrelle, Leisler's, serotine and noctule. No known tree roosts will be lost, however trees with high and moderate potential to be used by roosting bats will be lost. The AP2 revised scheme will result in the permanent loss and severance of key commuting routes and key foraging habitat along woodland edge and hedgerows but connectivity along the Bourne Brook will be retained. These severance impacts may deter bats from using the habitats and move bat populations away from preferred foraging and commuting habitats. One confirmed transient building roost for soprano pipistrelle and brown long-eared bat, likely to be associated with the assemblage of bats recorded within habitats fronting Shaw Lane and Tuppenhurst Lane, will be affected within the land required for construction of the AP2 revised scheme due to demolition of a residential building along Shaw Lane. The

combination of these impacts will lead to an adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a district/borough level.

11.4.37 There will be no water bodies supporting great crested newt lost within the assumed great crested newt metapopulation AMP29, south-west of Fradley. However, there will be a loss of five ponds close to the AMP which have not yet been surveyed due to access restrictions and which could support great crested newt. There would be approximately a third of available terrestrial habitat associated with the metapopulation that will be lost including grassland, woodland and hedgerows which could be suitable for foraging, refuge and hibernation. As a precaution, the AP2 revised scheme will result in permanent adverse effects on the conservation status of the metapopulation which will be significant at the county/metropolitan level.

11.4.38 There would be no loss of water bodies within the assumed great crested newt metapopulation AMP32, at Hanch Reservoir, but there will be minimal loss of terrestrial habitat resulting from access and utilities works. The terrestrial habitat affected would include a small section of arable field and hedgerow. This impact would not result in an adverse effect on the conservation status of the metapopulation and would not be significant. There are no expected impacts on the other assumed great crested newt metapopulations within the area (AMP30 and AMP31).

11.4.39 There will be loss of 54 water bodies which have not had detailed surveys for great crested newt due to access restrictions. Of these, 25 have been assessed as not requiring detailed surveys as they are considered unsuitable for great crested newt and other amphibians. Taking a precautionary approach to assessment, loss of the other 29 water bodies is assumed to result in an adverse impact on amphibian populations that would, in each case, be significant at up to a county/metropolitan level.

11.4.40 Woodland loss during construction, particularly at Ravenshaw Wood, where a potential holt has been identified, would remove potential otter resting habitat. Due to the design of the viaducts/overbridges there will be no permanent loss of accessible watercourse for otters. In addition, the bridging of watercourses may offer further cover and territorial marking sites for otters, dependent on final design. Construction activities along watercourses including the Mare Brook and Trent and Mersey Canal may result in noise and visual disturbance to otter, potentially acting as a deterrent to otter commuting, causing temporary barriers within an otter's territorial range. The realignment of over 200m of the Mare Brook has the potential to temporarily restrict the movement of otters and reduce foraging opportunities. However, these impacts will not result in a significant adverse effect on the conservation status of the otter population concerned.

11.4.41 The reduction in habitat resource within Whittington Heath Golf Course SBI could result in an adverse effect on the conservation status of the associated invertebrate assemblage, which would be significant at the county/metropolitan level.

11.4.42 The permanent loss of woodland within Ravenshaw Wood and Black Slough will cause in a reduction in woodland and deadwood resource, although this is unlikely to have a significant effect on the conservation status of the associated invertebrate assemblage.

11.4.43 The construction process is likely to deter notable bird species from using the area of land required for the construction of the AP2 revised scheme during winter months, as a result of loss of habitat, and also visual and noise disturbance as a result of the construction works. This avoidance will be temporary, lasting the duration of the construction process. The impacts could cause adverse effects on the conservation status of bird populations, which have the potential to result in an effect at up to the local/parish level that is not significant.

11.4.44 The construction process will cause temporary loss of habitats used by birds, together with disturbance of adjacent habitats. In areas of open farmland this will cause minimal effect as there is abundant suitable alternative habitat nearby. However, for the woodlands at Ravenshaw, Black Slough and the Slaish and Fradley Wood, some of the affected species will have less alternative habitat to utilise and the effect is relevant at the local/parish level, but is not significant.

11.4.45 The occasional barn owl roost site observed south-east of Handsacre, near Kings Bromley Wharf, will not be lost. There will be loss of some suitable foraging habitat within the likely barn owl territory. However, evidence shows that barn owl only occasionally use this area and nest further afield. Therefore, the barn owl pair is not expected to be displaced as a result of construction and no significant effect on the barn owl pair is expected.

11.4.46 It is considered unlikely that any other effects at more than the local/parish level will occur. Effects at the local/parish level are listed in SES and AP2 ES, Volume 5: Appendix EC-003-003.

Other mitigation measures

11.4.47 This section describes and assesses additional mitigation measures designed to reduce or compensate for significant ecological effects.

11.4.48 Fulfen Wood is likely to be added to the ancient woodland inventory and as a result, the section of Fulfen Wood located to the east of the HS2 route (0.61ha) will be retained. This will reduce the loss of ancient woodland from Fulfen Wood to 0.43ha. However, there will remain a permanent adverse effect significant at up to a county/metropolitan level. As much as practicable of Little Lyntus ancient woodland will be retained during construction. However, for the purposes of assessment the worst case scenario, that the entirety of the ancient woodland will be lost, has been assumed.

11.4.49 The retention of parts of Fulfen Wood will result in a total loss of ancient woodland of approximately 7.8ha as a result of the AP2 revised scheme. This will include losses from Fulfen Wood, Big Lyntus, Little Lyntus, Ravenshaw Wood, Vicar's Coppice, and John's Gorse and Hanch Wood. Ancient woodland is irreplaceable. However, this loss of woodland will be compensated through a range of measures, such as translocation of ancient woodland soil with its associated seed bank to: a 12.3ha woodland habitat creation area between the route and the retained part of Ravenshaw Wood and Black Slough; or to a 3.7ha woodland habitat creation area between Ravenshaw Wood and the Trent and Mersey Canal. Other measures may also be appropriate such as translocating coppice stools and dead wood. There will also be woodland creation areas adjacent to Vicar's Coppice (3.9ha), Tomhay Wood (1.6 ha) and John's Gorse and Hanch Wood (2.4ha). This planting will provide woodland links between the retained

sections of Ravenshaw Wood, Black Slough and the Slaish, and between Vicar's Coppice and Tomhay Wood to the south of the AP2 revised scheme.

11.4.50 To compensate for the loss from Little Lyntus, there is 2.6ha of woodland habitat creation adjacent to Big Lyntus wood that is included within the AP2 revised scheme. In addition, there is 0.56ha of woodland habitat creation between the route and the Manchester spur to the east and 0.75ha between the route and the realigned Wood End Lane to the west. To compensate for the loss of the western part (0.43ha) of Fulfen Wood approximately 1.1ha of woodland habitat creation has been included within the AP2 revised scheme between the WCML and the SSL. If suitable, ancient woodland soil with its associated seed bank will be carefully removed and translocated to a suitable receptor site.

11.4.51 These measures will also compensate for the loss of general woodland habitat in the northern section of this area, notably from Fulfen Wood, Big Lyntus, Little Lyntus, woodland adjacent to Wood End Lane, Fradley Wood, Ravenshaw Wood, Black Slough, Vicar's Coppice and John's Gorse and Hanch Wood. The target condition for woodland areas provided for ecological compensation would be the habitat of principal importance, lowland mixed deciduous woodland.

11.4.52 There is over 90ha of woodland and scrub planting included within CFA22 within the AP2 revised scheme, including both woodland habitat created for ecology compensation (31.2ha) and landscape planting (59.6 ha). This will add to the woodland cover in the area and provide woodland links between areas of planting within the AP2 revised scheme and the wider landscape.

11.4.53 Although it would take 50 years or more for planting within the woodland habitat creation areas to mature, many animals are likely to be able to utilise these areas prior to maturation and scrub planting is likely to establish within 10 years of planting. Following establishment and maturation of planting, any adverse impacts on woodlands will be reduced to a level which will not result in any adverse significant effect on the conservation status of woodland. The compensation will result in a permanent beneficial effect on the conservation status of woodland habitat, which will be significant at a district/borough level.

11.4.54 Suitable sections of Woodend Lane (hedgerow 1) SBI will be translocated, where necessary, to the edge of the woodland habitat creation areas near the southern end of Ravenshaw Wood and in the spaces left around the highways balancing pond at the junction of Wood End Lane and Watery Lane within the land required for construction of the AP2 revised scheme. Alternatively, the hedgerow within the SBI will be translocated to other sections of Wood End Lane from which undesignated hedgerows are removed due to highways and utility works. New hedgerow creation will be undertaken and connected habitat is provided within the landscape scheme to compensate for losses of wildlife corridors that hedgerows provide. There will be temporary adverse effects whilst the new hedges become established and mature (approximately 15 years). However, many species will be able to use the new hedges prior to maturation. Following establishment and maturation of planting, it is expected that any adverse impacts on hedgerows and the wildlife corridors they create will be reduced to a level which will not result in any significant effect on the conservation status of the habitat.

11.4.55 A 19ha heathland and acid grassland creation area has been identified near the A51 Tamworth Road (which is in the Drayton Bassett, Hints and Weeford area (CFA21)) to replace and translocate habitat required for the construction of the AP2 revised scheme within Whittington Heath Golf Course SBI. This will include translocation of turves and/or topsoil of affected habitat and will create a heathland and acid grassland mosaic. Following establishment which will take approximately 20 years, and with appropriate management, it is expected that any adverse impacts will be reduced to a level which will not result in any significant effect on the conservation status of the habitats concerned.

11.4.56 Appropriate habitats will be provided for terrestrial invertebrates within the ecological compensation areas (marked as grassland creation on the CT-06 plans) near Whittington Heath Golf Course and Fradley Business Park through a range of measures to be determined at detailed design. These measures are likely to include creation of bunds (beetle banks) and sowing with species-rich seed mixes. Retention of felled trees within the new planting areas adjacent to Ravenshaw Wood and Black Slough will retain deadwood habitat for invertebrates. Following these measures, it is expected that any adverse impacts will be reduced to a level which will not result in any significant effect on the conservation status of the terrestrial invertebrate assemblages concerned.

11.4.57 Additional measures to those within the draft CoCP will be implemented to reduce disturbance impacts on roosting, foraging and commuting bats in accordance with the principles of ecological mitigation identified within the SMR Addendum (main ES, Volume 5: Appendix CT-001-000/2). The woodland habitat creation areas near retained sections of Ravenshaw Wood and Black Slough and near Fradley Business Park will replace foraging habitat for bats and the planting will create new woodland edge habitat for commuting and foraging. Planting will also provide links to the wider landscape to reduce effects of habitat severance.

11.4.58 Alternative roosting structures will be provided within the AP2 revised scheme to replace those lost. Replacement roosts will be provided following the principles of ecological mitigation within the SMR Addendum (main ES, Volume 5: Appendix CT-0001-000/2). Habitat connectivity will be maintained under the AP2 revised scheme due to the presence of Whittington Footpath 16 accommodation underpass, Capper's Lane viaduct, Streethay Footpath 6 underpass, Streethay viaduct, Streethay Footpath 6 accommodation overbridge, Alrewas Footpath 31 underpass, Trent and Mersey Canal viaduct and Curborough Brook dive-under and viaduct, Kings Bromley 0.392 underpass and the Bourne Brook viaduct. Planting will be designed to encourage species such as bats to use these crossing points. Following the implementation of the measures proposed, it is expected that any adverse impacts on bats during the construction of the AP2 revised scheme will be reduced to a level at which they will not result in any significant effect on the conservation status of the species concerned.

11.4.59 Compensatory habitat to address impacts on the great crested newt metapopulation south-west of Fradley, on amphibian populations and on individual ponds will be provided within the ecological habitat creation areas near Fradley Business Park and Whittington Heath Golf Course, in accordance with the principles of ecological mitigation identified within the SMR Addendum (main ES, Volume 5: Appendix CT-001-000/2). This will include the provision of replacement ponds, terrestrial habitat

and hibernation habitat sufficient to maintain the favourable conservation status of the population effected. The ecological compensation areas near Fradley Business Park and Whittington Heath Golf Course will also be suitable for reptiles.

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

Summary of likely residual significant effects

11.4.61 The mitigation, compensation and enhancement (i.e. a new benefit to biodiversity, unrelated to any negative impact) measures described above reduce the effects to a level that is not significant, except for:

- ancient woodland within: Fulfen Wood, Big Lyntus, Little Lyntus, Ravenshaw Wood, Vicar's Coppice, and John's Gorse and Hanch Wood; and
- a Daubenton's bat population roosting within Curborough Brook culvert.

11.4.62 The residual effect on the Daubenton's population utilising the Curborough Brook culvert is a precautionary assessment. The potential presence of a Daubenton's swarming site has been assumed for the purposes of the assessment. If the roost represents a swarming site the AP2 revised scheme may result in abandonment of the roost and such sites (and conditions) cannot be readily recreated elsewhere. Further work to establish the status of the roost, and establish suitable mitigation if required, will be carried out as part of on-going survey work.

11.4.63 Due to the amount of woodland provided as compensatory habitat, particularly in the north of the area, there will be a permanent beneficial effect on the conservation status of woodland habitat.

11.5 Effects arising from operation

Avoidance and mitigation measures

11.5.1 The following measures have been included as part of the design of the AP2 revised scheme and avoid or reduce impacts on features of ecological value:

- connectivity will be maintained under the AP2 revised scheme due to the presence of Capper's Lane viaduct, Curborough Brook viaduct, Curborough dive-under, Alrewas Footpath 31 underpass, the Trent and Mersey Canal viaduct, Kings Bromley 0.392 underpass and the Bourne Brook viaduct. The spaces beneath these structures will offer animals a way of passing beneath the route of the AP2 revised scheme and will reduce the risk of collisions with trains; and
- planting has been located and will be further designed to encourage species such as bats to use these crossing points.

Assessment of impacts and effects

11.5.2 The operation of the AP2 revised scheme has the potential to result in a variety of impacts on bat populations including those as a result of collision with passing trains,

turbulence and noise. The point at which such impacts are considered to result in a significant adverse effect on the conservation status of the population concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat populations and/or assemblages concerned in determining the likely effects of the AP2 revised scheme on each of these receptors.

11.5.3 Noise and lighting from passing trains have the potential to disturb bat species foraging and commuting within habitats close to the AP2 revised 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 the brown long-eared bat, 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 there will be periods at night when there are no train movements.

11.5.4 Due to the large areas over which bats forage, it is likely that any displacement from suitable foraging habitat in the vicinity of the AP2 revised 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 prevented in moving between breeding sites, hibernation sites and other roosts which they commonly utilise.

11.5.5 Where the route of the AP2 revised 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 concerned and the vertical alignment of the AP2 revised scheme (i.e. whether the railway is in cutting, on embankment, on a viaduct, or at grade).

11.5.6 The following species have been identified within the area that could be particularly at risk of collision with trains: Natterer's, Daubenton's, whiskered bat, Brandt's bat, noctule, pipistrelle and brown long-eared bat. Viaducts within the Whittington and Handsacre area will cross watercourses used by foraging and commuting bats: Capper's Lane viaduct over the Wyrley and Essington Canal, the Trent and Mersey Canal viaduct, the Curborough Brook viaduct and bridge, and the Bourne Brook viaduct. Most bat species will fly underneath these structures by following the watercourse under them whilst the higher-flying noctule, Leisler's and serotine are likely to navigate over the structures. The deck of the bridge over Curborough Brook and the adjacent road bridge (viaduct) will be at 4m height; the viaduct at the Trent and Mersey Canal and the Capper's Lane viaduct over the Wyrley and Essington Canal will have a clearance of 3m. The viaduct above the Bourne Brook will have clearance of over 9m. The heights of these structure will allow bats to cross beneath the route of the AP2 revised scheme and reduce the risk of some bats flying up and over the structures and into the path of moving trains. Although there is a risk of individual bats being killed or injured by collision with trains, the impacts are unlikely to result in significant effects on the conservation status of any of the species concerned.

11.5.7 Given the concentration of bats in the vicinity of Ravenshaw Wood, Black Slough and the Slaish where the railway will be on low embankment immediately adjacent to retained sections of woodland, there could be an increased risk of collision of bats

with trains. This would be as a result of bats gliding at low height from roost sites and following established commuting routes along woodland edges crossed by the route of the AP2 revised scheme. Low-flying Myotis species and brown long-eared bats and noctules leaving roost sites at low height would be particularly at risk. However, radio-tracking work carried out after publication of the main ES indicated that a number of core foraging areas and commuting routes for the lower-flying bats, such as Daubenton's bat, Brandt's bat, Natterer's bat and soprano pipistrelle were centred on Ravenshaw Wood, Black Slough Wood, Fradley Wood and the Trent and Mersey Canal around Woodend Lock Cottage. These habitats will be retained on the eastern side of the route with continued access for bats along the canal beneath the Trent and Mersey Canal viaduct. Brown long-eared bat, some Natterer's and noctule bats radio-tagged in the vicinity of Ravenshaw Wood had limited core and occasional foraging areas to the south and west of the route meaning that commuting routes and foraging areas may be severed by the route, increasing the likelihood of collisions. However, there is a risk of individual bats particularly of brown long-eared and Natterer's bat being killed or injured by collision with trains, and the impacts may result in significant effects on the conservation status of the species populations concerned without mitigation.

11.5.8 The barn owl pair using the territory south-east of Handsacre, near Kings Bromley Wharf, are known to occasionally forage in the area of land crossed by the AP2 revised scheme. 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 level.

11.5.9 The noise made by passing trains has the potential to disturb birds within habitats close to the AP2 revised scheme. Birds habituate to loud noises that they hear regularly and frequently, and hence it is considered that this will not generally cause significant effects. There is some evidence to suggest that breeding bird densities can be reduced where there is persistent noise from busy roads due to birds being unable to hear each other's songs. However, this is not expected to occur with the AP2 revised scheme as trains will pass quickly. The effect of train noise on breeding birds is therefore not considered to be significant.

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

Other mitigation measures

11.5.11 This section describes and assesses additional mitigation measures designed to reduce or compensate for significant ecological effects. These include measures to discourage bats from foraging close to the AP2 revised scheme including planting that has been designed to create a 'funnel' effect to encourage bats to fly beneath the AP2 revised scheme, notably in the vicinity of the Wyrley and Essington Canal, the Trent and Mersey Canal, the Curborough Brook and the Bourne Brook, rather than up and over the railway.

11.5.12 In the vicinity of Ravenshaw Wood, Black Slough and the Slaish, new woodland planting will enhance habitat connectivity, commuting, foraging and roosting opportunities away from the route of the AP2 revised scheme. The design of

ecological mitigation areas will avoid planting woodland adjacent to the route, and may manipulate existing planting adjacent to the route to maintain open habitats adjacent to the railway, thereby reducing the risk of bat collisions with trains, particularly for woodland bat species such as brown long-eared bat which are less likely to cross open habitat. Woodland rides and woodland edges will be designed to encourage bats to continue using the Trent and Mersey Canal as a commuting and foraging route (with bats being able to cross under the Trent and Mersey Canal viaduct and to use the Kings Bromley Footpath 0.392 underpass). These measures will reduce impacts to levels which are not significant for the assemblage of bats concerned.

11.5.13 To offset potential losses to the breeding barn owl pair south-east of Handsacre near King's Bromley Wharf, 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

11.5.14 The mitigation, compensation and enhancement measures described above reduce the residual ecological effects during operation to a level that is not significant, except for the barn owl pair south-east of Handsacre near Kings Bromley Wharf.

11.5.15 Train strike is likely to result in the loss of the barn owl pair 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.

12 Land quality

12.1 Introduction

12.1.1 This section presents the baseline conditions that exist along the AP2 revised scheme in relation to land quality, and reports the likely impacts and any significant effects resulting from the construction and operation of the AP2 revised 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, areas of current underground or opencast mining and areas of designated mineral resources. Mitigation measures are presented and any residual effects are summarised.

12.1.2 Potentially contaminative areas of land have been identified that could affect, or be affected by, the construction of the AP2 revised 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 AP2 revised scheme will lead to contamination of its surrounding environment and what needs to be done to prevent such contamination.

12.1.3 Main environmental features of this area include the Wyrley and Essington Canal, Mare Brook (including several of its tributaries), the Trent and Mersey Canal, Pyford/Curborough Brook, Bourne Brook and widespread areas of sand and gravel (bedrock derived and superficial), all of which represent identified mineral resources.

12.1.4 The main land quality issues in this area include the presence of the following within the land required for the construction and operation of the AP2 revised scheme:

- areas of former or current potentially contaminative land use which the AP2 revised scheme will cross such as former airfield/military land, the WCML, the SSL, a disused tip and a vehicle maintenance garage; and
- three Mineral Consultation Areas[30] (MCA) - one bedrock derived sand and gravel MCA (underlying Whittington Heath) and two superficial sand and gravel MCA (the first is located just north of Streethay and the second extends from Gorse Farm to the northern edge of the study area).

[30] Mineral Consultation Areas (MCA) are provided by some county councils to ensure that in two-tier authority areas, consultation takes place between county and district planning authorities when mineral interests could be compromised by proposed non-minerals development. MCA also give an additional measure of safeguarding to sites related to minerals infrastructure, such as wharves and railway sidings, that cannot be protected by MSA. British Geological Survey (2007), Report CR/07/060: A guide to mineral safeguarding in England.

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

- Appendix CT-001-000/1: the SMR;
- Appendix CT-001-000/2 the SMR addendum; and
- Appendix LQ-001-022: Land quality appendix.

12.1.6 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 17 Water resources and flood risk assessment. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in SES and AP2 ES, Volume 3: Section 14.

12.1.7 Engagement has been undertaken with LDC and the Environment Agency regarding contaminated land and with Staffordshire County Council regarding mineral resources.

12.2 Scope, assumptions and limitations

12.2.1 The assessment scope, key assumptions and limitations for the land quality assessment are set out in the main ES, Volume 1 and in the SMR and its addendum presented in the main ES Volume 5, Appendices CT-001-000/1 and CT-001-000/2. This section follows the standard assessment methodology.

12.2.2 Baseline data were reviewed for the area of land required to construct the AP2 revised scheme together with a buffer extending out for a minimum of 250m, but in the case of groundwater data up to 1km. This is defined as the study area.

12.2.3 Areas of utility diversion works in existing highways have been excluded because they are a low risk construction activity with respect to land quality. Most of the excavation works will be within the highway construction layers and reinstatement will be undertaken with highway construction materials.

12.2.4 Familiarisation visits to the study area were made in October 2012, prior to the 2013 main ES submission, where the location of the then proposed scheme was viewed from points of public access only. The observations made during these visits remain valid for the AP2 revised scheme. The areas in which the AP2 revised scheme differs from the original scheme were viewed on aerial mapping. No key sites were identified in the study area which required site walk-over surveys. Key sites are those which are considered to have the greatest potential for contamination and are considered to be at risk of being affected by the AP2 revised scheme.

12.3 Environmental baseline

Existing baseline

12.3.1 Unless otherwise stated, all features described in this section are presented in the main ES Volume 5, Map Book - Land Quality Maps LQ-061b to LQ-065.

Geology

12.3.2 This section describes the underlying ground conditions within the study area. It first describes any made ground present, followed by near surface superficial deposits and

lastly describes the deeper bedrock geology. The geological mapping is illustrated in the SES and AP2 ES, Volume 5: Map Book – Land Quality Map WR-02-22.

12.3.3 The presence of 'made ground' is not indicated on British Geological Survey (BGS) mapping, but there is likely to be made ground associated with the WCML and the SSL, existing highways, the Wyrley and Essington Canal, the Trent and Mersey Canal and various small areas of infilling, including infilled pits, infilled ponds and infilled domestic water wells, scattered throughout the study area.

12.3.4 There is a landfill at Lichfield Road, south of Handsacre which is listed as an historical landfill which accepted industrial (pottery) waste.

12.3.5 Superficial deposits intermittently underlie the areas traversed by the AP2 revised scheme. The AP2 revised scheme will cross the following:

- Alluvium (comprising clay, silt, sand and gravel) and River Terrace Deposits (sand and gravel) associated with major surface watercourses;
- Glaciofluvial Sheet Deposits (comprising sand and gravel with lenses of clay, silt and organic material), which underlie the AP2 revised scheme almost continuously from Gorse Farm at Fradley to the northern end of the study area; and
- Head Deposits (variably comprising clay, silt, sand and gravel) present to the north of Streethay.

12.3.6 Bedrock of the Triassic period underlies the AP2 revised scheme. The Sherwood Sandstone Group (comprising the Bromsgrove Sandstone Formation and Kidderminster Formation) comprises pebbly, gravelly sandstone and is present from the southern end of the study area to an area south of Hill Farm and Streethay. The Mercia Mudstone Group, described as red and green-grey mudstones and subordinate siltstones with widespread thin beds of gypsum/anhydrite, underlies the AP2 revised scheme from south of Hill Farm at Streethay to the northern end of the study area.

Groundwater

12.3.7 There are four categories of aquifer identified within the study area. The Sherwood Sandstone Group is classified as a Principal aquifer and the Mercia Mudstone Group as a Secondary B aquifer. Where present, Alluvium, River Terrace Deposits and Glacialfluvial Sheet Deposits are classified as Secondary A aquifers. Head Deposits are classified as a Secondary (undifferentiated) aquifer.

12.3.8 The AP2 revised scheme will pass through a total catchment groundwater source protection zone (SPZ) 3 from the southern end of the study area as far north as Hill Farm at Streethay. The study area will encroach on an outer SPZ 2 to the south-west of Hill Farm. The SPZ 3 and SPZ 2 relate to a groundwater abstraction point off Burton Old Road in the south-west of Streethay. The study area also encroaches on an inner SPZ 1 and outer SPZ 2 between A515 Lichfield Road and Hanch Farm to the south-east of Handsacre. These SPZs relate to a groundwater abstraction from the Sherwood Sandstone Group at Seedy Mill Water Treatment Works.

12.3.9 There are five licensed groundwater abstractions located within 1km of the limit of the land required for the construction of the AP2 revised scheme, shown on SES and AP2 ES, Volume 5: Map Book – Land Quality, Map WR-02-22.

12.3.10 Further detail on the groundwater beneath the AP2 revised scheme can be found in Section 17 Water resources and flood risk assessment.

Surface waters

12.3.11 The AP2 revised scheme will cross the Wyrley and Essington Canal to the south of Capper's Lane. It will also cross the Trent and Mersey Canal once to the south-west of Fradley Wood.

12.3.12 Mare Brook will be crossed by the AP2 revised scheme to the west of Rough Stockings; Pyford Brook/Curborough Brook will be crossed to the north-east of Big Lyntus (a woodland area) and Bourne Brook will be crossed to the east of John's Gorse.

12.3.13 There are also numerous ponds present within the study area.

12.3.14 Further information on surface waters is provided in Section 17 Water resources and flood risk assessment.

Current and historical land use

12.3.15 All potentially contaminated sites (identified from both current and historical land uses) are shown on main ES Volume 5: Map Book - Land Quality, Maps LQ-01-061b to LQ-01-065. Each potentially contaminative land use is annotated on the maps using the code 22-XX, where 22 denotes the CFA number and XX denotes the individual site reference.

12.3.16 Current potentially contaminative land uses include Whittington Heath (main ES, Volume 5: Map Book – Land Quality, Map LQ-01-061b, A6); DMS Whittington (centred on Map LQ-01-061b, C3); the WCML (Map LQ-01-062, E6 and LQ-01-064, B7); the SSL (Map LQ-01-062, C6); a vehicle maintenance garage (Map LQ-01-061b, C6); a metal works (Map LQ-01-064, E4); a sewage works (Map LQ-01-063-D9) and a nursery (Map LQ-01-064-J9).

12.3.17 The community of Whittington Heath comprises a cluster of residential properties focused around the site of DMS Whittington, which is the headquarters for Defence Medical Services, formerly known as Whittington Barracks. A new medical training facility and associated living accommodation have been built on the site recently, which became operational in 2014. This allows for approximately 1,400 military and civilian personnel to be based at DMS Whittington, together with approximately 7,000 students.

12.3.18 Principal historical potentially contaminative land uses include an historical landfill to the south of Handsacre (main ES, Volume 5: Map Book – Land Quality, Map LQ-01-065, G6 and G7); a disused tip to the south of the Trent and Mersey Canal (Map LQ-01-063, C7); a former airfield and military base at Fradley (centred on Map LQ-01-063, F5); and the partially infilled Wyrley and Essington Canal (Map LQ-01-062, F5).

12.3.19 The historical landfill at Lichfield Road, south of Handsacre, accepted industrial (pottery) waste between 1958 and 1960 and was subsequently developed as a

residential area. Consultation with LDC revealed that the landfill was investigated under Part 2A of the Environmental Protection Act[31] and the investigations, completed in November 2010, concluded that the landfill was suitable for residential use and should not be determined as contaminated land.

12.3.20 Other historical land uses identified within the study area with the potential to have caused contamination include several infilled pits, infilled ponds and infilled domestic water wells. All of these areas may have been manually infilled with a variety of waste materials and could also give rise to landfill gases such as methane, carbon dioxide and volatile organic compounds.

12.3.21 Regulatory data reviewed include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). A number of these have been recorded in the study area, the most notable being a former licensed waste management facility at Orchard Farm, located to the east of the AP2 revised scheme.

Mining/mineral resources

12.3.22 The Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006[32] contains policies that seek to safeguard mineral resources against sterilisation from development.

12.3.23 There are no active mining or mineral sites or Preferred Areas[33] within the study area.

12.3.24 Three sand and gravel MCA are within the study area, two of which the AP2 revised scheme will pass through. The first MCA, for sand and gravel processed from the Kidderminster Formation, covers Whittington Heath at the south of this area and will be intersected by the AP2 revised scheme (main ES, Volume 5: Map Book – Land quality, Map LQ-01-061b). The second MCA, for superficial sand and gravel derived from an area of Head Deposits, just encroaches on the area of land required to construct the AP2 revised scheme to the north of Streethay, however the AP2 revised scheme will not intersect this MCA (main ES, Volume 5: Map Book – Land Quality, Map LQ-01-062). The AP2 revised scheme intersects a third, extensive MCA for superficial sand and gravel, relating to Glaciofluvial Sheet Deposits, from Gorse Farm in Fradley to the northern end of the study area (main ES, Volume 5: Map Book – Land Quality, Map LQ-01-063 to LQ-01-065).

Geo-conservation resources

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

12.3.26 The receptors that have been identified within this study area are summarised in Table 16.

[31] Part IIA of the Environmental Protection Act (1990), Her Majesty's Stationary Office.
[32] Staffordshire County Council (1999), Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006.
[33] Areas where mineral deposits are known to exist and where the County Council considers there would be least planning objection to mineral extraction taking place.

Table 16: Summary of sensitive receptors

Issue	Receptor type	Receptor description
Land contamination	People	Residents
		Workers
	Controlled waters	Principal aquifers
		Secondary A aquifers
		Secondary B aquifers
		Secondary (undifferentiated) aquifer
		Canals
		Other surface watercourses and water bodies
	Built environment	Buildings and property
		Underground structures and services
	Mineral resources	Bedrock sand and gravel MCA
		Superficial sand and gravel MCA
Impacts on mining/mineral sites (severance and sterilisation of mineral sites)	Mining/mineral sites	Bedrock sand and gravel MCA
		Superficial sand and gravel MCA

Future baseline

12.3.27 All committed development is described in SES and AP2 ES, Volume 5: Appendix CT-004-000.

12.3.28 The committed developments are either too far away from the AP2 revised scheme to impact on land quality, or the developments would not alter the land use sufficiently to impact on the land quality baseline during either construction or operation of the AP2 revised scheme.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The construction assessment takes into account the mitigation measures contained within the draft CoCP (main ES, 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 AP2 revised scheme. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work.

Such requirements include the following (main ES, Volume 5: Appendix CT-003-000/1):

- methods to control noise, waste, dust, odour gases and vapours (draft CoCP Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (draft CoCP Section 5);
- the management of human exposure for both construction workers and people living and working nearby (draft CoCP Section 11);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (draft CoCP Sections 7 and 15);
- management of any unexpected contamination found during construction (draft CoCP Section 11);
- a post remediation permit to work system (draft CoCP Section 11);
- storage requirements for hazardous substances such as oil (draft CoCP Section 16); and
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect land quality during construction (draft CoCP, section 5).

12.4.2 The draft CoCP requires that a programme of further investigations, which may include both desk based and site based work, will take place 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 AP2 revised scheme to be constructed safely and to prevent harmful future migration of contaminants (draft CoCP, Section 11). The investigation and assessment of potentially contaminated sites will be undertaken in accordance with:

- Environment Agency CLR11 'Model Procedures for the Management of Land Contamination' (2004)[34]; and
- British Standard BS10175 'Investigation of Potentially Contaminated Sites' (2011)[35].

12.4.3 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 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)[36]. The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

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

Assessment of impacts and effects

12.4.4 The AP2 revised scheme through this study area will be constructed with a balance of embankment and at grade with areas of cutting at Whittington Heath and Whittington Common to beyond the A38. The main construction features include viaduct crossings of the various watercourses, overbridges to enable the AP2 revised scheme to pass beneath railroads and roads, with some associated road realignments.

12.4.5 Construction works will include earthworks, utility diversions, deep foundations, temporary dewatering and other activities. In addition, road infrastructure works will also be required for the AP2 revised scheme in the Whittington to Handsacre area.

12.4.6 Construction compounds for the Whittington to Handsacre area will be located at various points along the AP2 revised scheme (Section 6.3). The compounds will include maintenance facilities for plant and machinery and fuel storage in bunded tanks.

Land contamination

12.4.7 In line with the assessment methodology, as set out in the SMR and SMR Addendum, 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 AP2 revised scheme. In total, 77 areas were considered during this screening process and 21 of these areas were taken forward to more detailed risk assessments (Stages C and D) in which the potential risks were assessed more fully. The majority of the areas undergoing the more detailed risk assessments were areas of infilled ground, former military land and existing railway lines. All areas assessed are shown on Maps LQ-01-061b to LQ-01-065 (main ES, Volume 5: CFA22) and those considered as potentially posing a risk to the AP2 revised scheme are labelled with a reference number.

12.4.8 Conceptual site models (CSMs) have been produced for the 21 areas taken to Stage C and D assessments. The detailed CSMs are provided in main ES Volume 5 (Appendix LQ 001-022) and the results of the baseline risk assessments are summarised in this section. Potentially contaminated areas have been grouped and considered together, where appropriate. The following factors have determined the need for Stage C and D assessments:

- whether the area is within or beyond the area of land required for the construction of the AP2 revised scheme or associated offline works; e.g. road realignments;
- the vertical alignment, i.e. whether the AP2 revised scheme is in cutting or on embankment;
- the presence of underlying Principal or Secondary A aquifers or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

12.4.9 A summary of the baseline CSM is provided in Table 17. 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 17: Summary of baseline CSM* for sites which may pose a contaminative risk for the AP2 revised scheme

Area ref.**	Area name (map)	Main potential impacts
22-03	Infilled mill pond (LQ-01-062, G5)	Potential impact to human health off-site, controlled waters and property receptors.
22-04	Infilled Wyrley and Essington Canal (LQ-01-062, F5)	Potential impact to human health off-site, controlled waters and property receptors.
22-08	Airfield (centred on LQ-01-062, C6)	Potential impact to off-site human receptors and groundwater.
22-15	Infilled pond (LQ-01-062, B7)	Potential impact to off-site human receptors, groundwater and property receptors.
22-18	Former airfield (centred on LQ-01-063, F5)	Potential impact to on-site human receptors and groundwater.
22-27	Disused tip (LQ-01-063, C7)	Potential impact to off-site human receptors, groundwater and property receptors.
22-38	Infilled pits (LQ-01-064, E8)	Potential impact to groundwater and property receptors.
22-39	Infilled well (LQ-01-064, C7)	Potential impact to off-site human receptors, groundwater and property receptors.
22-42 and 22-43	Infilled marl pits (LQ-01-064, C6 and B7 respectively)	Potential impact to off-site human receptors, groundwater and property receptors.
22-44 and 22-45	Infilled ponds (LQ-01-064, B7)	Potential impact to off-site human receptors, groundwater and property receptors.
22-46	Historical landfill (LQ-01-065, G6 and G7)	Potential impact to groundwater.
22-47	Infilled pit (LQ-01-065, F6)	Potential impact to off-site human receptors, groundwater and property receptors.
22-48	Whittington Heath (centred on LQ-01-061b, A6)	Potential impact to on-site and off-site human receptors and groundwater.
22-49	Whittington Barracks (centred on LQ-01-061b, C3)	Potential impact to on-site and off-site human receptors and groundwater.
22-51	Vehicle maintenance garage (LQ-01-061b, C6)	Potential impact to on-site human receptors and groundwater.

Area ref.**	Area name (map)	Main potential impacts
22-58, 22-61 and 22-70	Existing railway lines: WCML (LQ-01-062, E6 and LQ-01-064, B7) SSL (LQ-01-062,C6)	Potential impact to off-site human receptors and groundwater.
22-72	Metal works (LQ-01-064, E4)	Potential impact to on-site and off-site human receptors and groundwater.

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

** Each area is assigned a unique identification number (see main ES, Volume 5, Appendix LQ-001-022).

Temporary effects

12.4.10 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.

12.4.11 Table 18 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment has taken into account the requirements of the draft CoCP to which construction will adhere. The details of these comparisons are presented in main ES, Volume 5 (Appendix LQ 001-022).

12.4.12 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 AP2 revised scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

Table 18: Summary of temporary (construction) effects

Area ref.	Area name (map)	Main baseline risk	Main construction risk	Temporary effect and significance
22-03	Infilled mill pond (LQ-01-062, G5)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-04	Infilled Wyrley and Essington Canal (LQ-01-062, F5)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-08	Airfield (centred on LQ-01-062, C6)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-15	Infilled pond (LQ-01-062, B7)	Low	Low	Negligible (not significant)

Area ref.	Area name (map)	Main baseline risk	Main construction risk	Temporary effect and significance
22-18	Former airfield* (centred on LQ-01-063, F5)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-27	Disused tip (LQ-01-063, C7)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-38	Infilled pits (LQ-01-064, E8)	Low	Low	Negligible (not significant)
22-39	Infilled well (LQ-01-064, C7)	Low	Low	Negligible (not significant)
22-42 and 22-43	Infilled marl pits (LQ-01-064, C6 and B7 respectively)	Low	Low	Negligible (not significant)
22-44 and 22-45	Infilled ponds (LQ-01-064, B7)	Low	Low	Negligible (not significant)
22-46	Historical landfill (LQ-01-065, G6 and G7)	Moderate/Low	Moderate/low	Negligible (not significant)
22-47	Infilled pit (LQ-01-065, F6)	Low	Moderate/low	Negligible - Minor adverse (not significant)
22-48	Whittington Heath (centred on LQ-01-061b, A6)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-49	Whittington Barracks (centred on LQ-01-061b, C3)	Low	Low	Negligible (not significant)
22-51	Vehicle maintenance garage (LQ-01-061b, C6)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-58, 22-61 and 22-70	Existing railway lines*: WCML (LQ-01-062, E6 and LQ-01-064, B7) SSL (LQ-01-062,C6)	Low	Moderate/low (groundwater)	Negligible - Minor adverse (not significant)
22-72	Metal works (LQ-01-064, E4)	Low	Low	Negligible (not significant)

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

12.4.13 Table 18 indicates that based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination.

However, temporary risks to groundwater have been identified from the following potential sources of contamination:

- an infilled mill pond which will be intersected by the AP2 revised scheme or disturbed during construction;
- an infilled section of the disused Wyrley and Essington Canal which will be realigned and crossed by the AP2 revised scheme on viaduct;
- two areas of airfields/former military land which will be intersected by the AP2 revised scheme;
- a disused tip which will be intersected by the AP2 revised scheme;
- an infilled pit which will be intersected during construction by an access road relating to the AP2 revised scheme;
- Whittington Heath which will be intersected by the AP2 revised scheme;
- a vehicle maintenance garage which will be intersected by the AP2 revised scheme; and
- WCML and SSL which will be crossed by the AP2 revised scheme.

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

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

12.4.16 The main and satellite construction compounds may also be used for temporary storage of potentially contaminated soils. The mitigation measures outlined in the draft CoCP will manage potential risks from the storage of such materials. The location of these construction compounds is given in Section 6.3.

12.4.17 Additional remediation works will not be required over and above the mitigation measures contained as standard within the draft CoCP.

12.4.18 No significant cumulative temporary effects from construction have been identified.

Permanent effects

12.4.19 Baseline and post-construction CSM have been compared to assess the permanent (post-construction) effects. The post-construction CSM assumes that all required remediation has been carried out and validated. Table 19 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 main ES, Volume 5 (Appendix LQ-001-022).

Table 19: Summary of permanent (post-construction) effects

Area ref.	Area name (map)	Main baseline risk	Main post-construction risk	Post-construction effect and significance
22-03	Infilled mill pond (LQ-01-062, G5)	Low	Low	Negligible (not significant)
22-04	Infilled Wyrley and Essington Canal (LQ-01-062, F5)	Low	Low	Negligible (not significant)
22-08	Airfield (centred on LQ-01-062, C6)	Low	Low	Negligible (not significant)
22-15	Infilled pond (LQ-01-062, B7)	Low	Low	Negligible (not significant)
22-18	Former airfield (centred on LQ-01-063, F5)	Low	Low	Negligible (not significant)
22-27	Disused tip (LQ-01-063, C7)	Low	Very low	Negligible - Minor beneficial (not significant)
22-38	Infilled pits (LQ-01-064, E8)	Low	Low	Negligible (not significant)
22-39	Infilled well (LQ-01-064, C7)	Low	Low	Negligible (not significant)
22-42 and 22-43	Infilled marl pits (LQ-01-064, C6 and B7 respectively)	Low	Low	Negligible (not significant)
22-44 and 22-45	Infilled ponds (LQ-01-064, B7)	Low	Low	Negligible (not significant)
22-46	Historical landfill (LQ-01-065, G6 and G7)	Moderate/Low	Moderate/low	Negligible (not significant)
22-47	Infilled pit (LQ-01-065, F6)	Low	Very low	Negligible - Minor beneficial (not significant)
22-48	Whittington Heath (centred on LQ-01-061b, A6)	Low	Low	Negligible (not significant)
22-49	Whittington Barracks (centred on LQ-01-061b, C3)	Low	Low	Negligible (not significant)
22-51	Vehicle maintenance garage (LQ-01-061b, C6)	Low	Very low	Negligible - Minor beneficial (not significant)

Area ref.	Area name (map)	Main baseline risk	Main post-construction risk	Post-construction effect and significance
22-58, 22-61 and 22-70	Existing railway lines: WCML (LQ-01-062, E6 and LQ-01-064, B7) SSL (LQ-01-062,C6)	Low	Low	Negligible (not significant)
22-72	Metal works (LQ-01-064, E4)	Low	Low	Negligible (not significant)

12.4.20 The magnitude of the permanent effects and their significance has 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 AP2 revised scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary. Table 19 shows that the AP2 revised 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.

12.4.21 An example of a beneficial effect would be the disused tip (LQ-01-063, C7), which lies on the route of the AP2 revised scheme, which will be examined during ground investigations prior to construction. In accordance with the draft CoCP discussed in Sections 12.3.1, 12.3.2 and 12.3.3, should contamination be encountered in the location of the disused tip, a risk assessment will be undertaken to determine what, if any, site-specific remediation measures will be required to allow the AP2 revised scheme to be constructed safely and to prevent harmful future migration of contaminants. It has been assumed that remediation measures will be implemented, which would result in a minor beneficial effect.

12.4.22 No significant cumulative permanent effects have been identified.

Mining/mineral resources

12.4.23 Construction of the AP2 revised scheme has the potential to impact existing mineral resources. This could occur by sterilisation of the resource, direct excavation during construction of the AP2 revised scheme or through temporary and/or permanent severance[37] that may occur during the construction phase of the AP2 revised scheme, possibly continuing through to the operation.

Temporary effects

12.4.24 Temporary adverse effects are anticipated on MCA where land will be temporarily used for construction and returned to the landowner after construction. This includes satellite construction compounds and earthworks stockpiling in the Whittington to Handsacre area. There are temporary areas of earthworks stockpiling on Whittington

[37] In this context, severance refers to the AP2 revised 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.

Heath within the MCA. Construction compounds are proposed to the north of Little Lyntus Wood, A515 Lichfield Road and at Harvey's Rough overlying the superficial sand and gravel MCA between Gorse Farm and the northern end of the study area.

12.4.25 There are no temporary effects anticipated on the superficial sand and gravel MCA located to the north of Streethay.

12.4.26 Table 20 presents a summary of the assessment of temporary effects on the mining and mineral resources identified. The earthworks stockpiles and construction compounds cover a very small area of the MCA for a temporary period and the magnitude of impact is assessed as minor.

Table 20: Summary of temporary effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land underlying Whittington Heath LQ-01-061b	MCA	MCA for bedrock sand and gravel extraction.	Low	Minor	Negligible (not significant)
Area of land between Gorse Farm and northern edge of the AP2 revised scheme in the study area LQ-01-063 to 065	MCA	MCA for superficial sand and gravel extraction.	Low	Minor	Negligible (not significant)

12.4.27 No significant temporary effects have been identified on the existing mineral resource.

Permanent effects

12.4.28 The AP2 revised scheme will be constructed on embankment through the two sand and gravel MCAs that will be crossed, as shown in main ES Volume 5: Map LQ-01-061b and 063. There is a potential minor adverse impact but the effect is assessed as not significant because there will only be a minor severance or sterilisation of a large local resource.

12.4.29 Table 21 presents a summary of the assessment of effects on the mining and mineral resources identified.

Table 21: Summary of effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land underlying Whittington Heath LQ-01-061b	MCA	The MCA will be intersected by the AP2 revised scheme. It is a localised resource for bedrock derived sand and gravel extraction.	Low	Moderate	Minor adverse (not significant)
Area of land underlying north of Streethay LQ-01-062	MCA	The MCA just encroaches on the study area and will not be intersected by the AP2 revised scheme. It is a localised resource for superficial sand and gravel extraction.	Low	Minor	Negligible (not significant)

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land between Gorse Farm and northern edge of the AP2 revised scheme in the study area LQ-01-063 to 065	MCA	The MCA will be intersected by the AP2 revised scheme and is an extensive resource for superficial sand and gravel extraction.	Low	Moderate	Minor adverse (not significant)

12.4.30 There are anticipated to be no significant permanent effects from operation of the AP2 revised scheme on the mineral resources.

12.4.31 The cumulative effects on mineral resource across the whole of the AP2 revised scheme are discussed in the assessment of route-wide effects presented in SES and AP2 ES, Volume 3.

Geo-conservation resources

12.4.32 No geo-conservation areas, such as SSSI or local geological sites, are present in the study area.

Other mitigation measures

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

12.4.34 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 AP2 revised scheme adjacent to rather than beneath the trackbed, which will require good founding conditions. A plan will be discussed and agreed in advance of the construction works with the landowner, the Mineral Planning Department at Staffordshire County Council and any other interested parties to assist in achieving an effective management of minerals within the affected location of the MCA.

Summary of likely residual effects

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

12.5 Effects arising from operation

12.5.1 Users of the AP2 revised scheme (i.e. rail passengers) whilst within trains, will at all routine times be within a controlled environment and have been scoped out of the assessment on that basis.

Avoidance and mitigation measures

12.5.2 Maintenance and operation of the AP2 revised 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

12.5.3 Capper's Lane auto-transformer station will be situated to the north of Capper's Lane, and Lyntus auto-transformer station will be situated to the south of Wood End Lane. Mare Brook package substation will be situated to the north of Mare Brook, and Kings Bromley package substation will be situated to the south of Kings Bromley Footpath 0.392. An auto-transformer substation can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer substations and package substations, in common with other modern substations, will use secondary containment appropriate to the level of risk.

12.5.4 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.

12.5.5 It is unlikely that there will be any cumulative effects on land quality due to in-combination effects on receptors because of the environmental controls that will be placed on operational procedures.

Other mitigation measures

12.5.6 No other mitigation measures are expected beyond what has already been outlined relating to land quality in the Whittington to Handsacre study area.

12.5.7 There may be ongoing monitoring requirements following remediation works carried out during construction. Such monitoring, including monitoring of groundwater quality or ground gas, could extend into the operational phase of the AP2 revised scheme.

Summary of likely residual significant effects

12.5.8 No likely residual significant effects are anticipated associated with the operation of the AP2 revised scheme.

13 Landscape and visual assessment

13.1 Introduction

13.1.1 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 AP2 revised scheme and goes on to describe the significant effects that will arise during construction and operation on landscape character areas (LCAs) and visual receptors.

13.1.2 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 AP2 revised scheme.

13.1.3 Principal landscape and visual issues in the area include:

- temporary effects to LCAs and visual receptors during construction arising from the presence of construction plant, worksites, removal of existing vegetation and severance of agricultural land and construction of design elements of the AP2 revised scheme; and
- permanent landscape and visual effects during operation arising from the presence of:
  - new engineered landforms cutting across the existing landscape;
  - new viaducts and cuttings;
  - noise fence barriers, highway infrastructure; and
  - overhead line equipment and regular passing of high speed trains.

13.1.4 In the main, permanent adverse effects will reduce over time as planting established as part of the AP2 revised scheme matures.

13.1.5 A separate but related assessment of effects on the setting of heritage assets is included in the cultural heritage section (Section 10). Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in SES and AP2 ES, Volume 5: Appendix LV-001-022, 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.

13.1.6 Summer field surveys, including photographic studies of LCAs and visual assessment of viewpoints, were undertaken from May to July 2012 and from May to June 2013. Winter surveys were undertaken from December 2012 to March 2013. Photography for additional viewpoint 353.3.007: east from Streethay Footpath 6 adjacent to Hill Farm and for additional photomontage Figure LV-01- 289 for viewpoint 360.2.002:

north-east from Wood End Farm/The Cottage, Wood End Lane were undertaken in March 2015.

13.2 Scope, assumptions and limitations

13.2.1 The assessment scope, key assumptions and limitations for the landscape and visual assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-0001-000/1) and the SMR Addendum (Volume 5: Appendix CT-0001-000/2) of the main ES.

13.3 Environmental baseline

Existing baseline

Landscape baseline

13.3.1 A raised heath plateau at Whittington slopes gently northwards, down to the River Trent terraces, skirting east of Lichfield's well defined edge. North of Lichfield, the land rises towards the Cannock Chase and Cank Hills. The rural landscape is predominantly arable with some pasture, equestrian uses and market gardening with polytunnels. Villages, hamlets and isolated properties are linked by a network of minor roads. The Trent and Mersey Canal is used primarily for recreation. North-east of Lichfield, Fradley Business Park is prominent. Lichfield Cathedral and Close is the area's principal historic element, with the Cathedral's three spires forming a prominent landmark on the skyline in the rural areas south and east of the city.

13.3.2 The dominant pattern in the landscape is of medium to large fields enclosed by dense, well-maintained hedgerows and narrow tree belts. There are larger woodlands around Whittington, north-west of Fradley and south-east of Lichfield, including the A38 corridor. At Curborough, smaller well-hedged fields, tree belts and varied landform creates a more intimate landscape. The A38 is the primary road, with the A51 linking Lichfield and Tamworth and the M6 Toll. The WCML crosses the western part of the area. A network of lanes and PRoW, including the Heart of England Way, provide access to the countryside.

13.3.3 The LCAs within the area have been identified through reference to Staffordshire County Council's Supplementary Planning Guidance (SPG) document 'Planning for Landscape Change'[38] and confirmed through desk studies and field work.

13.3.4 Descriptions of all LCAs are provided in the main ES, Volume 5: Appendix LV-001-022 Part 2. For the purposes of this assessment the study area has been sub-divided into four discrete LCAs. A summary of these LCAs is provided below. The LCAs are shown in the main ES Volume 5: Map Book — Landscape and visual assessment, Maps LV-02-092b to LV-02-097.

Sandstone Outer Estatelands LCA

13.3.5 This LCA comprises a landscape of small villages and isolated cottages set in a regular pattern of large arable hedged or open fields. Landform is gently undulating, with limited hedgerows and few hedgerow trees. In pastoral areas, gapped hedgerows are important landscape features. The overall landscape condition is fair and the survival

[38] Staffordshire County Council Development Services Department (2000), Supplementary Planning Guidance 'Planning for Landscape Change'.

of scarce semi-natural heathland, such as at Whittington Heath, is critical to maintaining character and quality. The landscape includes some large modern farm buildings, power lines, recent housing developments and busy main roads, resulting in a medium level of tranquillity. This landscape is of local value due to the extensive network of PRoW and the setting it provides for the Heart of England Way. Therefore, this area has a medium sensitivity to change.

Settled Farmland LCA

13.3.6 This LCA comprises an undulating rural landscape with a good sense of enclosure. Land use is arable with a range of field sizes, with poorly maintained hedgerows. Small, infrequent woodlands are linked by a network of narrow, winding lanes, often bordered by hedgebanks and leading to clustered farmsteads. The PRoW network provides good access to the rural areas. There are increasing development pressures on villages with farm diversification, residential expansion and busy traffic on lanes. The overall landscape condition is fair. Night-time lighting in Lichfield and Fradley Business Park is evident. The A38 corridor is prominent, but minor roads lined by hedgerows are more discrete, resulting in a medium level of tranquillity. This LCA is of district value, due to the presence of designated green belt between Lichfield and Armitage with Handsacre. Therefore, this area has a medium sensitivity to change.

Settled Heathlands LCA

13.3.7 This LCA comprises a landscape of mixed farming in a regular pattern of hedged fields with dispersed settlements. Bracken and birch in woodlands and hedgerows reveal the area's heathland origins. Overall landscape condition is fair due to relatively sparse hedgerows and increasing urbanisation. Land uses are diverse and include part of Fradley Business Park and a popular recreational section of the Trent and Mersey Canal. There is little night-time lighting other than from Fradley Business Park. Major transport routes include the A515 and the existing WCML. The presence of Fradley Business Park and some busy roads, results in a medium level of tranquillity. This LCA is considered to be of district value due to the presence of canal-related tourist attractions and a network of PRoW. Therefore, this area has a medium sensitivity to change.

Terraced Alluvial Lowlands LCA

13.3.8 The land within this LCA is generally flat with a well-wooded landscape of intensive arable and improved pasture. Fields are well hedged with good tree cover and commonly large scale, with areas of older, smaller, irregularly shaped fields, including polytunnels at Handsacre, with a network of straight roads and lanes that links farms and villages. The overall landscape condition is good. Night-time lighting is noticeable on the unscreened eastern edge of Handsacre. Traffic on the A515 Lichfield Road and the B5014 Lichfield Road into Handsacre results in a medium level of tranquillity. The LCA is considered to be of value at a local level for its rural setting and access to PRoW. Therefore, this area has a medium sensitivity to change.

Visual baseline

13.3.9 Descriptions of the identified representative viewpoints are provided in the main ES, Volume 5: Appendix LV-001-022 Part 2. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are

shown on main ES, Volume 2, CFA22 Map Book, maps LV-03-92b, LV-03-94 to LV-03-97 and SES and AP2 ES Volume 2, CFA22 Map Book, map LV-03-093; and ES Volume 2, CFA22 Map Book, maps LV-04-092b, LV-05-096 and LV-04-097 and SES and AP2 ES Volume 2, CFA22 Map Book, map LV-04-093 to LV-04-95. The viewpoints are numbered to identify their locations. In each case, the middle number (xxx.X.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and Healthcare, 6: Employment and 7: Sports.

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

13.3.11 Residential receptors have a high sensitivity to change and include scattered farmsteads and individual properties and villages including Whittington and DMS Whittington, Huddlesford, Streethay and Armitage with Handsacre, as well as properties on the eastern edge of Lichfield. Views are typically across agricultural land. The combination of flat or gently undulating topography with well-treed hedgerows, small copses and woodland belts creates a diverse range of views, which vary in the distance and field of view available.

13.3.12 Recreational receptors, also with a high sensitivity to change, are located on PRoW throughout the study area, including the Heart of England Way and the Trent and Mersey Canal. Viewpoints are typically in rural locations, with fields or woodlands forming the surroundings, with a varying degree of enclosure dependent on landform and surrounding vegetation.

13.3.13 Viewpoints from roads generally include the network of minor roads that cross this area; these have a medium sensitivity to change. People travelling on main roads, including the A38, A515 and A51 have a low sensitivity to change. In general, views from the road network are characterised by arable and grazing land, with some polytunnels, but also include the edges of urban settlements at Lichfield, Fradley and Streethay.

13.3.14 Employment receptors, (e.g. people at their places of work, such as within Fradley Business Park), are the least sensitive receptors, as their attention is likely to be focused on their work activity. These receptors have a low sensitivity to change.

Future baseline

13.3.15 A summary of the committed developments which are assumed to be built and occupied prior to either the construction or operation of the AP2 revised scheme is provided below, along with the consequential effect on the character of LCAs and nature of views. Developments which would introduce new visual receptors which may be significantly affected are also described. These developments are shown in SES and AP2 ES, Volume 5, Map Book - Cross topic, Maps CT-13-061 to CT-13-065.

Construction (2017)

13.3.16 A summary of the known developments that are assumed to be mostly built and occupied prior to construction of the AP2 revised scheme is provided in Section 6.1 of this report. Since the publication of the main ES in 2013, other applications for development have been approved. Committed developments (either approved consents or allocations in adopted local plans prior to 28 February 2015) are listed

below and considered in the assessment sections, where material to the potential landscape and visual environmental impact of the AP2 revised scheme.

- land north of Burton Road and north-east of the WCML, Streethay, Lichfield, Staffordshire: construction of a sustainable mixed-use urban extension, comprising up to 750 dwellings; a primary school; mixed-use community hub/local centre to include retail development and community buildings, a care home (C2 Use Class); comprehensive green infrastructure, with footpaths, cycleways and open space;
- land at Fradley Park, Halifax Avenue, Fradley, Lichfield, Staffordshire: demolition of existing buildings and redevelopment of the site to provide up to 750 new homes, primary school, health centre, nursery, public house, public and private open space, car and cycle parking together with landscaping and associated servicing;
- Whittington Hill Farm, Darnford Lane; conversion of workshops/stables to form a three bedroom ancillary residential unit;
- land for employment development Burton Old Road, Lichfield; erection of business units of varying heights;
- land for employment development at Easthill Farm, Wood End Lane (Prologis/Tango Real Estate); erection of small and medium scale business units of varying heights;
- land at Fradley Park/ Halifax Avenue/Wood End Lane; erection of business units of varying heights and associated works; and
- Hanch Hall Farm, B5014 Lichfield Road, Handsacre; erection of a livestock, produce and implement store.

Operation (2026)

13.3.17 Section 6 identifies the projects that form part of the future baseline for operation. The sensitivity of the LCAs will remain as per the baseline assessment, although new visual receptors will be present. Planting at employment sites and mixed-use developments will have established sufficiently to partially filter views to the AP2 revised scheme, and completed developments will continue to be valid receptors during the operational phase.

13.4 Effects arising during construction

13.4.1 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible in many locations and will have the potential to give rise to significant temporary effects, which cannot be mitigated practicably. Such effects are temporary and vary over the construction period depending on the intensity and scale of the works at the time. The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase, which is defined as the period during which the main civil engineering works will take place, including establishment of compounds, main earthworks and structure works.

The effects associated with the peak construction phase in this CFA will generally be considered to be long term given the construction programme (see Section 6.3).

13.4.2 Overall, civil engineering works in this CFA will be undertaken between the start of 2018 and the end of 2025. The Capper's Lane main compound will be in place for approximately six years, the A515 Lichfield Road underbridge main compound for approximately four years and nine months and the Handsacre main compound (rail systems) for approximately five years. Satellite compounds will be in place for between approximately one and four years. Effects during other phases of works are likely to be less, due to less construction equipment being required at the time and a reduced intensity of construction activity.

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

- construction of a cutting north of the A51 Tamworth Road at Whittington Heath Golf Club;
- construction of Lichfield Road underbridge, Whittington Heath Footpath 16 underpass and embankment;
- construction of Darnford Lane overbridge;
- construction of Capper's Lane viaduct and embankment;
- construction of Capper's Lane realignment, including bridges over the Wyrley and Essington Canal and the HS2 route;
- use of land near Broad Lane/Capper's Lane for satellite compounds;
- construction of the WCML overbridge;
- construction of Streethay cutting;
- construction of Streethay Footpath 6 accommodation overbridge;
- construction of the SSL overbridge;
- construction of the A38 overbridge;
- construction of the A38 and A38 sliproad overbridges;
- use of land south of the A38 for roadheads and soil storage/material transfer;
- use of land near A38 for Capper's Lane satellite compounds and temporary workers' accommodation;
- construction of Fradley Wood embankment;
- realignment of Wood End Lane;
- construction of Wood End Lane underpass;
- construction of Curborough dive-under and Curborough embankment, realignment of Wood End Lane, including Wood End Lane underbridge, overbridge and a bridge over Curborough Brook;

- construction of a viaduct across the Trent and Mersey Canal;
- use of land near Trent and Mersey Canal for satellite compounds;
- use of land south of the Trent and Mersey Canal, west of the Manchester spur for a roadhead;
- use of land near the A515 for Lichfield Road main and satellite compounds;
- construction of Bourne Brook viaduct;
- use of land for temporary material transfer stockpiles at Shaw Lane;
- extension of Tuppenhurst Lane, between Shaw Lane and the A515 Lichfield Road;
- construction of Harvey's Rough embankment;
- construction of Harvey's Rough flyover and WCML tie-in;
- general construction activity including demolitions, earthworks (including topsoil stripping and stockpiling), temporary haul roads (10m wide alongside the earthworks footprint), formation of batters and profiling, piling and formation of structures and security fencing;
- general construction plant, equipment and associated infrastructure including cranes, batching plants; and
- temporary road and PRoW diversions and closures.

Avoidance and mitigation measures

13.4.4 Measures that have been incorporated into the draft CoCP to avoid or reduce landscape and visual effects during construction include the following (see the main ES, 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);
- replacement of any trees intended to be retained which may be accidentally felled or die as a consequence of construction works (draft CoCP Section 12);
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (draft CoCP Section 12); and
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions, which may affect landscape and visual resources during construction (draft CoCP Section 5).

13.4.5 The AP2 revised scheme has been developed to set the HS2 route between Whittington and Handsacre low in the landscape. The route will be in cutting at a maximum of approximately 18.8m from north of the A51 Tamworth Road to north of the A38 to successfully integrate the route within the local landscape setting. This will allow the route to run in cutting to the east and north of Lichfield and to pass beneath the WCML, the SSL and the A38.

13.4.6 The AP2 revised scheme Handsacre link passes west of the Trent and Mersey Canal, with one crossing of the canal corridor by the Manchester spur on viaduct.

Assessment of temporary impacts and effects

13.4.7 The most apparent changes to landscape character and viewpoints during construction will relate to the temporary presence of construction plant and the removal of existing landscape elements such as trees, hedgerows and agricultural land. Changes will be most notable along the embankments and cuttings through the landscape between Whittington Heath and Handsacre. Key issues for this area include:

- the construction of viaducts across lower-lying land at Capper's Lane, to the west of Fradley Business Park and over the Trent and Mersey Canal for the Manchester spur and at Bourne Brook;
- a flyover at Harvey's Rough for the Handsacre link;
- cuttings at Streethay to pass beneath the WCML, the SSL and the A38;
- road realignments and the overbridges at Darnford Lane, Capper's Lane and Wood End Lane; and
- the realignment of a section of the Wyrley and Essington Canal.

13.4.8 The height of construction plant and viaducts and the close proximity of construction activities to viewpoints, coupled with the absence of intervening screening (apart from the site hoardings) will result in significant visual effects during construction. The landform in certain locations (e.g. the existing A38 embankments) and the retention of intervening hedgerows and trees will partially screen low-level construction activity.

Landscape assessment

13.4.9 The following section describes the likely significant effects on LCAs during construction. All LCAs within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in the main ES, Volume 5: Appendix LV-001-022 Part 4.

Sandstone Outer Estatelands LCA

13.4.10 The AP2 revised scheme will pass though the Sandstone Outer Estatelands LCA from the boundary with CFA21, along the A51 at Whittington Heath Golf Club, to the WCML. Part of this LCA also lies within CFA21. Construction will require the removal of trees and woodland and will result in some loss and severance of agricultural land. Whittington Heath Golf Club clubhouse on the existing A51 alignment will be demolished. Vegetation removal will cause further fragmentation in areas where

hedgerows are scarce, whilst in more secluded areas openness will be increased and tranquillity reduced due to construction activity and night-time lighting. Traffic will increase on Capper's Lane from the junction with Austin Cote Lane east to just beyond Mill Farm, and on Broad Lane from the junction with Capper's Lane to just beyond the WCML. There will be temporary diversions of Lichfield Road and Broad Lane, and permanent realignments of Darnford Lane, Broad Lane and Capper's Lane.

13.4.11 Areas of scarce, semi-natural heathlands at Whittington Heath Golf Club will be removed, which will impact on the character of the LCA. North of Lichfield Road, Whittington, construction works will be at variance with the local character of the LCA. These will include the construction of an embankment and viaduct crossing gently sloping land and floodplain at Capper's Lane, and the realignment of an unnamed watercourse, part of the Wyrley and Essington Canal, and a section of Capper's Lane. Incongruous construction facilities, including worksites along the route within the LCA and temporary workers accommodation and a material transfer stockpile between the WCML and Capper's Lane, will be in place throughout the construction period. In CFA21, the character of this area will be substantially altered through the removal of vegetation and the introduction of new infrastructure. Therefore, due to the changes in setting within CFA22, and the changes in character described in CFA21, the magnitude of change will be high. The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a major adverse effect.

Settled Farmlands LCA

13.4.12 The AP2 revised scheme will pass through this LCA from the WCML to Wood End Lane at Fradley. Construction activities will result in the loss of hedgerows and trees within the route's alignment, including the west block of Fulfen Wood. There will also be temporary loss of agricultural land and disruption of field use. The construction of embankments and viaducts together with construction roadheads, worksites and extensive material-handling areas south of the SSL/A38 will result in changes to the existing character of the LCA in this area, urbanising the agricultural land south and east of Streethay and Fradley and resulting in a temporary reduction in tranquillity. Lighting at worksites and construction roadheads will be noticeable at night, despite the proximity to A38 vehicle and slip road lighting. At Fradley, the construction of the route will form a new western edge to future development at Fradley Business Park, narrowing the rural area separating Lichfield and Fradley. The magnitude of change to the LCA will be high. The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Settled Heathlands LCA

13.4.13 The AP2 revised scheme will cross the Settled Heathlands LCA from Wood End Lane at Fradley to Ashton Hays Farm, south of Handsacre. There will be localised loss of hedgerows, trees and areas of woodland at Fradley, Fradley Wood, Ravenshaw Wood and Black Slough Wood which are distinctive features within this LCA. There will also be loss of agricultural land and temporary disruption of field access. There will be realignments of Wood End Lane, Netherstowe Lane and Watery Lane and a temporary diversion of the A515 Lichfield Road. The construction of large scale earthworks, a viaduct for the Manchester spur over the Trent and Mersey Canal, and the alignment of the Handsacre link west of the canal corridor cutting through

canalside woods, will affect the canal conservation area and recreation, and reduce seclusion and tranquillity.

13.4.14 Construction-related traffic will be notable in certain areas, which will be out of character with the working rural and recreational landscape. Shaw Lane will be closed and there will be temporary diversions of National Cycle Route (NCR) No. 54 and PRoW Streethay Footpath 6. Construction worksites and lighting, particularly in rural areas, will extend the urban influence of Fradley Business Park and reduce local tranquillity. Therefore, the magnitude of change will be high. The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a major adverse effect.

Visual assessment

13.4.15 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken during winter, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, will be in leaf. Where residential receptors experience significant effects at night-time arising from additional lighting, these are also presented in this section. Representative viewpoints within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in SES and AP2 ES, Volume 5: Appendix LV-001-022 Part 4.

13.4.16 The number identifies the viewpoint locations which are shown in main ES and SES and AP2 ES, Volume 5: Map Book — Landscape and visual assessment, Maps LV-03-92b to LV-03-97. In each case, the middle number (xxx.X.xxx) identifies the type of receptor present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and Healthcare, 6: Employment and 7: Sports.

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

Viewpoint 347.2.002: View north-east from South Lodge, on the A51 Tamworth Road

13.4.18 Construction activities will be visible approximately 100m away from this viewpoint across the existing A51 Tamworth Road, beyond woodland belts at Whittington Heath Golf Club. Visual impacts will include the removal of a section of mature roadside trees for the temporary realignment of the A51, and of areas of woodland with the golf course along the route.

13.4.19 Construction plant for the cutting beneath the A51, the temporary diversion of the road closer to the property and its subsequent reconstruction on the original alignment will be prominent in the foreground, as will the construction of a package substation and access track north of the A51. A new farm access track from the A51 will be visible to the side of the viewpoint. Overall, the magnitude of change is considered to be high.

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

Viewpoint 347.4.007: View north-east from Lichfield Road, Whittington

13.4.21 Construction activities will be visible in the middle ground, approximately 700m away from this viewpoint. The removal of hedgerows and trees and the presence of construction plant required for the embankment north of Whittington Heath and for the Darnford Lane overbridge over a shallow cutting will be visible. Construction activities visible in the background will include the formation of an embankment on the approach to the viaduct crossing of Capper's Lane and the Wyrley and Essington Canal. The works and plant movements will be incongruous features across a broad arc of view, seen in the middle ground and background, beyond intervening vegetation, resulting in a medium magnitude of change.

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

Viewpoints 348.2.002 and 348.3.003: Views north-west from Thimble Hall Cottage and PRoW Whittington Footpath 17, Sandy Lane

13.4.23 Construction activities will be approximately 300m and 900m away from these viewpoints. The removal of hedgerows and trees along the route between Lichfield Road, Whittington and Darnford Lane will be visible across a narrow arc in the middle ground. Construction plant required for the formation of the embankment south of Ellfield House and for the cutting and overbridge at Darnford Lane will be noticeable, on gently rising ground between woodland at Whittington Heath and trees at Ellfield House. Therefore, the magnitude of change will be medium.

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

Viewpoint 348.3.007: View north from PRoW Whittington Footpath 16 (crossing the playing course of Whittington Heath Golf Club)

13.4.25 Construction activities will be approximately 100m away from this viewpoint representing a PRoW which will be closed by construction works for six months. From this viewpoint, there will be views along the route of the removal of trees at Whittington Heath Golf Club and of roadside vegetation at Lichfield Road, Whittington in the foreground and background. Construction plant and works for the embankment north to Darnford Lane, including Whittington Footpath 16 accommodation underpass, Lichfield Road underbridge and Lichfield Road underbridge satellite compound will be prominent in the foreground and middle ground; therefore the magnitude of change is considered to be high.

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

Viewpoint 349.2.002: View east from the A51Tamworth Road near Jockey Rise

13.4.27 Construction activities will be approximately 900m away from this viewpoint. The removal of trees and woods will be visible on the skyline in the middle ground and background. Construction activities for embankments from Lichfield Road, Whittington north and for Darnford Lane overbridge will be visible against the skyline

on rising ground, above intervening layers of vegetation. Therefore, the magnitude of change will be high.

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

Viewpoint 349.2.004: View north-east from Marsh Farm

13.4.29 Construction activities will lie approximately 400m away from this viewpoint. The removal of boundary vegetation along Darnford Lane will open up views along the route north towards Capper's Lane and south towards Lichfield Road, Whittington. The construction of Darnford Lane overbridge and the embankments north and south will be prominent features in the middle ground, seen across rising land. Therefore, the magnitude of change will be high.

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

Viewpoint 349.2.005: View east from Whittington Hill Farm and Whittington Hill House off Darnford Lane

13.4.31 Construction activities will lie immediately next to this viewpoint. The removal of vegetation in the immediate foreground and the presence of construction plant required for the route in shallow cutting at Darnford Lane, and for embankments north and south will be prominent. However, the construction of the environmental earthworks west of the route and the embankments for Darnford Lane overbridge in the foreground of the view will block views along the route to the north-east and east to the cutting. The magnitude of change will be high.

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

13.4.33 Assuming the completion of an additional residential unit at Whittington Hill Farm converted from workshop/ stables as set out in the future baseline section (Section 13.3), the additional receptor will experience the same magnitude of change and extent of effect.

Viewpoint 349.4.008: View north-east from Darnford Lane east of Lichfield

13.4.34 Construction activities will lie approximately 400m away from this viewpoint. The removal of field boundaries and trees and the presence of construction plant required for the embankment north of Darnford Lane to Capper's Lane will be visible in the middle ground. Works for Capper's Lane viaduct and the cuttings north and south of the WCML overbridge will be visible rising above the floodplain in the background, seen beyond intervening field hedgerows and woods. Therefore, the magnitude of change will be high.

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

Viewpoint 349.2.012: View east/south-east from junction of Darnford Lane with Gable Croft

13.4.36 Construction activities will lie over 1.5km from this viewpoint and be constructed on embankment and viaduct across a flood plain in the middle ground. Views of construction operations between Darnford Lane and Capper's Lane will be narrow and channelled by woodlands north of the A38; therefore the magnitude of change to this view will be low.

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

Viewpoint 350.2.001: View west from Ellfield House, off Lichfield Road, Whittington

13.4.38 Construction activities will lie approximately 100m west of this viewpoint, and be constructed in the foreground on a combination of embankment and shallow cutting between Lichfield Road, Whittington and Darnford Lane. The removal of field and roadside hedgerows and trees, the demolition of an outbuilding and the construction of approach embankments for Darnford Lane overbridge and the HS2 route on embankment south towards Lichfield Road, will bring a marked change to the nature of foreground and middle ground of the view, therefore the magnitude of change will be high.

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

Viewpoint 350.2.002: View west from Huddlesford House (and farm), Huddlesford Lane

13.4.40 Construction activities will be seen across low-lying land on embankment and viaduct in the background. Part of the view will be screened by a farm building, although taller elements of construction plant at Capper's Lane viaduct and the works to construct the route in cutting to the north and on embankment to the south, together with the realignment of a section of the Wyrley and Essington Canal and a length of Capper's Lane, will be visible above intervening vegetation. The magnitude of change is considered to be medium.

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

Viewpoints 350.3.005, 350.4.006 and 350.3.007: Views north-west from PRoW Whittington Footpath 8 between Capper's Lane and Darnford Lane, from Darnford Lane near Ellfield Nurseries and from PRoW Whittington Footpath 7, at Capper's Lane

13.4.42 The removal of field boundaries and trees to enable construction will be visible in the foreground and middle ground, north from Darnford Lane overbridge to Huddlesford embankment and Capper's Lane viaduct. The upper elements of Capper's Lane viaduct satellite compounds will be visible in the background. The magnitude of change will be high.

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

Viewpoint 351.2.001: View east/north-east from Fulfen Farm located between the A38 and Capper's Lane

13.4.44 Construction works for the Capper's Lane viaduct and embankment, the realignment of a section of the Wyrley and Essington Canal, and cuttings north and south of the WCML overbridge will be visible in the middle ground, as will the realignment of a section of Capper's Lane and overbridge construction. A material storage transfer area will also be visible in the middle ground, partially screening views to the existing WCML. The nature and location of the works for the AP2 revised scheme and the limited intervening screening will result in a high magnitude of change.

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

13.4.46 At night, the lighting at Capper's Lane main compound will be intrusive within the largely unlit context. There will also be partially filtered, background views of lighting at the Capper's Lane viaduct (west) satellite compound. Therefore, the magnitude of change to this receptor at night will be medium, resulting in a moderate adverse effect.

Viewpoint 351.2.002: View north-east from Fulfen Cottages on Capper's Lane

13.4.47 Construction plant and earthworks for the WCML overbridge and the route in cuttings to the north and south, and for the approach embankment to Capper's Lane overbridge will be prominent in the middle ground, as will a satellite construction compound. A material transfer stockpile off Capper's Lane will be visible in the foreground. The magnitude of change will be high.

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

13.4.49 At night, the lighting at the WCML satellite compound (south) will be intrusive within the largely unlit context. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 351.2.006: View north-east from Ivy Cottage on Broad Lane

13.4.50 Construction activities for the approach embankments to Capper's Lane overbridge will occupy the immediate foreground of this view, with the cuttings north and south of the WCML overbridge visible in the middle ground. A materials transfer stockpile will also be prominent north of Broad Lane. The proximity of the AP2 revised scheme will result in a high magnitude of change.

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

13.4.52 At night, the lighting at the WCML overbridge (south) satellite compound and at Capper's Lane overbridge satellite compound will be intrusive within the middle

ground views within a largely unlit context. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 351.4.004: View south-east from the A38 near crossing with WCML

13.4.53 Construction activity will occupy the foreground of this elevated view which will overlook the Capper's Lane main compound and A38 southbound roadhead. Changes in the middle ground of the view will include the loss of field boundaries; the construction of cuttings north and south of the WCML overbridge, and Capper's Lane overbridge, and Capper's Lane viaduct over a realigned section of the Wyrley and Essington Canal. Construction plant and earthworks operations will be prominent. The magnitude of change will be high.

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

13.4.55 At night, the lighting at Capper's Lane main compound and the satellite compounds off Capper's Lane will be intrusive within the largely unlit context. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 352.2.001: View north-west from Brook House and Mill Farm on Capper's Lane

13.4.56 Satellite compounds will be close to the properties, and earthworks and construction operations for Capper's Lane viaduct and approach embankments will be visible in the middle ground of the view. Views will be partly screened by the construction activities, and will extend north-west along Capper's Lane towards the formation of embankments for Capper's Lane canal overbridge. Cappers Lane viaduct (west) satellite compound will be visible in the middle ground, west of the AP2 revised scheme. The magnitude of change will be high.

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

13.4.58 At night, the lighting at the satellite compounds associated with the Capper's Lane viaduct will be intrusive within the largely unlit context. There will also be partially filtered, background views of lighting at Capper's Lane viaduct (west) compound. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 352.2.002: View north-west from Huddlesford junction near canalside property

13.4.59 The construction of the AP2 revised scheme will be visible in the middle ground, between and beyond mature trees along the Wyrley and Essington Canal and Broad Lane. The removal of field boundary vegetation, the WCML overbridge (south) satellite compound and construction activities for the cutting north of Capper's Lane and the WCML overbridge will be visible in the middle ground. The magnitude of change will be high.

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

Viewpoints 352.2.003 and 352.3.006: View north-west from Broad Lane near Barn Cottage and west from Coventry Canal near Huddlesford Bridge

13.4.61 Visual impacts during construction will include the removal of field boundaries and the use of fields for construction works, west of the AP2 revised scheme up to the SSL/A38 in the foreground and middle ground. The upper elements of satellite compounds for works associated with the WCML overbridge will also be visible in the middle ground. West of the WCML, land occupied by a roadhead and material transfer stockpiles will be visible in the middle ground, seen beyond the construction of a deep cutting from south of the WCML northwards, with construction activities and plant movements. Therefore, the magnitude of change will be high.

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

Viewpoint 353.2.005: View east from The Manor House adjoining the A38

13.4.63 From this location, construction activities for the northern section of the Streethay retained cutting emerging from beneath the A38/ SSL and the cutting to the north will dominate the foreground. One residential property at Field Cottage, Burton Road will be demolished and a roadhead, haul routes and the A38 overbridge (north-west) satellite compound will be nearby. Although the A38 on an existing embankment is close to the viewpoint, the proximity of the AP2 revised scheme and the absence of screening by vegetation will result in a high magnitude of change.

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

13.4.65 At night lighting of the several satellite compounds close to Streethay retained cutting will be visible in the foreground, partially obscured by intervening vegetation. Whilst this lighting will be apparent in a previously unlit location, it will be viewed in the context of the extensive area of skyglow in the middle and background of the view and the presence of lighting from vehicles on the A38. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 353.3.001: View north-east from the PRoW (junction between Footpath Streethay 3 and Streethay 2) near Streethay House Farm

13.4.66 Construction activity associated with the northern extent of Streethay retained cutting, north of the A38, will occupy the middle ground of this view, crossing gently rising land towards Fradley Business Park. Changes to the view will include plant movements on haul routes and the realignment of Mare Brook. The depth of the cutting and the change to the extent of view will result in a high magnitude of change.

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

Viewpoint 353.3.003: View east from the PRoW Streethay Footpath 1 near to the existing WCML

13.4.68 The construction of the AP2 revised scheme will be approximately 1.2km away, north of the A38/ SSL overbridge crossing rising land in the middle ground from at-grade to low embankment. Due to the distance from the viewpoint, and the prominence of Fradley Business Park in the existing view, the magnitude of change will be medium.

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

Viewpoint 353.2.008: View east from residences along Burton Old Road, Streethay

13.4.70 The presence of intervening vegetation in garden boundaries and on the embankments of the A38 will largely screen views to the upper elements of construction operations associated with Streethay retained cutting in the middle ground, and of works within the roadheads east of the A38. The magnitude of change will be low.

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

Viewpoint 353.3.007: View east from PRoW Streethay Footpath 6 adjacent to Hill Farm

13.4.72 From this viewpoint, the construction of the AP2 revised scheme will be visible in a deep, retained cutting north of the WCML overbridge on the approach to the SSL/ A38. The A38 southbound roadhead 2 will be visible in the foreground, with construction works including an overbridge to accommodate both a realigned footpath and farm vehicles in the middle ground. The magnitude of change will be high.

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

Viewpoint 354.2.001: View west from Streethay Farm adjacent to the A38, Streethay

13.4.74 Commercial buildings and vegetation close to the viewpoint will restrict the availability and extent of views, with tall roadside trees and vegetation north of the A38 largely screening the visibility of taller construction elements of the Streethay retained cutting emerging north of the trunk road, in the background. The depth of the construction works for the AP2 revised scheme cutting beneath A38/SSL and works for the temporary diversion of the A38 will alter existing views, resulting in a medium magnitude of change.

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

13.4.76 At night, the upper elements of lighting within the several A38 and SSL overbridge satellite compounds close to the Streethay retained cutting will be visible in middle ground, though partially obscured by intervening vegetation or nearby buildings.

Whilst this lighting will be apparent in a previously unlit location, it will be viewed in the context of the skyglow in the middle and background of the view and of lighting from vehicles on the A38. Therefore, the magnitude of change to this receptor at night is considered to be low, resulting in a moderate adverse effect.

Viewpoint 354.3.006: View west from King's Orchard Marina, adjacent to Coventry Canal

13.4.77 Construction activities will include Streethay retained cutting north of the WCML overbridge and south of the SSL/ A38 overbridge. Beyond the cutting, the A38 southbound roadhead will be visible in the middle ground, with the construction of an overbridge accommodating farm traffic and Streethay Footpath 6 diversion also visible. The magnitude of change is considered to be high.

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

Viewpoint 354.6.003: View north-west from Streethay Wharf adjacent to the Coventry Canal south of the A38

13.4.79 Construction activities within this view will include the upper elements of construction plant along the route of the AP2 revised scheme in the background as the route emerges north of the SSL/ A38 in overbridge in deep cutting. The magnitude of change will be low.

13.4.80 The low magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a minor adverse (non-significant) effect.

Viewpoint 355.3.003: View east from the PRoW Streethay Footpath 7, to the east of Curborough House

13.4.81 The AP2 revised scheme will lie approximately 500m east of this viewpoint and will be constructed on low embankment, west of Fradley Business Park, as the alignment of the Manchester spur begins to diverge from that of the Handsacre link, seen across rising land in the middle ground. The removal of field boundaries and haul routes, construction plant and temporary earthworks stockpiles will be visible, together with works for a balancing pond and access track. The magnitude of change will be high.

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

Viewpoint 356.2.007: View west from Orchard Farm (situated to the north of the A38)

13.4.83 Construction activities will lie approximately 400m west of this viewpoint and will be visible in the middle ground, with the AP2 revised scheme emerging from deep cutting north of the A38. Existing agricultural views beyond the route will be partially screened by the construction activity, though taller buildings on the edge of Lichfield will remain visible in the background. The magnitude of change will be high.

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

Viewpoint 356.2.008: View west from Bears Hay Farm, south of the Coventry Canal and close to the A38

13.4.85 Construction activities will lie approximately 600m-800m west of this viewpoint. Taller construction elements and plant will be visible in the middle and background for the construction of the AP2 revised scheme in Streethay retained cutting, seen between and over intervening vegetation. The magnitude of change will be low.

13.4.86 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a minor adverse (non-significant) effect.

Viewpoints 356.6.001, 356.4.005, 356.3.006, 358.6.004 and 356.6.009: Views west from Nanscawen Road in South Fradley, from junction of Wood End Lane with Nanscawen Road, from Alrewas Footpath 31, at Wood End Lane, from Depot adjoining Wood End Lane and from future receptor at Prologis Park Business Units

13.4.87 Construction activities will lie approximately 270m to 470m west of these viewpoints, and will cross the view on a low embankment, west of Fradley Business Park, as the alignment of the Manchester spur begins to diverge from that of the Handsacre link. Construction plant and earthworks will dominate the middle ground, screening background views to Lichfield and the Cathedral spires in a rural setting. The magnitude of change will be high.

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

Viewpoint 356.4.004: View south-west from Hilliard's Cross bridge (A38 flyover)

13.4.89 The panorama from this elevated viewpoint will include the removal of vegetation across the middle ground, with the AP2 revised scheme constructed in cutting between the WCML and north of the SSL/ A38. The taller elements of construction plant will be visible, across a broad arc of view, however the depth of the cutting will limit the visibility of construction works, resulting in a low magnitude of change.

13.4.90 The low magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a minor adverse (non-significant) effect.

Viewpoint 357.2.001: View north-east from Highfields Bungalow

13.4.91 The construction of the AP2 revised scheme will be visible across the middle ground of the view on low embankment at the commencement of the divergence between the Manchester spur and Handsacre link, skirting gently rising land west of Fradley Business Park. The removal of woodland in Little Lyntus will be noticeable, although some construction plant and movements will be partially screened by intervening field boundary hedgerows. Curborough dive-under satellite compound will be prominent in the middle ground. Taller elements of plant involved in the construction of the Manchester spur will be visible beyond the route of the Handsacre linklink, screening views to the lower edge of Fradley Business Park in the background. The magnitude of change will be high.

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

Viewpoints 357.2.002, 357.2.003 and 357.3.004: View east from Curborough House, and north-east from Curborough Farm and PRoW Streethay Footpath 4, near Little Curborough

13.4.93 Views from these locations will be characterised by construction plant across the middle ground, at the start of the divergence between the Handsacre link and the Manchester spur on embankments of increasing heights crossing the gently rising land west of Fradley Business Park. The removal of woodland at Little Lyntus will be visible; however, due to the intervening vegetation the magnitude of change will be medium.

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

Viewpoint 358.2.003: View west from Gorse Farm, Gorse Lane

13.4.95 Construction activities will be visible in the middle ground for the Manchester spur on embankment and for the realignment of Wood End Lane via an underbridge, partially screening the construction of the Handsacre link further west. The lower sections of construction plant and plant movements will be partially screened by property boundary vegetation and intervening vegetation at Fradley Wood, and also by buildings in Fradley Business Park. The magnitude of change will be medium.

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

Viewpoint 358.4.005: View west from Wood End Lane junction with Gorse Lane

13.4.97 Construction works at the commencement of the divergence between the Manchester spur and the Handsacre link will be visible in the foreground and middle ground on embankments of varying heights. The upper elements of the Curborough dive-under satellite compound will be visible between the alignments of both routes. Due to the proximity of the construction works, the magnitude of change will be high.

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

Viewpoint 359.3.001: View south-west from the PRoW Alrewas Footpath 0.256, near Fradley Wood

13.4.99 From this viewpoint, construction plant and plant movements for the Manchester spur at the point of divergence from the Handsacre link will be on embankment across a broad arc in the middle ground between buildings in Fradley Business Park. Changes to the view will include the removal of field boundary vegetation along the route, crossing gently sloping land, including mature trees in Little Lyntus wood. The realignment of Wood End Lane via an underbridge beneath the Manchester spur will also be visible. The magnitude of change will be high.

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

Viewpoint 359.3.002: View south-west from the PRoW Alrewas Footpath 44 at its junction with Alrewas Footpath 0.252 and 0.256, near Fradley Junction

13.4.101 Views from this location will be along a narrow well-wooded canal corridor to the removal of woodland for the construction of the Manchester spur on embankment and viaduct across the Trent and Mersey Canal, in the middle ground. Although the existing canalside woods will restrict the visibility of the construction of the embankments north and south of the canal, the magnitude of change will be high.

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

Viewpoint 360.3.001: View north-east from the Trent and Mersey Canal, close to Wood End Lock Cottage

13.4.103 The construction of the terminal embankment of the Manchester spur will be partially visible on the extreme right hand of the view, approximately 450m from the viewpoint, seen through and beyond trees and woodland lining the canal and along Curborough Brook. The magnitude of change will be low.

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

Viewpoints 360.2.002 and 360.4.006: View north-east from Wood End Farm/The Cottage, Wood End Lane and north and east from Wood End Lane near Ravenshaw Wood

13.4.105 Construction activities for the Handsacre link will lie adjacent to viewpoint 360.2.002 and approximately 200m north-east of viewpoint 360.4.006. The removal of field boundary hedgerows, canalside trees and part of Ravenshaw wood will be visible in the foreground and middle ground, together with the construction of the embankments and overbridge for the Wood End Lane realignment. Hedgerows on the existing alignment of Wood End Lane will provide some limited screening in the foreground. The magnitude of change will be high.

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

Viewpoint 360.3.007: View north-east from PRoW Alrewas Footpath 44, on Wood End Lane, adjacent to the Trent and Mersey Canal

13.4.107 The construction of the Handsacre link and works at the Curborough Brook viaduct and satellite compound will be visible in the foreground, with the realignment of a section of Wood End Lane beyond, immediately to the east. In the middle ground, the construction of the Manchester spur will be visible on embankment on the approach to the Trent and Mersey viaduct crossing. Areas of canalside trees and other vegetation in the foreground and middle ground will be removed. The magnitude of change will be high.

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

Viewpoint 361.2.002: View south-west from Cranberry residence near Fradley Junction

13.4.109 Construction activities for the Manchester spur across the Trent and Mersey Canal on viaduct and for the embankment at the limit of Phase One railway works will be visible in the foreground. Changes to the view will include the removal of part of Brokendown Wood, of vegetation along a section of Curborough Brook and along part of the canal. Views of construction works for the realignment of a section of Wood End Lane and for the Handsacre link, both immediately west of the canal corridor, together with the Wood End Lane overbridge in the background, will be largely screened by vegetation along the brook. The height of the viaduct and embankment and proximity to the viewpoint will result in a high magnitude of change.

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

Viewpoint 361.3.003: View south-west from the PRoW Alrewas Footpath 44, adjoining Trent and Mersey Canal

13.4.111 Visible in the foreground will be the removal of trees north of the canal, within Brokendown Wood, and of vegetation on both sides of the canal for the construction of the Manchester spur viaduct across the canal and the embankments to the north and south. The construction of the Handsacre link will be visible beyond the Manchester spur works, in the background of the view. The open views along the canal and the proximity and height of the viaduct and embankments will result in a high magnitude of change.

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

Viewpoint 362.2.001: View north from Black Slough Farm on Wood End Lane

13.4.113 Construction activities for the Handsacre link at grade will be visible in the foreground, approximately 100m to the north and east. Construction works for the realignment of Wood End Lane will be visible. The removal of trees within Ravenshaw Wood and sections of field hedgerows in the middle ground will also be visible. The magnitude of change will be high.

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

Viewpoints 362.3.002 and 362.2.003: View north from PRoW Kings Bromley Footpath 0.392, near Tomhay Wood and east from residence (Birch Ridings) on Wood End Lane near Vicar's Coppice

13.4.115 Construction activity will lie approximately 200m from these viewpoints located west of the route. Visual changes will include the removal of some sections of hedgerow and trees within Ravenshaw Wood and Black Slough in the middle ground, and the

presence of construction plant for the Handsacre link west of the Trent and Mersey Canal. The magnitude of change will be high.

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

Viewpoint 363.2.001: View south-east from Wood End Common Barn

13.4.117 Construction activity for the Handsacre link and the realignment of Wood End Lane on overbridge will be approximately 700m-800m west of this viewpoint in the background of the view, beyond intervening areas of canalside vegetation and trees in Ravenshaw Wood. The construction of the termination of the Manchester spur, on embankment north of the canal, will be partially visible in the background, seen through intervening woodland along Curborough Brook. The magnitude of change will be low.

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

Viewpoint 364.2.001: View north-east from Hanch Hall Farm adjoining B5014 Lichfield Road, Handsacre

13.4.119 Construction activity for the Handsacre link on embankment on the approach to Harvey's Rough flyover at the tie-in with the WCML will be visible in the middle ground, as will works to an overhead power line. The view will include the Handsacre main compound for WCML modification works and taller elements of works at Bourne Brook viaduct and the embankment to the north. Although the WCML, its overhead line equipment and train movements are already visible in the middle ground, the proximity of the works for the AP2 revised scheme and elevation of the Handsacre linklink will result in the magnitude of change being medium.

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

13.4.121 At night, the lighting of the Handsacre (A515) main compound (rail systems) will be visible in the middle ground of the view in a landscape which is, at present, generally unlit. There will also be some oblique views to the Harvey's Rough flyover satellite compound and Shaw Lane satellite compound seen in the middle ground. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 364.2.002: View north and north-east from 'The Elms' on Shaw Lane, close to the junction with the B5014 Lichfield Road, Handsacre

13.4.122 The upper elements of construction plant and movements within Harvey's Rough satellite compound/ Shaw Lane satellite compound (for WCML modification works) will be visible in the middle ground, with views of construction activity for Harvey's Rough flyover at the tie-in with the WCML visible in the background, over and beyond intervening horticultural structures (polytunnels) and partially screened by intervening garden and roadside vegetation. Despite the presence of the WCML the magnitude of change will be high.

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

Viewpoint 364.4.008: View north from the WCML overbridge on the A515 Lichfield Road

13.4.124 To the far left of the view the A515 Lichfield Road satellite compound and haul routes immediately east of the WCML will be visible in the foreground, with the WCML tie-in and the Harvey's Rough/Shaw Lane satellite compound (rail systems) for WCML modification works seen in the middle ground. Intervening hedgerows and small woods north and south of Bourne Brook will screen lower level elements of the construction of Bourne Brook viaduct and the embankment to the north, in the middle ground. Views beyond Bourne Brook viaduct to A515 Lichfield Road underbridge main compound in the background will be limited by intervening vegetation. The magnitude of change will be high.

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

Viewpoint 365.2.001: View south from Wharf Farm, off the A515 Lichfield Road

13.4.126 Construction activities will lie approximately 600m south of this viewpoint. The construction of the route on embankment between Ravenshaw Wood, and the temporary diversion and overbridge for the A515, and the A515 Lichfield Road main compound will be visible in the middle ground. The elevated nature of the route above low-level screening vegetation will result in a high magnitude of change.

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

Viewpoint 365.2.004: View south-west from Tuppenhurst Lane near Shaw Lane Farm and Shaw House

13.4.128 The middle ground of this view will be dominated by construction works for the embankment and flyover at Harvey's Rough, on the approach to and tie-in with the WCML. Also visible, in the foreground, will be areas for the temporary storage of material south of Shaw Lane. Although garden hedgerows and outbuildings will provide some screening, the close proximity of construction works will result in a high magnitude of change.

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

Viewpoint 365.3.002: View south-west from Kings Bromley Marina, off A515 Lichfield Road

13.4.130 Views from this location will be characterised by construction works for the A515 Lichfield Road underbridge and the embankments to the north and south visible across a wide arc of the middle ground. Construction plant on haul routes across the middle ground will be partially screened by intervening field and roadside hedgerows. Taller elements of the construction of Bourne Brook viaduct and the embankments to

the north and south will be visible in the background. The magnitude of change will be high.

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

Viewpoint 365.4.005: View south-west from the A515 Lichfield Road

13.4.132 Construction works in this view will include the AP2 revised scheme on embankment in the middle ground, including works for the A515 Lichfield Road underbridge, together with the construction of Bourne Brook viaduct and the embankments to the north and south. The temporary diversion of the A515 Lichfield Road and the construction of an extension to Tuppenhurst Lane will be visible in the foreground and middleground, together with the A515 Lichfield Road underbridge main compound. The proximity to and visibility of the construction works in the foreground and middle ground will result in a high magnitude of change.

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

Viewpoint 366.2.001: View north-east from 'Newtown' located on the B5014 Lichfield Road, Handsacre

13.4.134 Construction activities will lie approximately 250m north-east of this viewpoint. The upper elements of the construction of the WCML tie-in on flyover at Harvey's Rough viaduct and two rail systems satellite compounds for gantry installations as part of the WCML modification works will be visible in the middle ground. Intervening garden vegetation and roadside and field hedgerows will screen views of lower elements of the construction works. Therefore, the magnitude of change will be medium.

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

13.4.136 At night, the night working associated with the WCML tie-in and for the rail systems gantry installation works will be visible in the middle ground of the view, although partially filtered by existing vegetation along B5014 Lichfield Road, Handsacre. As this will be within a largely unlit area, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoints 366.2.002 and 366.3.008: north-east from Barn Farm (north-east of Longdon Green) and PRoW Longdon 0.394, close to Barn Farm

13.4.137 From these viewpoints, taller elements of the AP2 revised scheme for the construction of the tie-in to the existing WCML will be in the middle ground, seen against rising land in the background. As these will form minor components within a wide panorama, filtered by intervening vegetation, the magnitude of change will be low.

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

Viewpoint 366.2.003: View north-east from Hill Top Farm adjacent to the PRoW Longdon 29

13.4.139 Construction activities associated with the WCML tie-in and at Harvey's Rough flyover will be visible in the middle ground approximately 1km from this elevated viewpoint. Due to intervening field hedgerows and vegetation these views will be partially screened, resulting in a medium magnitude of change.

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

Viewpoint 366.2.007: View north-east from residences adjoining Hanch Hall, B5014 Lichfield Road, Handsacre

13.4.141 Visual changes to the middle ground view will include the upper elements of construction associated with the WCML tie-in, the embankments and flyover at Harvey's Rough, the Harvey's Rough flyover satellite compound and Shaw Lane satellite compound in the middle ground. Intervening garden and field boundaries and horticultural polytunnels will screen the visibility of lower construction elements. Due to distance and the intervening vegetation, the magnitude of change will be medium.

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

Viewpoint 367.2.001: View south-west from Ashton Hays Farm/Ashton Hays, off Tuppenhurst Lane

13.4.143 Foreground views from this location will be dominated by the immediately adjacent construction activities at the WCML tie-in. Rail systems crane platforms for gantry installations as part of the WCML modification works will be visible in the foreground, east of the WCML and AP2 revised scheme corridor. Despite the viewpoint's location next to the WCML, the close proximity of construction and the elevation of the route will result in a high magnitude of change.

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

13.4.145 At night, the night working associated with the WCML tie-in will be visible in the foreground within a largely unlit landscape. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 367.2.005: View south-west from Shaw Barn, Shaw Lane

13.4.146 The construction for the WCML tie-in and the flyover and embankments at Harvey's Rough will be visible in the middle ground seen against the WCML, overhead line equipment and train movements. The view across arable land will be partially filtered by intervening field boundaries; however, the magnitude of change will be high.

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

Viewpoint 367.4.003: View south-west from Tuppenhurst Lane near Shaw House

13.4.148 Construction works for Harvey's Rough flyover, the embankments to north and south, and for the tie-in with the WCML will dominate the foreground of the view. On the left of the view, Harvey's Rough flyover satellite compound/ Shaw Lane satellite compound on Shaw Lane will be visible, west of the WCML. Although the construction works for the route will ultimately screen some existing foreground views of the WCML, the proximity and elevation of the route will result in a high magnitude of change.

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

Viewpoint 368.2.001: View south-east from residences located along Chestnut Close, Handsacre

13.4.150 Taller elements of construction plant will be visible to both east and west of the WCML in the foreground and middle ground, for works associated with the WCML tie-in. Temporary crane platforms associated with the WCML modification works will be visible in the foreground, west of the WCML. Due to the proximity and elevation of the AP2 revised scheme, the magnitude of change will be high.

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

Viewpoint 369.2.001: View south from residences on Bridge Road, Handsacre

13.4.152 In the foreground and middle ground, the construction of a permanent access from Bridge Road to the eastern side of the WCML will be visible. The HS2 route works will also be visible at the tie-in with the WCML, extending towards Harvey's Rough viaduct in the middle ground together with a temporary crane platform associated with the WCML modification works. Taller elements of the northern extent of Harvey's Rough embankment will be visible in the background of the view beyond intervening vegetation. The magnitude of change will be high.

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

Cumulative effects

13.4.154 Section 6.1 and SES and AP2 ES, Volume 5: Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the AP2 revised scheme. These are termed 'committed developments' and will form part of the baseline for the construction of the AP2 revised scheme. The consequential cumulative effect of these developments on LCAs and viewpoints is described below.

13.4.155 The developments are shown on SES and AP2 ES, Volume 5: Map Books — Cross topic, maps CT-13-061 to CT-13-065.

13.4.156 The following developments are likely to be under construction at the same time as the AP2 revised scheme, with the potential for consequential cumulative effects on LCAs and visual receptors. Effects will occur due to the combined scale of access and construction operations:

- land north of Burton Road and north-east of the WCML, Streethay, Lichfield, Staffordshire: construction of a sustainable mixed-use urban extension, comprising of up to 750 dwellings; a primary school; mixed-use community hub/local centre to include retail development and community buildings, a care home (C2 Use Class); comprehensive green infrastructure, with footpaths cycleways and open space; and
- land at Fradley Park, Halifax Avenue, Fradley, Lichfield, Staffordshire: demolition of existing buildings and redevelopment of the site to provide up to 750 new homes, primary school, health centre, nursery, public house, public and private open space, car and cycle parking together with landscaping and associated servicing.

Cumulative landscape effects

13.4.157 The effects of the AP2 revised scheme on the Settled Farmlands LCA is assessed as moderate adverse for construction (a high magnitude of change to an LCA with a medium sensitivity to change). The combination of the construction of the AP2 revised scheme occurring at the same time as the construction of the mixed-use development at Streethay will also result in a high magnitude of change. Therefore, the cumulative effect to this LCA of both sets of construction activities occurring at the same time would also be moderate adverse.

Cumulative visual effects

13.4.158 Viewpoint 353.3.003: view east from PRoW Streethay Footpath 1 near to the existing WCML would experience cumulative effects, should the construction of the AP2 revised scheme be concurrent with the construction of the mixed-use development at Streethay. The construction effects on this viewpoint as a result of the AP2 revised scheme are assessed to be moderate adverse (a medium magnitude of change, assessed alongside the high sensitivity of the receptor). However, the cumulative construction effects of the AP2 revised scheme with those for the construction of the mixed-use urban extension at Streethay would result in the effects on this viewpoint being major adverse for construction (a high magnitude of change, assessed alongside the high sensitivity of the receptor).

Other mitigation measures

13.4.159 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 phase. This may include consideration of early planting in ecological migrations 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 temporary significant effects

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

13.5 Effects arising during operation

13.5.1 The specific elements of the AP2 revised scheme that have been taken into account in determining the effects on landscape and visual receptors include:

- construction of a cutting north of the A51 Tamworth Road at Whittington Heath Golf Club;
- Darnford Lane overbridge;
- Whittington Heath and Huddlesford embankments;
- Capper's Lane viaduct and embankment;
- Wyrley and Essington Canal realignment;
- Capper's Lane realignment, including bridges over the Wyrley and Essington Canal and the HS2 route;
- WCML overbridge;
- Streethay cutting;
- Streethay Footpath 6 accommodation overbridge;
- SSL overbridge;
- A38 overbridge and Curborough embankment, realignment of Wood End Lane, including Wood End Lane underbridge, overbridge and a bridge over Curborough Brook;
- Manchester spur viaduct crossing the Trent and Mersey Canal;
- Handsacre link west of the Trent and Mersey Canal;
- Lichfield Road underbridge;
- Bourne Brook viaduct;
- extension of Tuppenhurst Lane, between Shaw Lane and the A515 Lichfield Road;
- Shaw Lane embankment;
- WCML tie-in at Handsacre junction; and
- realignment and reconfiguration of overhead electricity transmission lines, including new electricity pylons.

Avoidance and mitigation measures

13.5.2 The operational assessment of impacts and effects is based on year 1 (2026), year 15 (2041) and year 60 (2086) of the AP2 revised scheme. A process of iterative design and assessment has been employed to avoid or reduce adverse effects during the operation of the AP2 revised scheme. Measures that have been incorporated into the design of the AP2 revised scheme include:

- the development of the AP2 revised scheme between Whittington and Handsacre to run in cutting to the east of Lichfield, enabling the HS2 route to pass beneath the WCML, the SSL and the A38;
- the development of the scheme to limit potential effects on the Trent and Mersey Canal, with the Handsacre link passing west of the canal, and one crossing of the canal corridor by the Manchester spur;
- the adoption of a green infrastructure approach to the design of the landscape environment within the AP2 revised scheme to ensure the creation of a well-connected landscape that helps to alleviate flooding, and benefit biodiversity and recreation;
- the design of embankment and cuttings, both for the route of the AP2 revised scheme and highway realignments, so as to integrate the AP2 revised scheme into the character of the surrounding landscape;
- where it was considered that a noise fence barrier will create a visual impact on neighbouring residences, where reasonably practicable, a landscape bund has been provided;
- planting, including native broad-leaved woodland, shrubs and hedgerows, to screen the new railway and associated roads from neighbouring residences and users of adjacent PRoW, and to aid integration of the AP2 revised scheme into the landscape; and
- selection of species will reflect tree and shrub species native to the area and take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases.

13.5.3 Specific design measures to aid in integrating the AP2 revised scheme within the landscape include:

- ecological mitigation/compensation areas in three main locations: between Mare Brook south and Alrewas Footpath 31; within the Wood End Lane realignment; and between the Trent and Mersey Canal to the WCML junction in Handsacre; and
- substantial areas of new planting, between Whittington Heath Golf Club and Broad Lane, at Streethay, near the A38, at Fradley, near the Trent and Mersey viaduct and canal Conservation Area, at Ravenshaw Wood and Black Slough and on the north side of Shaw Lane.

13.5.4 These measures have been taken account of in the assessment of the operational effects below.

Assessment of impacts and effects

13.5.5 The likely significant effects on landscape character and viewpoints in operation will arise from new engineered embankments and cuttings across the existing landscape; the introduction of new viaducts with associated infrastructure; the introduction of noise fence barriers that will create a man-made linear feature; permanent severance of land; the introduction of highway infrastructure into the rural environment, including road bridges and road realignments; the introduction of overhead line equipment; and the introduction of regular high speed trains. At a number of locations, views of the AP2 revised scheme will be almost entirely obscured by existing and retained roadside vegetation. Furthermore, in most cases, effects will reduce over time as planting established as part of the AP2 revised scheme matures.

Landscape assessment

13.5.6 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 the main ES Volume 5: Appendix LV-001-022 Part 4.

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

Sandstone Outer Estatelands LCA

13.5.8 The AP2 revised scheme will cross the Sandstone Outer Estatelands LCA from Whittington Heath Golf Club to the route of the existing WCML close to Huddlesford. Apart from a short section in shallow cutting at the A51 realignment and at Darnford Lane, and a deepening of the cutting on the approach to the WCML overbridge, the route will be largely on embankment. Landscape effects of the AP2 revised scheme will include:

- engineered landforms of steep and graded out embankment slopes cutting across the natural landform, appearing incongruous in the adjacent landscape context;
- introduction of a viaduct at Capper's Lane spanning a realigned section of the Wyrley and Essington Canal;
- the realignment of Capper's Lane to cross the proposed route on overbridge;
- the realignment of an unnamed watercourse;
- introduction of overhead line equipment and trains visible on embankment and viaduct, which although both are already present on the WCML, will be at odds with the predominantly rural context; and
- agricultural land either side of the AP2 revised scheme will be reinstated and returned to agricultural use but there will be permanent severance of land, requiring access via either overbridges or underpasses.

13.5.9 The presence of high speed trains will result in noise and visual interruption which will reduce tranquillity locally within the predominantly rural area.

13.5.10 The AP2 revised scheme will result in the severance of the valued heathland at Whittington. It will also alter the character of the low-lying rural landscape at Capper's Lane, where the AP2 revised scheme will be prominent, requiring a realignment of the Wyrley and Essington Canal and an unnamed watercourse, a stopping up of Capper's Lane and a new alignment of a section of Capper's Lane including an overbridge across the AP2 revised scheme. Therefore, the magnitude of change is considered to be medium in year 1 of operation.

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

13.5.12 By year 15 of operation, planting will have established sufficiently to begin to deliver greater integration of the AP2 revised scheme into the rural landscape, including through:

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

13.5.13 However, due to the continued influence of the viaduct and overbridges, which will remain prominent landscape features, and the changes to the tranquillity of the area, the magnitude of change will continue to be medium in year 15 of operation.

13.5.14 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 15 of operation unchanged from year 1.

13.5.15 By year 60 of operation, the maturity of planting will further integrate the AP2 revised scheme into the landscape; reducing the effects of the viaducts on local landscape character and resulting in effects becoming minor adverse (non-significant).

Settled Farmlands LCA

13.5.16 The AP2 revised scheme will pass through the Settled Farmlands LCA from where the scheme crosses the existing WCML close to Huddlesford, to Wood End Lane at Fradley. Landscape effects of the AP2 revised scheme will include:

- engineered landforms of deep cuttings and graded out embankment slopes crossing the floodplain and valley sides, incongruous in the local landscape;
- introduction of overhead line equipment and trains visible on embankments, viaducts and above shallow cuttings. Although the adjacent WCML is visible, the AP2 revised scheme will add further infrastructure into the local context; and
- agricultural land either side of the AP2 revised scheme will be reinstated and returned to agricultural use, but there will be permanent severance of land, requiring access via either overbridges or underpasses or watercourse realignments.

13.5.17 The presence of high speed trains will result in noise and visual interruption which will reduce tranquillity locally within the predominantly rural area, despite the existing urbanising influence of traffic on the A38 dual carriageway, the presence of national (WCML) and local rail lines (SSL) and Fradley Business Park.

13.5.18 The AP2 revised scheme will result in the loss and fragmentation of woodlands and hedgerows, and will erode into and increase the urbanisation of the narrow rural wedge separating Lichfield and Fradley, affecting local landscape character. Therefore, the magnitude of change is considered to be medium.

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

13.5.20 By year 15 of operation, planting will have established sufficiently to achieve greater landscape integration of the scheme into the rural landscape, including through:

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

13.5.21 However, due to the continued influence of the HS2 route as a prominent linear feature crossing the local landscape, of the southern commencement of the divergence between the Handsacre link and the Manchester spur, and the changes to the tranquillity of the area, the magnitude of change will continue to be medium in year 15 of operation. The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 15 of operation.

13.5.22 By year 60 of operation, the maturity of planting will further integrate the AP2 revised scheme into the landscape resulting in impacts on local landscape character becoming minor adverse (non-significant).

Settled Heathlands LCA

13.5.23 The AP2 revised scheme will cross the Settled Heathlands LCA from Wood End Lane at Fradley to north of Ashton Hays Farm. Landscape effects of the AP2 revised scheme will include:

- engineered landforms of steep and graded-out embankment slopes cutting across the natural landform, appearing incongruous in the adjacent landscape context;
- introduction of a dive-under at Curborough to provide a crossing of the Handsacre link by the Manchester spur;
- introduction of a viaduct crossing the Trent and Mersey Canal for the Manchester spur. This structure will cut across the canalside Conservation Area, which is a key component of this LCA;
- the location of the Handsacre link immediately west of the Trent and Mersey Canal, at-grade and close to a bend in the canal Conservation Area. The AP2 revised scheme will be separated from the canal by a realigned section of Wood End Lane, with the lane crossing Handsacre link on overbridge;
- a new access to Wood End Lock and Cottage from the realigned section of Wood End Lane;
- introduction of overhead line equipment and trains visible on embankment and viaducts, bringing noise and movement; and

- agricultural land either side of the AP2 revised scheme will be reinstated and returned to agricultural use but there will be permanent severance of land, requiring alternative access.

13.5.24 Vegetation lost during construction will change the local landscape context, particularly in the well-wooded canalside. The presence of high speed trains will result in noise and visual interruption which will affect the perception of tranquillity in the middle of the LCA and reduce tranquillity within a section of the Trent and Mersey Canal which is both a conservation area and a popular recreational resource. Though these changes will occur over a minor part of the LCA, they will have a significant impact on a characteristic area of particular value, resulting in a magnitude of change considered to be medium in year 1 of operation.

13.5.25 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.

13.5.26 By year 15 of operation, planting will have established sufficiently to achieve greater landscape integration of the scheme into the rural landscape, including through:

- reducing the influence of engineered landforms; and
- partially screening overhead line equipment, noise fence barriers and trains on embankments.

13.5.27 However, the Manchester spur viaduct crossing the Trent and Mersey Canal, the realignment of a section of Wood End Lane to run immediately next to the canal and the location of the Handsacre linklink west of the canal will continue to strongly influence the character of the canalside landscape. As a result of this, and the changes to the tranquillity of the area, the magnitude of change will remain as medium in year 15 of operation.

13.5.28 By year 60 of operation, the maturity of planting will further integrate the AP2 revised scheme into the landscape resulting in effects becoming minor adverse (non-significant).

Visual assessment

13.5.29 This section describes the significant effects on visual receptors during year 1, year 15 and year 60 of operation.

13.5.30 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.

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

13.5.32 The number identifies the viewpoint locations which are shown in the main ES and SES and AP2 ES Volume 5: Map Book - Landscape and visual assessment, Maps LV-

04-092b to LV-04-097. In each case, the middle number (xxx.X.xxx) identifies the type of receptor that is present in this area - 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and Healthcare, 6: Employment and 7: Active Sports.

13.5.33 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 347.2.002: View north-east from South Lodge, on the A51 Tamworth Road

13.5.34 The AP2 revised scheme will be visible in the foreground emerging from shallow cutting onto low embankment crossing the golf course. Views across the A51 Tamworth Road to the route will be filtered by intervening golf course vegetation. A new access track west of the route will be visible, next to the A51 overbridge. There will be views from the side of the residential property along the rebuilt section of the A51 Tamworth Road over the new overbridge in the foreground and middle ground. Therefore, the magnitude of change is considered to be high.

13.5.35 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.

13.5.36 In the summer of year 1 of operation, the proposed planting will have yet to mature and effects will remain major adverse.

13.5.37 By year 15 of operation, proposed planting on the rebuilt A51Tamworth Road and to the west of the route will be established, screening lower level views of overhead line equipment and train movements in the foreground. Therefore, the magnitude of change will be medium, giving rise to a moderate adverse effect in the summer of year 15 of operation.

13.5.38 By year 60 of operation, the further growth and maturity of the proposed planting will substantially screen the AP2 revised scheme, reducing effects on this viewpoint to minor adverse (non-significant).

Viewpoint 347.4.007: View north-east from Lichfield Road, Whittington

13.5.39 The AP2 revised scheme will be visible on embankments and environmental mounding in the middle ground and background between Lichfield Road, Whittington and Capper's Lane viaduct including Darnford Lane overbridge. Though views will be partially obstructed by intervening field boundary vegetation, the upper elements of overhead line equipment and train movements and traffic on Darnford Lane overbridge will be visible. Therefore, the magnitude of change will be medium.

13.5.40 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.

13.5.41 In the summer of year 1 of operation, whilst the intervening hedgerows will provide some additional screening, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

13.5.42 By year 15, planting on embankments will be established, largely screening overhead line equipment and train movements visible in the middle and background, and reducing effects to minor adverse (non-significant).

13.5.43 By year 60 of operation, these effects will further reduce to negligible (non-significant).

Viewpoint 348.2.002 and 348.3.003: Views north-west from Thimble Hall Cottage and PRoW Whittington Footpath 17, Sandy Lane

13.5.44 The AP2 revised scheme on embankment with landscape earthworks, and noise fence barriers north and south of Lichfield Road, Whittington will be visible in the middle ground of this narrow arc of view, between Lichfield Road and the wooded curtilage of Ellfield House. Although these views will be partially screened by intervening field hedgerows and woodlands, overhead line equipment and passing trains will be visible. Therefore, the magnitude of change will be medium.

13.5.45 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.

13.5.46 In summer of year 1 of operation, whilst the intervening hedgerows will provide some additional screening, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

13.5.47 By year 15, planting growth on embankments will be maturing, substantially screening the AP2 revised scheme, reducing effects to minor adverse (non-significant).

13.5.48 These effects will further reduce to negligible (non-significant) by year 60.

Viewpoint 348.3.007: View north from PRoW Whittington Footpath 16 (crossing the playing course of Whittington Heath Golf Club)

13.5.49 From this viewpoint the AP2 revised scheme will emerge from shallow cutting, crossing Whittington Heath Golf Club on low embankment towards Lichfield Road, Whittington. Embankments, noise fence barriers, overhead line equipment and train movements will be visible in the foreground through the intervening golf course woodland. Security fencing will be visible where the footpath is parallel to the route. The magnitude of change will be high.

13.5.50 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.

13.5.51 In the summer of year 1 of operation, whilst the intervening golf course woodland will provide some additional screening, the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

13.5.52 By year 15 of operation, proposed planting on embankments will be established, screening lower elements of the overhead line equipment and train movements; however taller elements will remain prominent in the foreground. The magnitude of change is considered to be medium, resulting in a moderate adverse effect in the summer of year 15.

13.5.53 By year 60 of operation, the proposed planting will be mature; however, due to the proximity to the AP2 revised scheme, taller elements of overhead line equipment and train movements will continue to be visible in the foreground. Therefore, the

magnitude of change will continue to be medium, resulting in a moderate adverse effect.

Viewpoint 349.2.002: View east from the A51 Tamworth Road, near Jockey Rise

13.5.54 From this viewpoint, Darnford Lane overbridge will be visible in the middle ground above the AP2 revised scheme on embankment. Intervening hedgerows and trees will provide screening of the route in the middle ground, though the upper elements of overhead line equipment south of the overbridge will be visible. The magnitude of change is considered to be medium.

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

13.5.56 In the summer of year 1 of operation, whilst the intervening hedgerows will provide some additional screening, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.57 By year 15 of operation, planting established on embankments as part of the AP2 revised scheme will have matured, largely screening views of both trains and overhead line equipment. Therefore, the magnitude of change will be low, reducing effects to minor adverse (non-significant).

13.5.58 These effects will reduce further by operational year 60 to negligible (non-significant).

Viewpoint 349.2.004: View north-east from Marsh Farm

13.5.59 From this viewpoint, Darnford Lane overbridge will be visible in the middle ground over an embanked section of the AP2 revised scheme. Views of the upper elements of overhead line equipment and train movements will be visible on the route north towards Capper's Lane viaduct, seen between and beyond intervening hedgerows and trees. The magnitude of change is considered to be medium.

13.5.60 The medium 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.

13.5.61 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.62 By year 15 of operation, planting established on embankments as part of the AP2 revised scheme will have matured, largely screening views of the upper elements of overhead line equipment. Therefore, the magnitude of change will be low, reducing effects to minor adverse (non-significant).

13.5.63 By operational year 60, effects will reduce further to negligible (non-significant).

Viewpoint 349.2.005: View east from Whittington Hill Farm and Whittington Hill House off Darnford Lane

13.5.64 The landscape earthworks on the western side of the AP2 revised scheme, together with the western approach embankment to the overbridge in the middle ground will together screen the visibility of train movements and overhead line equipment.

However, due to the proximity of the viewpoint to the AP2 revised scheme, the magnitude of change is considered to be high.

13.5.65 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.

13.5.66 In the summer of year 1 of operation due to the low growth achieved by the proposed planting, effects will be unchanged.

13.5.67 By year 15 of operation, proposed planting will have established and matured sufficiently to provide some screening to Darnford Lane overbridge embankments and the landscape earthworks west of the HS2 route, reducing the magnitude of change to low, and resulting in a moderate adverse effect.

13.5.68 By year 60, the maturing of planting will further reduce the magnitude of change, resulting in a negligible (non-significant) effect.

Viewpoint 349.4.008: View north-east from Darnford Lane east of Lichfield

13.5.69 The AP2 revised scheme will be visible on viaduct at Capper's Lane in the middle ground, as a new element within the floodplain. Due to the removal of vegetation along the route within a broad valley, the structure, noise fence barriers, and upper elements of overhead line equipment will be visible although filtered by vegetation along intervening field boundaries. The magnitude of change is considered to be medium.

13.5.70 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.

13.5.71 In the summer of year 1 of operation, although the proposed planting will not be effective in providing screening, existing intervening hedgerows and trees will reduce the magnitude of change to low, resulting in effects being minor adverse (non-significant).

13.5.72 By year 15 and beyond to year 60 of operation, planting established as part of the AP2 revised scheme will have matured to screen views of the AP2 revised scheme. This will reduce effects to negligible (non-significant).

Viewpoint 350.2.001: View west from Ellfield House, off Lichfield Road, Whittington

13.5.73 From this viewpoint, the AP2 revised scheme north of Lichfield Road, Whittington on the approach to Darnford Lane overbridge will be visible with the overbridge embankments in the foreground. Train movements and the lower elements of overhead line equipment will be screened by landscape earthworks east of the route. Due to the proximity of the HS2 route, the magnitude of change is considered to be high.

13.5.74 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.

13.5.75 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.76 In operational year 15, the growth of planting established on the landscape earthworks and on the overbridge approach embankments as part of the AP2 revised scheme will result in a low magnitude of change, which alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

13.5.77 By operational year 60, the maturing of this planting will further reduce effects to be minor adverse (non-significant).

Viewpoint 350.2.002: View west from Huddlesford House (and farm), Huddlesford Lane

13.5.78 The upper elements of moving trains and overhead line equipment along the AP2 revised scheme will be visible in the middle ground on Capper's Lane viaduct, together with the realigned Capper's Lane crossing of the Wyrley and Essington canal, visible above and between intervening hedgerows and brook-side vegetation. The magnitude of change will be medium.

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

13.5.80 In the summer of year 1 of operation, although intervening hedgerow and brook-side vegetation will afford a greater level of screening in the foreground and middle ground, overall effects will be unchanged.

13.5.81 By year 15 of operation, planting as part of the AP2 revised scheme will have established to provide effective screening towards the canal bridge and Capper's Lane viaduct, with little visibility of overhead line equipment remaining. The magnitude of change will reduce to low, resulting in a minor adverse (non-significant) effect.

13.5.82 By year 60 of operation, the maturity of the proposed planting will further screen the proposed route resulting in effects reducing to negligible (non-significant).

Viewpoints 350.3.005, 350.4.006 and 350.3.007: Views north-west from PRoW Whittington Footpath 8 between Capper's Lane and Darnford Lane, from Darnford Lane near Ellfield Nurseries and from PRoW Whittington Footpath 7, at Capper's Lane

13.5.83 From these locations, the landscape earthworks east of the AP2 revised scheme will be visible in the foreground and middle ground, across a broad arc of view from Darnford Lane overbridge to north of Capper's Lane viaduct. Train movements and the lower elements of overhead line equipment will be largely screened by the landscape earthworks, with the exception of Capper's Lane viaduct, where they will be visible in the middle ground above noise barriers and seen against a background extending to the outskirts of Lichfield. The magnitude of change is considered to be high.

13.5.84 The high magnitude of change, assessed alongside the high sensitivity of the receptors, will result in a major adverse effect in the winter of year 1 of operation.

13.5.85 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.86 In year 15, maturing mitigation planting on the landscape earthworks, on bridge embankments and along realigned watercourses will substantially screen views of overhead line equipment and train movements. Therefore, the magnitude of change is considered to be low, which assessed alongside the high sensitivity of the receptor, will result in a minor adverse (non-significant) effect.

13.5.87 By year 60 of operation, planting will be mature and the magnitude of change will reduce to negligible (non-significant).

Viewpoint 351.2.001: View east/north-east from Fulfen Farm located between the A38 and Capper's Lane

13.5.88 From this viewpoint, the AP2 revised scheme will be visible in the middle ground from north of Capper's Lane viaduct as the HS2 route enters a deepening cutting on the approach to the WCML overbridge. The realigned section of Capper's Lane crossing the route on overbridge and the lane's western approach embankment will also be visible in the middle ground. As the route continues north towards the WCML overbridge, the route will become screened from view within a deep cutting, however the magnitude of change is considered to be high.

13.5.89 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.

13.5.90 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.91 By year 15 of operation and beyond to year 60 of operation, planting on landscape earthworks will provide some screening of Capper's Lane overbridge, and of the upper elements of overhead line equipment and train movements. Therefore, the magnitude of change will be low, giving rise to a minor adverse (non-significant) effect.

Viewpoint 351.2.002: View north-east from Fulfen Cottages on Capper's Lane

13.5.92 The northern abutment of Capper's Lane viaduct, noise fence barriers, train movements and overhead line equipment will be visible in the middle ground to the extreme right of the view. North of the viaduct, the realigned Capper's Lane, overbridge and approach embankments will be prominent in the middle ground as the AP2 revised scheme enters a cutting to pass beneath the WCML overbridge, screening train movements and overhead line equipment due to the cutting depth and the landscape earthworks west of the route. The magnitude of change is considered to be high.

13.5.93 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.

13.5.94 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.95 By year 15 and beyond to year 60 of operation, Capper's Lane viaduct and noise fence barriers will remain visible in the middle ground, as will overhead line equipment and train movements. However, the visibility of other elements of the AP2 revised scheme

north of Capper's Lane overbridge will be screened by maturing planting on the HS2 route. The magnitude of change will be low, resulting in a minor adverse (non-significant) effect.

Viewpoint 351.2.006: View north-east from Ivy Cottage on Broad Lane

13.5.96 Views across the broad floodplain over the WCML towards the tree-lined Coventry Canal will be interrupted by the approach embankment of the realigned section of Capper's Lane and overbridge in the immediate foreground, screening views of the AP2 revised scheme in cutting, on approach to the WCML overbridge. South of Capper's Lane overbridge, train movements and overhead line equipment will be screened by the landscape earthworks west of the HS2 route. The proximity of the overbridge approach embankment will screen the visibility of rural views towards the Coventry Canal. The magnitude of change is considered to be high.

13.5.97 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.

13.5.98 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.99 By year 15 of operation, Capper's Lane overbridge and the upper elements of train movements and overhead line equipment will be screened by the growth of planting on the landscape earthworks and overbridge embankments. However, some visibility of the upper elements of traffic movements on the realigned Capper's Lane and overbridge will remain. The magnitude of change will reduce to medium, which assessed against the high sensitivity of the receptor will result in a moderate adverse effect.

13.5.100 By year 60 of operation, the maturing of planting will further reduce effects to minor adverse (non-significant).

Viewpoint 351.4.004: View south-east from the A38 near crossing with WCML

13.5.101 From this elevated viewpoint, there will be broad views of the route crossing the floodplain, currently dominated by the WCML and an overhead electricity transmission line. The AP2 revised scheme will be visible in the middle ground north of Capper's Lane viaduct. The upper elements of overhead line equipment and trains will be visible on the viaduct above noise barrier fences and for a short section to the north before passing beneath the realigned Capper's Lane and overbridge and the cutting beneath the WCML. Views over the AP2 revised scheme towards the higher rural land in the background will remain. Capper's Lane overbridge and its approach embankments will be prominent. The line of the HS2 route will be visible marked by landscape earthworks, from south of Capper's Lane to north of the WCML, on the approach to the Streethay footpath 6 accommodation overbridge. The magnitude of change is considered to be high.

13.5.102 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.

13.5.103 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.104 By year 15 and beyond to year 60 of operation, planting growth will provide screening to the landscape earthworks, though Capper's Lane viaduct and overbridge will remain visible. Therefore, the magnitude of change will be low. Assessed alongside the low sensitivity of the receptor, this will result in a minor adverse (non-significant) effect.

Viewpoint 352.2.001: View north-west from Brook House and Mill Farm on Capper's Lane

13.5.105 This section of the AP2 revised scheme will cross a realigned section of the Wyrley and Essington Canal on viaduct in the middle ground of the view, unobstructed by intervening vegetation. Embankments north and south of the viaduct will be prominent, as will noise fence barriers, overhead line equipment and train movements on the viaduct. The magnitude of change will be high. The view of the AP2 revised scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-257 (SES and AP2 ES, Volume 2, CFA22 Map Book).

13.5.106 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.

13.5.107 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.108 By year 15 and beyond to year 60 of operation, mitigation planting will provide some screening to the embankments. However, Capper's Lane viaduct will continue to be prominent in the foreground with overhead line equipment and train movements visible above the noise barrier fences. Therefore, effects will be unchanged and will remain as major adverse. The view of the AP2 revised scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-257 (SES and AP2 ES, Volume 2, CFA22 Map Book).

Viewpoint 352.2.002: View north-west from Huddlesford junction near canal side residential property

13.5.109 Capper's Lane overbridge, crossing the HS2 route and its eastern approach embankment will be visible in the middle ground, seen beyond and between intervening woodland and field boundaries. South of the WCML, the AP2 revised scheme will be in cutting screening visibility of trains and overhead line equipment. The magnitude of change will be medium.

13.5.110 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.

13.5.111 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.112 By year 15 of operation, the growth of planting will provide screening to landscape earthworks, overhead line equipment and train movements. The magnitude of change will be low. Assessed alongside the high sensitivity of the receptor, the low magnitude will result in a minor adverse (non-significant) effect.

13.5.113 By year 60, the maturing of planting will further reduce effects to negligible (non-significant).

Viewpoints 352.2.003 and 352.3.006: Views north-west from Broad Lane near Barn Cottage and west from Coventry Canal near Huddlesford Bridge

13.5.114 The AP2 revised scheme will cross the foreground and middle ground, in cutting, within the broad valley north of the WCML, on the approach to the SSL/A38. The depth of the cutting combined with landscape earthworks will screen views of train movements and overhead line equipment. The magnitude of change will be medium.

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

13.5.116 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.117 By year 15 and beyond to year 60 of operation, planting established as part of the AP2 revised scheme will further screen the line of the landscape earthworks east of the route in cutting. This will reduce effects to negligible (non-significant).

Viewpoint 353.2.005: View east from The Manor House adjoining the A38

13.5.118 The AP2 revised scheme will be immediately adjacent to the viewpoint, with the route north of the A38 in deep cutting, screening views of the lower elements of overhead line equipment and train movements. However, due to the proximity of the route to the viewpoint and the visibility of taller elements, the magnitude of change is considered to be high.

13.5.119 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in the winter of year 1 of operation.

13.5.120 In the summer of year 1 of operation, effects will be unchanged.

13.5.121 By year 15, the growth of planting on landscape earthworks west of the AP2 revised scheme will reduce the magnitude of change to medium, resulting in moderate adverse effects.

13.5.122 By year 60 of operation, due to the maturing of planting, the magnitude of change will further reduce effects to minor adverse (non-significant).

Viewpoint 353.3.001: View north-east from the PRoW (junction between Footpath references Streethay 3 and Streethay 2) near Streethay House Farm

13.5.123 Landscape earthworks to the west of the route as it emerges from the Streethay retained cutting north of the A38 will screen the visibility of train movements and overhead line equipment on the AP2 revised scheme. Views will extend over the HS2 route to Fradley Business Park in the background. The magnitude of change is considered to be medium.

13.5.124 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.

13.5.125 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.126 By year 15 of operation, planting east and west of the AP2 revised scheme will further assimilate the AP2 revised scheme within the local landscape context. The magnitude of change is considered to be low, which will result in a minor adverse (non-significant) effect.

13.5.127 By year 60 of operation, maturing planting will further integrate the route into the local landscape setting, reducing effects to negligible (non-significant). These non-significant effects are reported in SES and AP2 ES, Volume 5: Appendix LV-001-022.

Viewpoint 353.2.008: View east from residences along Burton Old Road, Streethay

13.5.128 The AP2 revised scheme will be largely screened by a combination of garden boundary vegetation, the embanked A38 and by the landscape earthworks north of the HS2 route where it is in deep cutting between the WCML and SSL/A38. Some properties will have views of the upper elements of the Streethay footpath 6 accommodation overbridge. The magnitude of change will be low.

13.5.129 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a minor adverse (non-significant) effect in the winter of year 1 of operation.

13.5.130 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.131 By year 15 and beyond to year 60 of operation, planting established on the AP2 revised scheme embankments will have matured, integrating the route into the wider agricultural landscape reducing effects to negligible (non-significant).

Viewpoint 353.3.007: View east from Streethay Footpath 6 adjacent to Hill Farm

13.5.132 The AP2 revised scheme will be in deep cutting in the middle ground, screening views of train movements and overhead line equipment. The Streethay footpath 6 accommodation overbridge will be visible at ground level, with views over the HS2 route extending beyond a line trees marking the route of the Coventry Canal, to the rural landscape in the background. The magnitude of change is considered to be medium.

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

13.5.134 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.135 By year 15 and beyond to year 60 of operation, planting established as part of the AP2 revised scheme will further screen the line of the AP2 revised scheme in cutting, assisting the integration of the route into the local landscape. This will reduce effects to negligible (non-significant).

Viewpoint 354.2.001: View west from Streethay Farm adjacent to the A38, Streethay

13.5.136 Due to the AP2 revised scheme being in cutting beneath the SSL/A38, the route will not be visible from this viewpoint. Therefore, the magnitude of change is considered to be negligible.

13.5.137 The negligible magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a negligible (non-significant) effect in the winter of year 1 of operation.

13.5.138 The effects will remain unchanged in the summer of year 1, and will continue to year 15 and beyond to year 60 of operation.

Viewpoint 354.3.006: View west from King's Orchard Marina, adjacent to the Coventry Canal

13.5.139 From this viewpoint, the location of the AP2 revised scheme will be in deep cutting between the WCML and SSL/A38, such that neither train movements nor overhead line equipment will be visible. The Streethay Footpath 6 accommodation overbridge crossing the HS2 route will be visible at grade in the middle ground, and existing views extending to the southern outskirts of Lichfield in the background will be retained. The magnitude of change is considered to be low.

13.5.140 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a minor adverse (non-significant) effect in the winter of year 1 of operation.

13.5.141 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.142 By year 15 and beyond to year 60 of operation, proposed planting will soften the alignment of the landscape earthworks marking the route of the HS2 route in cutting. The magnitude of change is considered to be negligible, resulting in a negligible (non-significant) effect.

Viewpoint 354.6.003: View north-west from Streethay Wharf adjacent to the Coventry Canal south of the A38

13.5.143 The AP2 revised scheme will be in cutting beneath the SSL/A38, so that train movements and overhead line equipment will not be visible. The magnitude of change is considered to be negligible.

13.5.144 The negligible magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a negligible (non-significant) effect in the winter of year 1 of operation.

13.5.145 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.146 These effects will continue to year 15 and beyond to year 60 of operation.

Viewpoint 355.3.003: View east from the PRoW Streethay Footpath 7, to the east of Curborough House

13.5.147 The AP2 revised scheme will be at grade at the commencement of the embanked sections of route for the divergence between the Manchester spur and Handsacre linklink. Landscape earthworks west of the HS2 route will be visible in the middle ground, crossing gently rising land, with Fradley Business Park seen in the background. Lower elements of trains and overhead line equipment will be screened and therefore the magnitude of change is considered to be medium.

13.5.148 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.

13.5.149 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.150 By year 15 and beyond to year 60 of operation, the growth of planting on the landscape earthworks and within ecological mitigation areas will assist in softening views of the route's alignment cutting across rising land. The magnitude of change will reduce to negligible, giving rise to a negligible (non-significant) effect in the summer of years 15 and 60.

Viewpoint 356.2.007: View west from Orchard Farm (situated to the north of the A38)

13.5.151 The AP2 revised scheme will be in shallow cutting north of the SSL/A38, and will be visible as a prominent line edged by landscape earthworks cutting across the agricultural landscape, which will screen the visibility of the lower elements of train movements and overhead line equipment. The magnitude of change will be medium.

13.5.152 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.

13.5.153 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.154 By year 15 and beyond for year 60 of operation, effects will reduce to be minor (non-significant).

Viewpoint 356.2.008: View west from Bears Hay Farm, south of the Coventry Canal and close to the A38

13.5.155 From this viewpoint, the AP2 revised scheme will not be visible, located within a deep cutting beneath the SSL/A38, and with the alignment of the cutting screened by intervening vegetation along the Coventry Canal, the SSL and field boundaries. Therefore, the magnitude of change will be negligible.

13.5.156 The negligible magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a negligible, non-significant adverse effect in the winter of year 1 of operation.

13.5.157 The effects will be unchanged in the summer of year 1, and will continue to year 15 and beyond to year 60 of operation.

Viewpoints 356.6.001, 356.4.005, 356.3.006, 358.6.004 and 356.6.009: Views west from Nanscawen Road in South Fradley, junction of Wood End Lane with Nanscawen Road, PRoW Alrewas Footpath 31, at Wood End Lane, from Depot adjoining Wood End Lane and from future receptor at Prologis Park Business Units

13.5.158 The AP2 revised scheme will be visible crossing gently sloping land in the middle ground at grade/on rising embankment at the commencement of the divergence between the Manchester spur and the Handsacre link. Views will extend beyond the HS2 route to agricultural land on the outskirts of Lichfield. The extent of the visibility of the route from some viewpoints will be restricted by intervening buildings and structures within Fradley Business Park in the foreground and middle ground. Overhead line equipment and train movements will be visible. The magnitude of change is considered to be high.

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

13.5.160 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.161 By year 15, proposed planting adjoining the route and around the Mare Brook realignment will soften the appearance of landscape earthworks and screen the lower elements of trains and overhead line equipment. The magnitude of change will reduce to medium, resulting in minor adverse (non-significant) effects.

13.5.162 By operational year 60, due to the maturing of planting, these effects will further reduce to negligible (non-significant).

Viewpoint 356.4.004: View south-west from Hilliard's Cross bridge (A38 flyover)

13.5.163 From this viewpoint, the AP2 revised scheme will not be visible, being in deep cutting beneath the SSL/A38, therefore the magnitude of change will be negligible. The view of the AP2 revised scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-156 (SES and AP2 ES, Volume 2, CFA22 Map Book).

13.5.164 The negligible magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a negligible (non-significant) effect in the winter of year 1 of operation.

13.5.165 The effects will remain unchanged in the summer of year 1 and beyond to years 15 and 60.

Viewpoint 357.2.001: View north-east from Highfields Bungalow

13.5.166 The AP2 revised scheme will be visible on embankments of varying heights in the middle ground as the Manchester spur and Handsacre link diverge. The upper elements of overhead line equipment and train movements on both routes will be visible above landscape earthworks west of the HS2 route, seen above and beyond intervening garden and field boundary vegetation. The magnitude of change will be high.

13.5.167 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.

13.5.168 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.169 By operational year 15, maturing planting established on the landscape earthworks and within woodland habitat creation areas planted as part of the AP2 revised scheme will reduce the magnitude of change to be medium, resulting in moderate adverse effects.

13.5.170 By year 60, the maturing of planting will further reduce the effects to minor adverse (non-significant).

Viewpoint 358.2.003: View south-west from Gorse Farm, Gorse Lane and 358.4.005: View west from Wood End Lane junction with Gorse Lane

13.5.171 The Manchester spur of the AP2 revised scheme will be visible on embankment in the foreground, north of the divergence from the Handsacre link at the Curborough dive-under. Views will also include the Wood End Lane underbridge and balancing ponds east of the HS2 route. The magnitude of change is considered to be high.

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

13.5.173 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.174 By year 15, planting proposed as part of the AP2 revised scheme will have matured, providing some screening to the Manchester spur embankment and lower elements of overhead line equipment and train movements. However, the visibility of the upper elements and of Wood End Lane underbridge will remain. The magnitude of change will be medium giving rise to a moderate adverse effect in the summer of year 15.

13.5.175 By operational year 60, the maturing of planting east of the HS2 route and around the balancing ponds will further reduce effects to minor adverse (non-significant).

Viewpoint 359.3.001: View south-west from the PRoW Alrewas Footpath 0.256, near Fradley Wood

13.5.176 The Manchester spur of the AP2 revised scheme will be visible on embankment in the middle ground, north of the divergence from the Handsacre link. Views will include overhead line equipment and train movements but the field of view will be restricted by buildings in Fradley Business Park. The magnitude of change will be medium.

13.5.177 The medium 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.

13.5.178 In the summer of year 1 of operation, although intervening vegetation in leaf will provide increased screening, the magnitude of change is considered to remain medium.

13.5.179 By year 15 of operation, planting established east of the Manchester spur embankments, along Wood End Lane road realignment and around the balancing

ponds will be maturing providing additional screening. Therefore, the magnitude of change will be low, resulting in moderate adverse effects.

13.5.180 The maturing of planting by operational year 60 will reduce these effects to minor adverse (non-significant). These are reported in SES and AP2 ES, Volume 5: Appendix LV-001-022.

Viewpoint 359.3.002: View south-west from the PRoW Alrewas Footpath 44 at its junction with Alrewas Footpath 0.252 and 0.256, near Fradley Junction

13.5.181 The Manchester spur on viaduct across the Trent and Mersey Canal will be visible in the middle ground viewed along a narrow canalside corridor. Overhead line equipment and any train movements will be visible; therefore, the magnitude of change is considered to be high.

13.5.182 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.

13.5.183 In the summer of year 1 of operation, canalside woodland and hedgerows in leaf will provide some screening, reducing the magnitude of change to medium, resulting in a moderate adverse effect.

13.5.184 By year 15 and beyond to year 60, planting established on the AP2 revised scheme will be maturing, although overhead line equipment and any train movements on the viaduct over the canal will remain visible. The effects will continue to be moderate adverse.

Viewpoint 360.3.001: View north-east from the Trent and Mersey Canal, close to Wood End Lock Cottage

13.5.185 The embankment at the northern termination of the Manchester spur will be visible in the background, though largely screened by intervening canalside woodland and thick vegetation alongside Curborough Brook. The magnitude of change will be low.

13.5.186 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a minor adverse (non-significant) effect in the winter of year 1 of operation.

13.5.187 In the summer of year 1 of operation, intervening vegetation in leaf will reduce the effects to negligible (non-significant).

13.5.188 By operational year 15 and beyond to operational year 60, the negligible (non-significant) effects will persist.

Viewpoints 360.2.002 and 360.3.007: View north-east from Wood End Farm/The Cottage, Wood End Lane and north-east from PRoW Alrewas Footpath 44, on Wood End Lane adjacent to the Trent and Mersey Canal

13.5.189 The AP2 revised scheme will be visible across a broad arc of the view, at grade in the middle ground and foreground with views of trains and the lower elements of overhead line equipment screened by landscape earthworks. A realigned section of Wood End Lane crossing the route on overbridge will be visible from Viewpoint 360.2.002, together with approach embankments. Views of the Trent and Mersey Canal and Wood End Lock Cottage will be screened by a combination of landscape

earthworks and the Wood End Lane overbridge embankments. Due to the proximity and scale of the AP2 revised scheme, the magnitude of change will be high.

13.5.190 The high magnitude of change assessed alongside the high sensitivity of the receptors will result in a major adverse effect in the winter of year 1 of operation.

13.5.191 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.192 By year 15 the growth of planting will screen views of the upper elements of overhead line equipment and soften the lines of the landscape earthworks and bridge embankments. The scale of changes to views towards the canalside corridor will be medium, resulting in moderate adverse effects.

13.5.193 By operational year 60, the maturing of planting will further reduce effects to minor adverse (non-significant).

Viewpoint 360.4.006: View north and north-east from Wood End Lane near Ravenshaw Wood

13.5.194 The upper elements of train movements and overhead line equipment on the Handsacre link will be visible across the middle ground, seen beyond the western approach embankment of the realigned Wood End Lane overbridge. Views of the Trent and Mersey Canal corridor and Wood End Lock Cottage will be screened by the landscape earthworks west of the AP2 revised scheme and the overbridge embankment. Due to the proximity of the AP2 revised scheme, the magnitude of change will be high.

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

13.5.196 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.197 By year 15, planting will have matured to screen the upper elements of overhead line equipment, resulting in a medium magnitude of change, reducing effects to moderate adverse.

13.5.198 By operational year 60, the maturing of planting will further reduce effects to minor adverse (non-significant).

Viewpoint 361.2.002: View south-west from Cranberry residence near Fradley Junction

13.5.199 The termination of the Manchester spur viaduct will be visible in the foreground with some visibility of the Handsacre link in the background, west of the Trent and Mersey Canal corridor, though largely screened by intervening vegetation along Curborough Brook and in canalside woodland. The scale of the Manchester spur viaduct and embankments and the proximity of the route to the viewpoint will result in a high magnitude of change.

13.5.200 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.

13.5.201 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.202 By year 15 of operation, proposed planting will have matured to screen lower elements of the AP2 revised scheme, although overhead line equipment and any train movements on the viaduct will remain visible. However, the magnitude of change will reduce to medium, resulting in a moderate adverse effect in the summer of year 15.

13.5.203 By operational year 60, effects will further reduce to minor adverse (non-significant), due to the maturing of planting proposed as part of the AP2 revised scheme.

Viewpoint 361.3.003: View south-west from the PRoW Alrewas Footpath 44, adjoining Trent and Mersey Canal

13.5.204 The Manchester spur viaduct and southern embankment will be visible in the foreground, with a view through the supporting structure, towards a bend in the canal corridor with the realigned section of Wood End Lane and the Handsacre link visible in the background. Overhead line equipment and any train movements on the Manchester spur will be visible in the foreground, as will traffic on Wood End Lane, though trains on the Handsacre link will be screened by noise fence barriers. The proximity, scale and elevation of the viaduct and the more distant views of the Handsacre link will be visually intrusive in the context of the canal corridor. Therefore, the magnitude of change will be high. The view of the AP2 revised scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-158 (SES and AP2 ES, Volume 2, CFA22 Map Book).

13.5.205 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.

13.5.206 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.207 By year 15 and beyond to year 60 of operation, the Manchester spur viaduct crossing the canal will remain as a prominent element in the foreground of this view, including overhead line equipment and any train movements, although the maturing of planting as part of the AP2 revised scheme will reduce the magnitude of change to medium, resulting in moderate adverse effects.

Viewpoint 362.2.001: View north from Black Slough Farm on Wood End Lane

13.5.208 From this viewpoint the Handsacre link will be visible at grade in the middle ground from Ravenshaw Wood to Black Slough Wood. The extent of available views of the route will be determined by existing farm buildings within Black Slough Farm which will restrict views of train movements and overhead line equipment. Due to the proximity of the proposed route, the magnitude of change will be high.

13.5.209 The high magnitude of change, assessed alongside the high sensitivity of the receptors, will result in a major adverse effect in the winter of year 1 of operation.

13.5.210 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.211 By year 15 and beyond to year 60 of operation, planting will be maturing to provide some screening of the AP2 revised scheme, although the upper elements of overhead line equipment and train movements will be visible. The magnitude of change will be medium, resulting in moderate adverse effects.

Viewpoints 362.3.002 and 362.2.003: View north from PRoW Kings Bromley Footpath 0.392, near Tomhay Wood and east from residence (Birch Ridings) on Wood End Lane near Vicar's Coppice

13.5.212 From these viewpoints the Handsacre link will be visible in the middle ground, at grade from Ravenshaw Wood onto rising embankment on the approach to the A515 Lichfield Road underbridge. Train movements and overhead line equipment will be visible. The magnitude of change will be high.

13.5.213 The high magnitude of change, assessed alongside the high sensitivity of the receptors, will result in a major adverse effect in the winter of year 1 of operation.

13.5.214 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.215 By year 15 of operation, planting west of the AP2 revised scheme and north of PRoW Kings Bromley Footpath 0.392 will be maturing to provide screening of the at-grade sections of the route from ground level views, although the upper elements of overhead line equipment and trains will be visible on the embanked sections of the HS2 route. The magnitude of change will reduce to medium, resulting in moderate adverse effects.

13.5.216 By operational year 60, woodland habitat planting established as part of the AP2 revised scheme will have matured, screening the upper elements of overhead line equipment and reducing effects to minor adverse (non-significant).

Viewpoint 363.2.001: View south-east from Wood End Common Barn

13.5.217 The only visible element of the AP2 revised scheme will be the terminal embankment of the Manchester spur, seen through and beyond intervening woodland, field boundaries and vegetation along Curborough Brook. The magnitude of change will be low.

13.5.218 The low magnitude of change assessed alongside the high sensitivity of the receptors will result in a minor adverse (non-significant) effect in the winter of year 1 of operation.

13.5.219 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.220 By year 15 and beyond to year 60 of operation, woodland planting established to the west of the Manchester spur embankment will reduce effects to negligible (non-significant).

Viewpoint 364.2.001: View north-east from Hanch Hall Farm adjoining B5014 Lichfield Road, Handsacre

13.5.221 The AP2 revised scheme will be visible in the middle ground, beyond the WCML in the foreground. Harvey's Rough embankment, overhead line equipment and train

movements will be seen above intervening vegetation on the approach to the WCML tie-in, though Bourne Brook viaduct in the middle ground will be partly screened by intervening woodland. As the WCML is an existing prominent component of views in the foreground, the scale and elevation of the embankments and additional overhead line equipment and train movements in the middle ground will result in a medium magnitude of change.

13.5.222 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.

13.5.223 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.224 By year 15, planting established on the AP2 revised scheme embankments and on land between the Handsacre link and the WCML will have matured, reducing effects to minor adverse (non-significant).

13.5.225 By year 60, these effects will reduce further to negligible (non-significant).

Viewpoint 364.2.002: View north and north-east from 'The Elms' on Shaw Lane, close to the junction with the B5014 Lichfield Road, Handsacre

13.5.226 The AP2 revised scheme will be visible beyond the WCML, with Harvey's Rough embankment and flyover on the approach to the WCML tie-in seen in the middle ground. The visibility of the AP2 revised scheme will be partially filtered by intervening garden and field boundaries and woodland. The magnitude of change will be medium.

13.5.227 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.

13.5.228 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.229 By year 15 and beyond to year 60 of operation, planting established on the AP2 revised scheme between the WCML and the Handsacre link will have matured, reducing effects to minor adverse (non-significant).

Viewpoint 364.4.008: View north from the WCML overbridge on the A515 Lichfield Road

13.5.230 The route will be visible on the overbridge crossing the A515 Lichfield Road and further north on the embankment approaching Bourne Brook viaduct. There will also be views to the AP2 revised scheme along and across the WCML. Overhead line equipment and train movements will be visible in the background, from the A515 Lichfield Road, towards Bourne Brook viaduct and beyond to Harvey's Rough flyover, although intervening woodland at Bourne Brook will largely screen the viaduct. Due to the extent and elevation of the AP2 revised scheme the magnitude of change will be high. The view of the route in the winter of year one of operation is illustrated on the photomontage shown in Figure LV-01-160 (the SES and AP2 ES, Volume 2, CFA22 Map Book).

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

13.5.232 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.233 By year 15 of operation, although proposed planting on embankments and mitigation areas will have matured, the overhead line equipment and train movements will remain visible. The magnitude of change will be medium, resulting in a reduction to a moderate adverse effect. The view of the AP2 revised scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-261 (the SES and AP2 ES, Volume 2, CFA22 Map Book).

13.5.234 By year 60 of operation, the further growth and maturity of the proposed planting will provide substantial screening, reducing effects to minor adverse (non-significant).

Viewpoint 365.2.001: View south from Wharf Farm, off the A515 Lichfield Road

13.5.235 There will be views across rising land to the AP2 revised scheme on embankment south of Bourne Brook viaduct, north to Harvey's Rough retaining structure and flyover in the middle ground. The visibility of the WCML will be obscured by the embanked route. The magnitude of change will be high.

13.5.236 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.

13.5.237 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.238 By year 15 of operation, maturing planting north of Bourne Brook will screen lower level elements of the AP2 revised scheme and partially screen views to the WCML. Therefore, the magnitude of change will be medium, resulting in a moderate adverse effect.

13.5.239 By operational year 60, the further growth and maturity of the planting proposed as part of the AP2 revised scheme will substantially screen views, reducing effects to minor adverse (non-significant).

Viewpoint 365.2.004: View south-west from Tuppenhurst Lane near Shaw Lane Farm and Shaw House

13.5.240 The AP2 revised scheme will be visible on Shaw Lane embankment and viaduct in the middle ground, at Harvey's Rough flyover on the approach to the tie-in with the WCML. Overhead line equipment and train movements will be visible, with the AP2 revised scheme blocking rural views beyond. Due to the proximity and elevation of the route the magnitude of change will be high. The view of the AP2 revised scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-161 (SES and AP2 ES, Volume 2, CFA22 Map Book).

13.5.241 In the winter of year 1 of operation, the high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

13.5.242 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.243 By year 15 and beyond to year 60 of operation, proposed planting on embankments and mitigation areas will have matured partially screening the lower levels of overhead line equipment and train movements. However, due to the proximity and elevation of the route, the AP2 revised scheme will remain visible. Therefore effects will be unchanged and remain as major adverse. The view of the route in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-262 (SES and AP2 ES, Volume 2, CFA22 Map Book).

Viewpoint 365.3.002: View south-west from Kings Bromley Marina, off A515 Lichfield Road

13.5.244 The AP2 revised scheme will be visible across rising land on embankment from south of the A515 northwards to Harvey's Rough retaining structure and flyover, with the WCML visible beyond the route. The extent of the embankments and viaduct crossing the arc of view in the middle ground will result in a medium magnitude of change.

13.5.245 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.

13.5.246 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.247 By year 15 and beyond to year 60 of operation, the maturity of the proposed planting will provide substantial screening, reducing effects to minor adverse (non-significant).

Viewpoint 365.4.005: View south-west from the A515 Lichfield Road

13.5.248 The AP2 revised scheme will be visible in the middle ground on embankment crossing the A515 Lichfield Road on overbridge and northwards to Bourne Brook viaduct, and the embankments at Harvey's Rough. The A515 Lichfield Road underbridge will be in the centre of the view, with overhead line equipment and train movements visible along the elevated route. The magnitude of change will be high.

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

13.5.250 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.251 By year 15 of operation, planting will provide some visual screening, although Bourne Brook viaduct and the upper elements of overhead line equipment and train movements will remain visible. The magnitude of change will reduce to medium, resulting in a moderate adverse effect.

13.5.252 By year 60 of operation, the further growth and maturity of the proposed planting will provide substantial screening, reducing effects to minor adverse (non-significant).

Viewpoint 366.2.001: View north-east from 'Newtown' located on the B5014 Lichfield Road, Handsacre

13.5.253 There will be views to Harvey's Rough flyover at the tie-in of the AP2 revised scheme with the WCML, including a pedestrian underpass in the foreground, though these will be partly screened by intervening vegetation. Views of overhead line equipment and train movements will be additional to those on the WCML. The magnitude of change will be medium.

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

13.5.255 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.256 By year 15 and beyond to year 60 of operation, maturing planting will contribute to the screening of lower elements of the AP2 revised scheme, but there will be visibility of the overhead line equipment and train movements in addition to those on the WCML. The level of change will remain as medium, resulting in a moderate adverse effect.

Viewpoint 366.2.007: View north-east from residential properties adjoining Hanch Hall, B5014 Lichfield Road, Handsacre

13.5.257 There will be views beyond the WCML to the AP2 revised scheme from Harvey's Rough flyover to the WCML in the middle ground. However, the availability and extent of these views will depend on aspect and intervening vegetation. The magnitude of change will be medium.

13.5.258 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.

13.5.259 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.260 By year 15, the growth and maturity of the proposed planting will provide substantial screening, reducing effects to minor adverse (non-significant)

13.5.261 By year 60, these effects will reduce further to negligible (non-significant).

Viewpoint 367.2.001: View south-west from Ashton Hayes Farm/Ashton Hayes, off Tuppenhurst Lane

13.5.262 The embanked AP2 revised scheme at the WCML tie-in north of Harvey's Rough, together with environmental mitigation earthworks will be visible in the immediate foreground. Kings Bromley pedestrian underpass (Footpath 6) will be adjacent to the viewpoint and overhead line equipment and train movements will add to those on the nearby WCML. The magnitude of change will be high.

13.5.263 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.

13.5.264 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.265 By year 15 of operation, proposed planting either side of the underpass, east of Harvey's Rough flyover will screen some ground-level views to lower-level elements of overhead line equipment and train movements. However, to either side of the entrance to the footpath underpass, overhead line equipment and train movements will continue to be fully visible. The magnitude of change will be high, continuing to result in a major adverse effect.

13.5.266 By year 60 of operation, the further growth and maturity of the proposed planting will provide screening (with the exception of the immediate vicinity of the entrance to the footpath underpass), to the lower elements of Harvey's Rough flyover, though the upper elements of overhead line equipment and train movements will remain visible, reducing the magnitude of change to medium, and resulting in moderate adverse effects.

Viewpoint 367.2.005: View south-west from Shaw Barn, Shaw Lane

13.5.267 There will be longer distance views to Harvey's Rough flyover, retaining structures and tie-in with the WCML, which will be visible beyond the AP2 revised scheme. The magnitude of change will be medium.

13.5.268 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.

13.5.269 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.270 By year 15 and beyond to year 60 of operation, the growth and maturity of the proposed planting will provide substantial screening, reducing effects to minor adverse (non-significant).

Viewpoint 367.4.003: View south-west from Tuppenhurst Lane near Shaw House

13.5.271 There will be a view to the AP2 revised scheme in the foreground, on embankment and north to the flyover and retaining structures at Harvey's Rough, on the approach to the tie-in with the WCML. Overhead line equipment and train movements will be visible in addition to those on the nearby WCML. The magnitude of change will be high.

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

13.5.273 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.274 By year 15 and beyond for year 60 of operation, the growth of maturing mitigation planting will screen views to lower elements of the AP2 revised scheme, but overhead line equipment and train movements will be visible in addition to those on the WCML. The level of change will reduce to medium, resulting in a moderate adverse effect.

Viewpoint 368.2.001: View south-east from residences located along Chestnut Close, Handsacre

13.5.275 The AP2 revised scheme will be visible in the foreground and middle ground, beyond the WCML on Harvey's Rough flyover and embankment, reducing in height on the approach to the WCML tie-in. Overhead line equipment and train movements would be visible, in addition to those already visible on the WCML. Therefore, the magnitude of change will be high.

13.5.276 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.

13.5.277 In the summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

13.5.278 By year 15 and beyond to year 60 of operation, planting growth will be providing some visual screening of the lower elements of the WCML, although the upper elements of overhead line equipment and train movements on both the WCML and Handsacre link on Harvey's Rough flyover in the middle ground will remain visible. The magnitude of change will remain as high, resulting in a major adverse effect.

Cumulative effects

13.5.279 Section 6.1 and SES and AP2 ES, Volume 5, Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the AP2 revised scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the AP2 revised scheme. The consequential cumulative effect of these committed developments on LCAs and viewpoints is described below. The developments are shown in SES and AP2 ES, Volume 5: Map Book – Cross-Topic Maps, Maps CT-13-061 to CT-13-065.

13.5.280 The following developments are likely to be completed in phases, concurrent with the AP2 revised scheme, and therefore have the potential to be components of cumulative effects on LCAs and visual receptors. Effects will occur due to the combined scale of development and magnitude of change:

- land north of Burton Road and north-east of the WCML, Streethay, Lichfield, Staffordshire: construction of a sustainable mixed-use urban extension, comprising of up to 750 dwellings; a primary school; mixed-use community hub/local centre to include retail development and community buildings, a care home (C2 Use Class); comprehensive green infrastructure, with footpaths cycleways and open space; and
- land at Fradley Park, Halifax Avenue, Fradley, Lichfield, Staffordshire: demolition of existing buildings and redevelopment of the site to provide up to 750 new homes, primary school, health centre, nursery, public house, public and private open space, car and cycle parking together with landscaping and associated servicing.

Cumulative landscape effects

13.5.281 The effects of the AP2 revised scheme on the Settled Farmlands LCA is assessed as moderate adverse for operational years 1, 15 and beyond to year 60 (resulting a high

magnitude of change to an LCA with a medium sensitivity to change). The combination of the operation of the AP2 revised scheme with the completion or partial completion of the mixed-use development at Streethay will also result in a high cumulative magnitude of change to this LCA, when taken in the context of the geographical spread of this LCA.

13.5.282 Therefore, the assessment of the cumulative effects of the AP2 revised scheme in combination with the Streethay development in HS2 operational years 1, 15 and 60 will also be moderate adverse.

13.5.283 The effects of the AP2 revised scheme on the Settled Heathlands LCA is assessed as moderate adverse for operational years 1 and 15 and as minor adverse (non-significant) for year 60 (resulting from a medium magnitude of change to an LCA with a medium sensitivity to change). The combination of the operation of the AP2 revised scheme with the completion or partial completion of the development at Fradley will also result in a medium cumulative magnitude of change to this LCA, when taken in the context of the geographical extent of the LCA.

13.5.284 Therefore, the assessment of the cumulative effects of the AP2 revised scheme in combination with the mixed-use development at Fradley Park in HS2 operational years 1 and 15 will also be moderate adverse and in operational year 60, minor adverse (non-significant).

Cumulative visual effects

13.5.285 Viewpoint 353.3.3.003: view east from PRoW Streethay Footpath 1, is located immediately east of the existing WCML and the assessed effects of the AP2 scheme would be a low magnitude of change assessed against a high sensitivity of receptor, resulting in a minor adverse effect (non-significant) for operation year 1, reducing to negligible (non-significant) by year 15 and beyond to year 60.

13.5.286 The phased completion of the development proposals shown on the Streethay indicative masterplan would result in views of the AP2 revised scheme from this viewpoint being screened by intervening, phased, residential and related development. The effects on this viewpoint of a completed or partially completed Streethay mixed-use development would alter to a high magnitude of change, which assessed against a high sensitivity of receptor would result in an effect of major adverse in HS2 operational year 1, though views of the AP2 revised scheme would no longer be available, due to intervening development. These effects would extend to year 15, as phased completion of the development progressed. However, these effects would reduce to moderate adverse by year 60, due to the growth of the intended planting shown on the proposed development's indicative layout.

Other mitigation measures

13.5.287 The permanent effects of the AP2 revised scheme on landscape and visual receptors will be 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 AP2 revised scheme into the landscape. However, no other mitigation measures

are considered practicable due to the high visibility of elements of the AP2 revised scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

13.5.288 In most cases, significant effects will reduce over time, as the proposed mitigation planting matures and reaches its designed intention. Therefore, on the basis that the proposed other mitigation measures are delivered, the following residual effects will remain following year 15 of operation:

- adverse effects on LCAs:
  - adverse effects on the character of the Sandstone Outer Estatelands LCA, due to the influence of engineered landforms and viaducts on a rural landscape. These effects will reduce by year 60 of operation, following greater maturity of the proposed planting;
  - adverse effects on the character of the Settled Farmlands LCA, due to the influence of engineered landforms and viaducts on a rural landscape. Although the proposed planting will be mature by operation year 60, the magnitude of effects will remain as moderate adverse; and
  - adverse effects on the character of the Settled Heathlands LCA, due to the influence of engineered landforms and viaducts on a rural landscape. Although the proposed planting will be mature by operation year 60, the magnitude of effects will remain as moderate adverse.
- adverse effects on residential properties across parts of the study area arising from the visibility of the different elements of the AP2 revised scheme including trains, overhead line equipment and noise fence barriers:
  - adverse effects on views from a residential property on the A51 Tamworth Road at Whittington Heath (viewpoint 347.2.002) arising from the visibility of the AP2 revised scheme on low embankment crossing the golf course and of the A51 Tamworth Road overbridge. These will reduce by year 60 of operation following greater maturity of the proposed planting;
  - adverse effects on views from residential properties on Darnford Lane, west of the AP2 revised scheme at Whittington Hill Farm and House (viewpoint 349.2.005), and east of the route at Ellfield House (viewpoint 350.2.001) arising from the visibility of the AP2 revised scheme on Whittington Common embankment and of Darnford Lane overbridge. These effects will reduce by year 60 of operation following greater maturity of the proposed planting;
  - adverse effects on views from residential property Ivy Cottage on Broad Lane (viewpoint 351.2.006) arising from the proximity of the proposed route in cutting and of the Capper's Lane overbridge and approach embankments and by the realignment of Fulfen Wood Brook. These effects will reduce by year 60 of operation following greater maturity of the proposed planting;
  - adverse effects on views from Brook House and Mill Farm on Capper's Lane (viewpoint 352.2.001) arising from the visibility of the AP2 revised scheme on

viaduct and embankment. Due to proximity and elevation the effects on these properties will remain beyond operational year 60;

- adverse effects on views from the Manor House, close to the A38 (viewpoint 353.2.005) arising from the proximity to and visibility of the AP2 revised scheme in cutting. These effects will reduce by year 60 of operation, following greater maturity of the proposed planting;
- adverse effects on views from Highfields Bungalow (viewpoint 357.2.001) arising from the visibility of the AP2 revised scheme on embankment at the divergence between the Handsacre link and Manchester spur. These effects will reduce by year 60 of operation, following greater maturity of the proposed planting;
- adverse effects on views from Gorse Farm, Gorse Lane (viewpoint 358.2.003) arising from the visibility of the AP2 revised scheme on embankment north of the divergence between the Manchester spur and Handsacre link. These effects will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from Wood End Farm and Cottage (viewpoint 360.2.002) on/reached from Wood End Lane, arising from the visibility of the realigned Handsacre link west of the Trent and Mersey Canal together with the approach embankments and overbridge for the realigned Wood End Lane. These effects will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential property Cranberry (viewpoint 361.1.002), near Fradley Junction, arising from the visibility of the main line/Manchester spur on embankment and viaduct crossing the Trent and Mersey Canal. These will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential property at Black Slough Farm (viewpoint 360.2.001) on Wood End Lane, arising from the proximity and visibility of the Handsacre link realigned to be west of the Trent and Mersey Canal corridor. These effects will remain after operational year 60;
- adverse effects on views from residential property Birch Ridings (viewpoint 362.2.003) arising from the visibility of the AP2 revised scheme on embankment approaching the A515 underbridge. These effects will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential property on the A515 Lichfield Road at Wharf Farm (viewpoint 365.2.001) arising from the visibility of the AP2 revised scheme embankment and flyover at Harvey's Rough and the tie-in with the WCML. These will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential properties Shaw Lane Farm and Shaw House on Tuppenhurst Lane (viewpoint 365.2.004) arising from the visibility of the AP2 revised scheme on embankment and flyover at Harvey's Rough and the tie- in with the WCML. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain significant after operational year 60;

- adverse effects on views from residential properties at Newtown on B5014 Lichfield Road, Handsacre (viewpoint 366.2.001) arising from the visibility of the AP2 revised scheme embankment and flyover at Harvey's Rough and the tie-in with the WCML. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain significant after operational year 60; and
- adverse effects on views from residential property at Ashton Hayes Farm (viewpoint 367.2.001), off Tuppenhurst Lane arising from the proximity and visibility of an elevated section of route at Harvey's Rough flyover and a pedestrian underpass beneath the HS2 route to accommodate Kings Bromley footpath 6. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain after operational year 60;

- adverse effects on users of PRoW and other recreational resources across parts of the study area arising from the visibility of the different elements of the AP2 revised scheme including trains, noise fence barriers and overhead line equipment, although some of these effects will reduce by year 60 of operation, effects on users of the following PRoW will remain:
  - crossing Whittington Heath Golf Club (PRoW Whittington Footpath 16) (viewpoint 348.3.007), arising from the proximity and visibility of the AP2 revised scheme in shallow cutting and on low embankment across the golf course, including overhead line equipment and train movements. Although proposed planting will mature over time, these effects will remain at operational year 60 and beyond;
  - from PRoW Alrewas Footpath 0.256, near Fradley Wood (viewpoint 359.3.001), arising from the visibility of the AP2 revised scheme on embankment on the Manchester spur. These effects will reduce by year 60 of operation following greater maturity of the proposed planting;
  - from PRoW Alrewas Footpath 44 (viewpoint 359.3.002) at its junction with Alrewas Footpaths 0.252 and 0.256, arising from the visibility of the AP2 revised scheme and Manchester spur viaduct crossing of the Trent and Mersey Canal. These effects continue to year 60 and beyond;
  - from PRoW Alrewas Footpath 44 on Wood End Lane (viewpoint 360.3.007), arising from the proximity and visibility of the Handsacre link at grade, west of the Trent and Mersey Canal and of the Manchester spur crossing the canal on embankment. The proposed planting will mature over time, reducing these effects by operational year 60;
  - from along the Trent and Mersey Canal at Fradley, PRoW Alrewas Footpath 44 (viewpoint 361.3.003); arising from the proximity and elevation of the main line/Manchester Link on viaduct across the Trent and Mersey Canal and towpath. Overhead line equipment and train movements will be visible and although the proposed planting will mature over time, these effects will remain at operational year 60 and beyond; and
  - from PRoW King's Bromley Footpath 0.392 near Tomhay Wood (viewpoint 362.3.002) arising from the visibility of the AP2 revised scheme on embankment.

These effects will reduce by year 60 of operation following greater maturity of the proposed planting.

- adverse effects on users of transport routes across parts of the study area arising from the visibility of the different elements of the AP2 revised scheme including trains, noise fence barriers and overhead line equipment:
  - from the junction between Wood End Lane and Gorse Lane (viewpoint 358.4.005), arising from the proximity and visibility of the Manchester spur on embankment and the realignment of Wood End Lane. These effects will reduce by operational year 60;
  - from the A515 Lichfield Road bridge crossing the WCML (viewpoint 364.4.008), arising from the proximity and visibility of the Handsacre link both along the WCML and at Bourne Brook viaduct. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60; and
  - from the A515 Lichfield Road, east of the AP2 revised scheme (viewpoint 365.4.005) arising from the proximity and visibility of the AP2 revised scheme crossing the A515 Lichfield Road underbridge. Following greater maturity of the proposed planting, these effects will reduce to non-significant by operational year 60; and from Tuppenhurst Lane, near Shaw House (viewpoint 367.4.003) arising from the proximity and visibility of the AP2 revised scheme on embankment and flyover at Harvey's Rough. These effects will remain at operational year 60 and beyond.

14 Socio-economics

14.1 Introduction

14.1.1 This section of the report provides a description of the environmental baseline in relation to socio-economics that is relevant to the assessment. In addition, it then reports on the likely impacts and significant socio-economic effects as a result of the construction and operation of the AP2 revised scheme.

14.2 Scope, assumptions and limitations

14.2.1 The assessment scope, key assumptions and limitations for socio-economics are as set out in main ES Volume 1, the SMR (Volume 5: Appendix CT-001 -000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES.

14.3 Environmental baseline

Existing baseline

Study area description

14.3.1 The following provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the area. The Whittington to Handsacre area lies wholly within the area covered by Lichfield District Council.

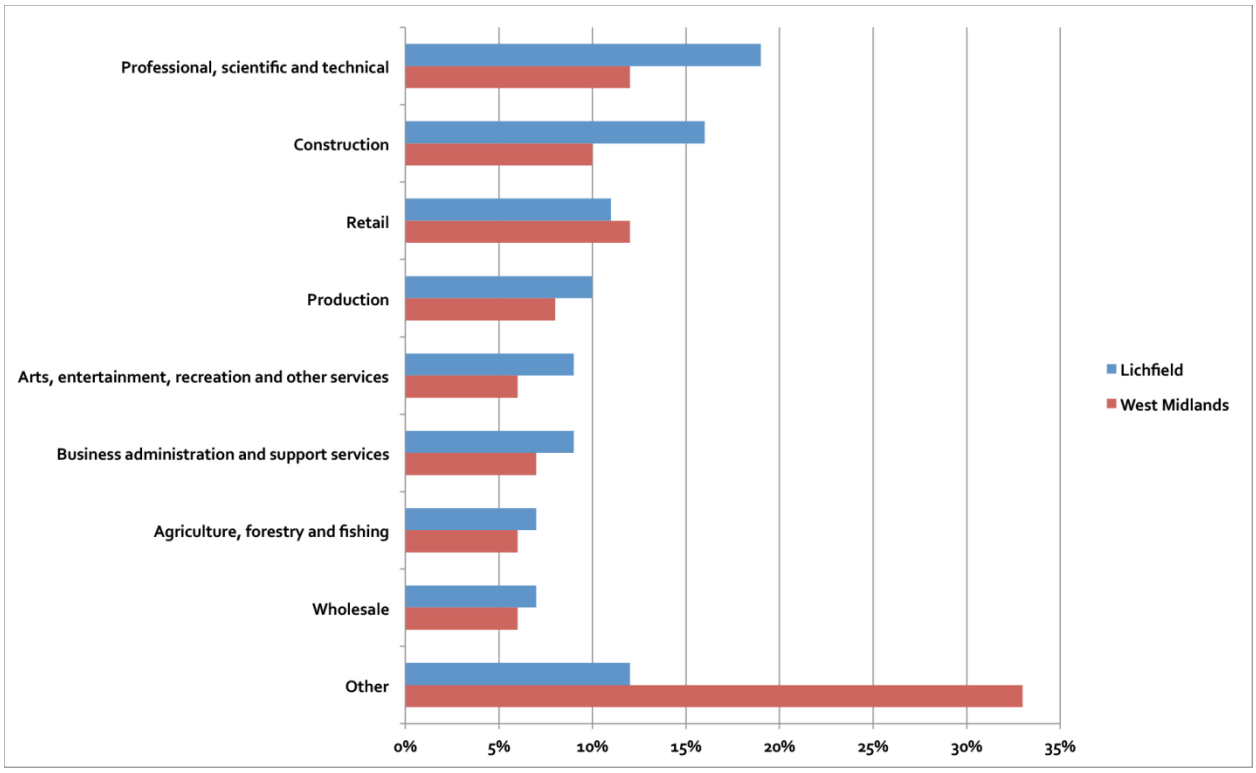
14.3.2 Where possible, baseline data has been gathered on demographic character areas (DCA)[39] to provide a profile of local communities. Volume 5: Appendix SE-002-107 of the main ES shows the location of the DCA. The Whittington to Handsacre area contains three DCAs – Lichfield East and Whittington DCA, Fradley DCA and Armitage and Handsacre DCA. The Lichfield East and Whittington DCA includes the eastern suburbs of Lichfield city, the settlement of Streethay, and Whittington and its rural hinterland. The Fradley DCA mostly covers an area immediately to the east of the route including the industrial area and settlement of Fradley South. The Armitage and Handsacre DCA includes the area just north of the edge of the AP2 revised scheme, extending just beyond the parish boundary; however, given its proximity to the route and concentration of settlement, this DCA has been included for contextual purposes.

Business and labour market

14.3.3 The largest business sector in Lichfield District in 2011 was professional, scientific and technical services which accounts for a larger proportion (at 19%) of businesses than the West Midlands region average (12%) and the English average (14%). Lichfield District also has a higher proportion of construction sector businesses than is typical (at 16% compared to 10%) in the region[40]. This is shown in Figure 5[41].

[39] DCA have been determined through an understanding of local context and aim to be aligned as closely as possible to groups of lower super output areas (LSOAs).
[40] Office for National Statistics (ONS) (2012), *UK Business: Activity, Size and Location 2011.* Please note 2011 data has been used to provide an appropriate comparison with 2011 Census data.
[41] The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.

Figure 5: Business sector composition in Lichfield District Council and West Midlands[42, 43]



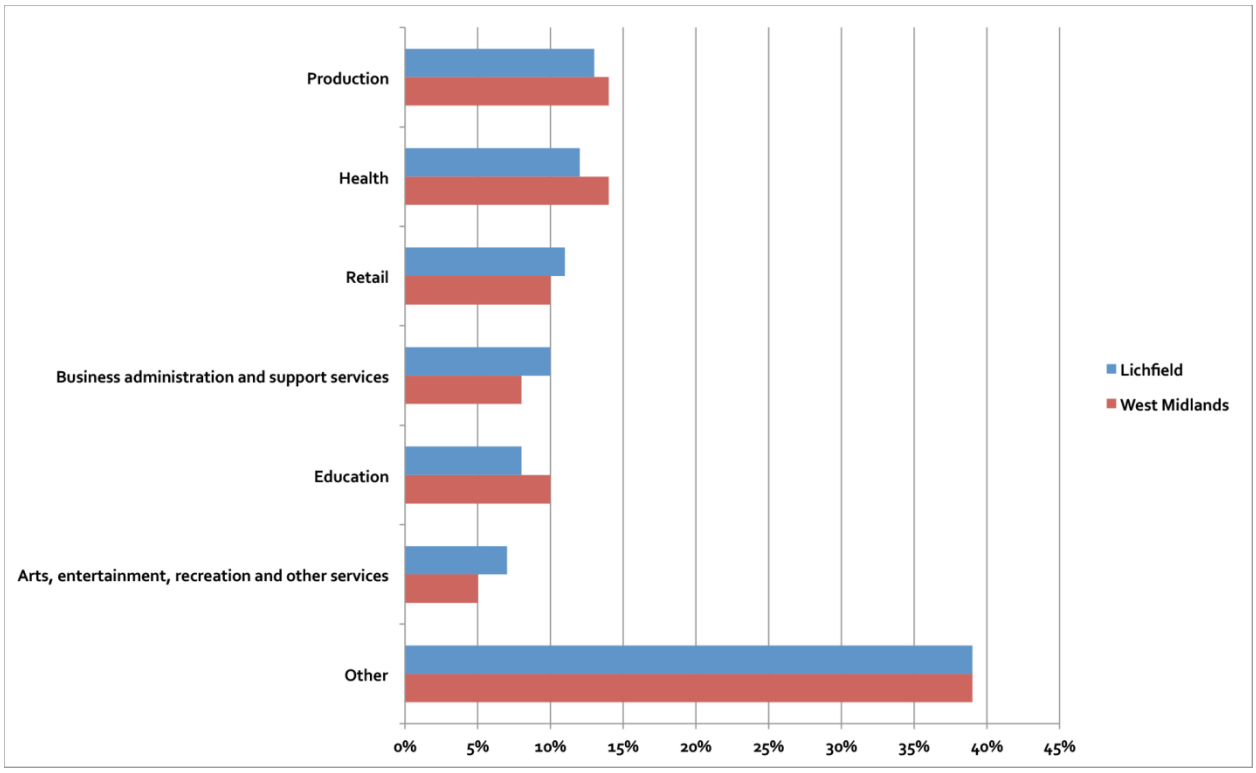
14.3.4 Approximately 40,000 people worked in Lichfield District while 7,000 were employed within the Lichfield East and Whittington DCA, 3,100 in Fradley DCA and 200 in Armitage and Handsacre DCA[44].

14.3.5 The sectors with the highest proportion of employment in Lichfield were production (13%) and health (12%). For production[45] this is less than the proportion for the West Midlands (14%) and higher than for England (10%), while for health this is lower than the West Midlands average (14%) and England average (12%). A further key sector for Lichfield was retail which at 11% is higher than the average for the West Midlands and England (both 10%). This is shown in Figure 6. The sector makeup varies between DCA. The largest employment sector in Lichfield East and Whittington DCA was business administration and support services (19%), in Fradley DCA it was retail (26%) and Armitage and Handsacre DCA it was education (20%).

14.3.6 According to the 2011 Census[46], the employment rate[47] within the Lichfield District in 2011 was 66% (49,000 people) which is higher than that recorded for both the West Midlands (62%) and England (65%). The employment rate for Lichfield East and Whittington DCA was 66%, for Fradley DCA it was 73% and for Armitage and Handsacre DCA was 68%. In 2011 unemployment in Lichfield District was 6% which was lower than for the West Midlands (9%) and England (7%). The unemployment rate for Fradley DCA was 4%, for Lichfield East and Whittington DCA it was 5% and for Armitage and Handsacre DCA it was 6%.

[42] 'Other' includes motor trades; transport and storage; finance and insurance; property; public administration and defence; and education.
[43] ONS (2012), *UK Business: Activity, Size and Location 2011*, ONS, London.
[44] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.
[45] Production, as per ONS definition, is comprised of the mining, quarrying and utilities, and manufacturing sectors.
[46] ONS (2012), *Census 2011*, ONS, London.
[47] The proportion of working age (16-74 years) residents that is in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.

Figure 6: Proportion of employment by industry in Lichfield District Council and West Midlands[48, 49]



14.3.7 According to the 2011 Census, 28% of Lichfield residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 23% in West Midlands and 27% in England, while 22% of these residents had no qualifications, which was lower than that recorded for the West Midlands (27%) and the same as the average for England (23%). In Lichfield East and Whittington DCA 36% of residents aged 16 and over were qualified to NVQ4 compared to 37% in Fradley DCA and 22% in Armitage and Handsacre DCA. In Lichfield East and Whittington DCA 17% of residents had no qualifications, compared to 13% in Fradley DCA and 25% in Armitage and Handsacre DCA.

14.3.8 Lichfield East and Whittington DCA and Fradley DCA have skills levels above the regional and national averages, while Armitage and Handsacre DCA has skills levels closer to the regional and national averages. Each DCA has a different employment focus with Lichfield East and Whittington DCA being focused in business administration and support services, Fradley DCA being focused in retail and Armitage and Handsacre DCA being focused in education.

Property

14.3.9 Average vacancy rate for industrial and warehousing property in Lichfield District Council area in July 2013 has been assessed as 28% based on marketed space against known stock[50]. Overall, this suggests a good availability of alternative accommodation.

[48] 'Other' includes agriculture, forestry and fishing; construction; motor trades; wholesale; information and communication; finance and insurance; property; and public administration and defence.
[49] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.
[50] Vacant Space is based on marketed space identified from Estates Gazette (EGi); stock data is taken from the information supplied by the Valuation Office (VOA).

Future baseline

Construction (2017)

14.3.10 Consents or allocations which are assumed to have been implemented by 2017 are set out in the SES and AP2 ES Volume 5: Appendix CT-004-000 and these are unaffected by the AP2 revised scheme.

Operation (2026)

14.3.11 Volume 5: Appendix CT-004-000 of the SES and AP2 ES provides details of the developments which are assumed to have been implemented by 2026. There are no consents or allocations which are expected to have a material impact on the socio-economic assessment.

14.4 Effects arising during construction

Avoidance and mitigation measures

14.4.1 In order to avoid or minimise the environmental impacts during construction, the AP2 revised scheme design includes provisions to maintain access to businesses during the construction phase.

14.4.2 The draft Code of Construction Practice (CoCP) (see main ES Volume 5: Appendix CT-003-000) includes a range of provisions that will help mitigate socio-economic effects associated with construction within this local area, including:

- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (draft CoCP Section 5);
- reducing nuisance through sensitive layout of construction sites (draft CoCP Section 5);
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (draft CoCP Section 13);
- contractors will be required to monitor and manage flood risk and other extreme weather events which may affect socioeconomic resources during construction (draft CoCP, sections 5 and 16); and
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP Section 14).

Assessment of impacts and effects

Temporary effects

14.4.3 No significant temporary socio-economic effects have been identified within this area as a result of the AP2 revised scheme.

Permanent effects

14.4.4 The AP2 revised scheme would have a direct impact on one business accommodation unit within the area - the Whittington Heath Golf Club. However, from an employment perspective, no significant permanent socio-economic effects have been identified within the area.

14.4.5 It is estimated that land required for the construction of the AP2 revised scheme would result in the displacement or possible loss of approximately 21 jobs within this area. Taking into account the availability of alternative premises and the total employed within the district (approximately 40,000), the displacement or possible loss of jobs is considered to be modest compared to the scale of economic activity and opportunity in the area.

Other mitigation measures

14.4.6 The assessment has concluded that there are no significant adverse effects arising during construction and therefore no mitigation measures are required.

Cumulative effects

14.4.7 No committed developments have been identified that are considered to interact with the AP2 revised scheme.

Summary of likely residual significant effects

14.4.8 There are no likely residual significant effects arising during construction.

14.5 Effects arising from operation

Avoidance and mitigation measures

14.5.1 No mitigation measures are proposed during operation within this area.

Assessment of impacts and effects

14.5.2 No significant socio-economic effects have been identified within this area as a result of the AP2 revised scheme.

Other mitigation measures

14.5.3 The assessment has concluded that there are no significant adverse effects arising during operation and therefore no mitigation measures are required.

Cumulative effects

14.5.4 No committed developments have been identified that are considered to interact with the AP2 revised scheme.

Summary of likely residual significant effects

14.5.5 There are no significant effects identified in the assessment that will arise during operation.

15 Sound, noise and vibration

15.1 Introduction

15.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the AP2 revised scheme for the Whittington to Handsacre area on:

- people, primarily where they live ('residential receptors') in terms of a) individual dwellings, and b) on a wider community basis, including any shared community open areas[51]; 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'[52].

15.1.2 The assessment of likely significant effects from noise and vibration on agricultural, community, heritage or ecological receptors and the assessment of tranquillity are presented in sections 7, 9, 11 and 13 of this report, respectively.

15.1.3 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 AP2 revised scheme. 'Noise' is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

15.1.4 Effects can either be temporary from construction or permanent from the operation of the AP2 revised scheme. These effects may be direct, resulting from the construction or operation of the AP2 revised 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 AP2 revised scheme.

15.1.5 More detailed information and mapping regarding the sound, noise and vibration assessment for Whittington to Handsacre is available in the relevant appendices:

- sound, noise and vibration, route-wide assumptions and methodology (main ES Appendix SV-001-000);
- sound, noise and vibration baseline (main ES Appendix SV-002-022);
- sound, noise and vibration construction assessment (SES and AP2 ES Appendix SV-003-022);
- sound, noise and vibration operation assessment (SES and AP2 ES Appendix SV-004-022); and

[51] '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.

[52] '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.

- Map Series SV-01, SV-02, SV-03 and SV-04 (SES and AP2 ES Volume 5, Sound, noise and vibration Map book).

15.2 Environmental baseline

Existing baseline

15.2.1 The area is predominantly rural and characterised by small villages, hamlets and isolated properties, but is also close to several major settlements. The A38 is the main road in the area, connecting Birmingham and Sutton Coldfield in the south to Lichfield and Fradley before continuing north to Burton on Trent and Derby. The A515 is another important road, linking Lichfield with Kings Bromley, acting as an arterial route through the surrounding countryside to the west of Alrewas and Burton on Trent. The M6 Toll is located on the western edge of the study area along with the WCML, which bisects the village of Handsacre. Close to these roads and railways, high baseline sound levels are experienced during the daytime. Night-time levels remain high in the vicinity of the A38. In areas further from these sources, lower baseline sound levels are experienced.

15.2.2 South of the A38 and around the villages of Whittington and Huddlesford the area is predominantly arable farm land with a number of isolated residences and farms. The sound environment is dominated by the sound of road traffic from the A51 and A38, as well as traffic on local roads (Darnford Lane, Capper's Lane and Common Lane) with frequent contributions from natural sound sources (e.g. tree rustle, bird song and livestock). Typical baseline sound levels range from 55 to 60dB[53] during daytime, reducing to 50 to 55dB[54] at night-time in these areas.

15.2.3 In the residential area of Streethay, west of the A38, the sound environment is characterised by transportation sources, namely the A38, the A5127 (Trent Valley Road) and the SSL which bounds the southern edge of the village. North of the A38 and south of Fradley, the character is urban fringe and is dominated by major business and industrial uses. The sound environment is dominated by industrial and transportation sources. Typical baseline sound levels in Streethay are 55 to 60dB during the day and 50 to 55dB at night.

15.2.4 Between Curborough and Handsacre the area is rural in character, with large areas of agricultural land used for both livestock and arable farming. The sound environment is dominated by natural sources and agricultural activity with contributions from nearby transportation sources namely the A515, Wood End Lane, the A513, and distant trains on the WCML. In this region, the typical baseline daytime sound levels range from 60 to 65dB close to transport corridors to 50dB in the most isolated areas. At night, the baseline sound level is generally 45 to 50dB.

15.2.5 In the residential areas of Handsacre, the sound environment is dominated by trains along the WCML together with community sounds (local road traffic and normal every day residential activities). The typical baseline sound levels in Handsacre are 55 to 60dB during the day and 40 to 45dB at night.

[53] Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, LpAeq,16hr.
[54] Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, LpAeq,8hr.

15.2.6 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in main ES, Volume 5: Appendix SV-002-022.

15.2.7 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[55]. Vibration at all receptors from the AP2 revised scheme has therefore been assessed using specific thresholds, below which receptors will not be affected by vibration. Further information is provided in main ES, Volume 1, Section 8.

Future baseline

15.2.8 Without the AP2 revised scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low-speed roads. On higher-speed roads[56], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

15.2.9 The assessment of noise from construction activities assumes a baseline year of 2017 which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline (2012/13) and the future baseline year of 2017. The assessment of noise from construction traffic assumes a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak. Further information can be found in the traffic and transport assessment.

Operation (2026)

15.2.10 The assessment is based upon the predicted change in sound levels that result from the AP2 revised 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 AP2 revised scheme.

15.3 Effects arising during construction

Local assumptions and limitations

Local assumptions

15.3.1 The construction arrangements that form the basis of the assessment are presented in Section 6.3 of this report.

[55] Further information is available in the Volume 5: Appendix SV-001-000, the SMR and its Addendum.
[56] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

15.3.2 The following construction activities will need to be undertaken during the evening and night-time for reasons of safety, engineering practicability or to reduce the impact on existing transport:

- the WCML overbridge;
- the SSL overbridge; and
- the WCML tie in at Handsacre.

15.3.3 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.

15.3.4 Although it is anticipated that there may be some night-time working during works to cross or tie into existing roads and railways, it is expected that the noise effects would be limited in duration and would hence not be considered significant. Any noise effects arising from these short term construction activities will be controlled and reduced by the management processes set out in the draft CoCP.

Local limitations

15.3.5 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.

Avoidance and mitigation measures

15.3.6 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP which are:

- 'best practicable means' (BPM), as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA), will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings; and then
  - screening: for example local screening of equipment or perimeter hoarding;
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing will be offered in accordance with the draft CoCP's noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of CoPA for the proposed construction works. The

consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration including confirmation of noise insulation/ temporary re-housing provision;

- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

15.3.7 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP.

15.3.8 In addition to this mitigation, taller screening as described in the draft CoCP[57] has been assumed along the edge of the construction site boundary adjacent to the community at Handsacre, and in the vicinity of Handsacre Primary school, Ellfield House, Mill Farm, The Manor House, Ravenshaw Cottage, and Shaw Lane Farm.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

15.3.9 The mitigation measures will reduce noise inside all dwellings, such that it does not reach a level where it would significantly affect[58] residents.

Residential receptors: direct effects –communities

15.3.10 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

15.3.11 In locations with lower existing sound levels[59], construction noise adverse 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. These adverse effects are considered to be significant when assessed on a community basis taking account of the local context[60].

15.3.12 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 not considered to be significant.

Residential receptors: indirect effects

15.3.13 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

[57] 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
[58] Further information is provided in main ES, Volume 5: Appendix SV-001-000.
[59] Further information is provided in main ES Volume 5: Appendix SV-001-000.
[60] Further information is provided in main ES Appendix SV-001-000 and AP2 and SES Appendix SV-003-022.

Non-residential receptors

15.3.14 Significant construction noise or vibration effects on non-residential receptors are unlikely to occur in this area.

Cumulative effects from the AP2 revised scheme and other committed development

15.3.15 This assessment has considered the potential cumulative construction noise effects of the AP2 revised scheme and other committed developments[61]. As noted earlier in this report, significant development is likely to be taking place in the Streethay area at the same time as work to build the AP2 revised scheme. Within this area, the construction noise or vibration associated with these developments in conjunction with the construction of the AP2 revised scheme do not result in any significant cumulative effects.

Summary of likely residual significant effects

15.3.16 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it would significantly affect residents[62].

15.3.17 The measures also reduce the adverse effects[63] of outdoor construction noise on the acoustic character around the local residential communities such that the effects are not considered to be significant.

15.4 Effects arising during operation

Local assumptions and limitations

15.4.1 The effects of noise and vibration from the operation of the AP2 revised scheme have been assessed based on the likely train flows on each section including, where it would lead to higher noise levels, 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.

15.4.2 The expected passenger service frequency for both Phase One, and Phase One with Phase Two services are described in main ES Volume 1[64]. As a reasonable worst case, this assessment for the route up to the connection to Manchester is based upon the service pattern for Monday to Saturday, including Phase Two services. For the section of the route between the connection to Manchester and the connection to the WCML at Handsacre, the reasonable worst case is based upon the service pattern for Monday to Saturday for Phase One services only. The number of services on this section of the route would reduce when HS2 Phase Two become operational.

15.4.3 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 22. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after

[61] Further information is provided in main ES, Volume 5: Appendix SV-001-000
[62] Further information is provided in main ES, Volume 5: Appendix SV-001-000.
[63] Further information is provided in main ES, Volume 5: Appendix SV-001-000.
[64] The change in noise and vibration effects between the different passenger services is assessed in main ES Volume 1

21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 22.

Table 22 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
South of connection to Manchester	07:00-21:00	12 (8)	330kph for 90% of services, 360kph for 10% of services
North of connection to Manchester Phase Two (Handsacre link to WCML)	07:00-21:00	1 (8)	As above, slowing to 175kph at the connection with WCML at Handsacre

Avoidance and mitigation measures

15.4.4 The development of the AP2 revised scheme has, as far as reasonably practicable, kept the alignment away from main communities. This has protected many communities from likely significant noise or vibration effects.

Airborne noise

15.4.5 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 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 Main ES Volume 5: Appendix SV-001-000.

15.4.6 To avoid or reduce significant airborne noise effects, the AP2 revised 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 SES and AP2 ES Volume 2: Map Book - Sound, noise and vibration Map series SV-05.

15.4.7 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.

15.4.8 The AP2 revised 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.

15.4.9 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 SES and AP2 ES Volume 5: Map Book - Sound, noise and vibration, Map series SV-05.

15.4.10 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements (for further information please see main ES Volume 5: Appendix SV-001-000).

15.4.11 Noise insulation measures will be offered for 'qualifying buildings', as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[65] (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations. Qualification for noise insulation under the Regulations will be identified and noise insulation offered at the time that the AP2 revised scheme becomes operational.

15.4.12 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.

15.4.13 Following the Government's National Planning Practice Guidance[66], where the noise from the operation of the AP2 revised scheme measured outside a dwelling exceeds the Interim Target defined by the WHO Night Noise Guidelines for Europe[67], residents are considered to be significantly affected by the resulting noise inside their dwelling. The effect on people at night due to the maximum sound level as each train passes has also been assessed[68]. 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 from operation of the AP2 revised scheme are predicted following the methodology set out in the Regulations to exceed 55dB[69], 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

15.4.14 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

15.4.15 Taking account of the avoidance and mitigation measures incorporated into the AP2 revised scheme, the assessment has identified two residential buildings close to the

65 Her Majesty's Stationery Office, (1996), *The Noise Insulation (Railways and Other Guided Transport Systems) Regulations*, London.
66 National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk.
67 World Health Organization, Night-time Noise Guidelines for Europe, 2010.
68 During the night (2300-0700) a significant effect is also identified where the Proposed Scheme results in a maximum sound level at the façade of a building at or above: 85 dB LpAFmax (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80 dB LpAFmax (where the number of train pass-bys exceeding this value is greater than 20).
69 Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings.

AP2 revised scheme where the daytime forecast noise level does not exceed the threshold level set in the Noise Insulation (Railways and other guided systems) Regulations but the forecast night-time noise level would exceed the World Health Organisation's Interim Target of 55dB, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion.

15.4.16 It is estimated that these buildings will be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are indicated on SES and AP2ES Map series SV-05 and are as follows:

- Mill Farm, Lichfield; and
- Streethay Wharf, Streethay.

15.4.17 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

15.4.18 The avoidance and mitigation measures in this area will avoid significant airborne noise effects on the majority of receptors, and at the following communities:

- Whittington (except as noted in Table 23);
- Streethay;
- Lichfield; and
- Handsacre (except as noted in Table 23).

15.4.19 Taking account of the envisaged mitigation, SES and AP2 ES Map Series SV-05 (Volume 2 Map book) shows the long-term 40dB[70] night-time sound level contour from the operation of trains on the AP2 revised scheme. The extent of the 40dB night-time sound level contour is equivalent to, or slightly larger than, the 50dB daytime contour[71]. In general, below these levels adverse effects are not expected.

15.4.20 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 AP2 revised scheme. The airborne noise impacts and effects forecast for the operation of the scheme are presented on SES and AP2 ES Map Series SV-05 (Volume 2 Map Book).

15.4.21 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 context[72].

15.4.22 The direct adverse effects[73] on the areas of the residential communities identified in Table 23 are considered to be significant.

[70] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$).
[71] 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.
[72] Further information is provided in SV-001-000 and SV-004-022.

Table 23: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number (see Map series SV-05)	Source of significant effect	Time of day	Location and details
OSV22-C01	Airborne noise increase from new train services	Daytime and night-time	Around 10 dwellings in the north of Whittington in the vicinity of Darnford Lane, Marsh Lane and Lichfield Road. 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. The effect on the acoustic character of residential areas reduces on those that are located further from the railway would be a minor effect. There is shared open space adjacent to these dwellings that would also be adversely affected in this community area.
OSV22-C02	Airborne noise increase from new train services (Phase One operation only)	Daytime and night-time	Around 60 dwellings on the south of Handsacre, closest to the WCML and the tie-in to AP2 revised scheme in the vicinity of Chestnut Close, Rowan Drive, Warren Croft, Barn Road, Lichfield Road and Millcroft Way. 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. The effect on the acoustic character of residential areas that are located further from the railway would be a moderate effect. There is shared open space located just off Chestnut Close that would also be adversely affected in this community area.

Residential receptors: indirect effects

15.4.23 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

Non-residential receptors: direct effects

15.4.24 The assessment of operational noise and vibration indicates that no significant effects are likely.

15.4.25 The assessment of effects on non-residential receptors has been undertaken on a worst-case basis. Further information can be found in SES and AP2 ES Volume 5: Appendix SV-004-022.

Non-residential receptors: indirect effects

15.4.26 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

15.4.27 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect residents.

[73] Further information is provided in SV-001-000 and SV-004-022.

15.4.28 The avoidance and mitigation measures in this area will avoid noise and vibration adverse effects[63] on the majority of receptors and communities including shared open areas.

15.4.29 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 in the south of Handsacre closest to the WCML and the community north of Whittington, together with their shared open space is considered significant.

15.4.30 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.

16 Traffic and transport

16.1 Introduction

16.1.1 This section provides a description of the current and future baseline for traffic and transport. It describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction and operation of the route through the Whittington to Handsacre area as affected by the AP2 revised scheme.

16.1.2 With regard to traffic and transport, the main issues are increased traffic as a result of construction of the AP2 revised scheme, road realignments and consequential temporary road closures, and temporary and permanent realignments of PRoW.

16.1.3 The effects on traffic and transport have been assessed quantitatively, based on baseline traffic conditions and future projection scenarios.

16.1.4 A detailed report on traffic and transport and surveys undertaken within the area is contained in the main ES Volume 5 Appendix TR-001-000, Transport Assessment and the Addendum to this prepared for the AP2 revised scheme, SES and AP2 ES Volume 5 Appendix TR-001-000, Transport Assessment.

16.1.5 Engagement has been undertaken with the key transport authorities, including Staffordshire County Council and the Highways Agency - now known as Highways England.

16.2 Scope, assumptions and limitations

16.2.1 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), of the main ES. This report follows the standard assessment methodology.

16.2.2 The study area covers the roads potentially affected by the scheme including sections of the A38, A515 Lichfield Road, Lichfield Road (Whittington), Darnford Lane, Capper's Lane, Broad Lane, Wood End Lane, Netherstowe Lane and Shaw Lane.

16.2.3 A number of transport modelling tools have been used to inform the assessment including the Department for Transport's traffic forecasting tool, Trip End Model Presentation Program (TEMPRO), for forecast road traffic growth in the area. The assessment covers the morning (08:00-09:00) and evening (17:00-18:00) peak periods for an average weekday.

16.3 Environmental baseline

Existing baseline

16.3.1 Existing conditions in the area have been determined through site visits, specially commissioned transport surveys, and liaison with Staffordshire transport authorities and stakeholders to source information on public transport, highway flows, PRoW and accident data.

16.3.2 Traffic surveys of all roads crossing the route or potentially affected were undertaken in June, July and November 2012 and May and June 2013. Additional surveys were undertaken in September 2014, comprising junction turning counts and queue surveys, as well as automatic traffic counts. A detailed report on traffic and transport and surveys undertaken within the area is contained in the main ES Volume 5 Appendix TR-001-000, Transport Assessment. The additional 2014 surveys are reported in the SES and AP2 ES Volume 5 Appendix TR-001-000, Transport Assessment. This data was supplemented by traffic and transport data obtained from other sources, including from Highways England and survey information held by the local authorities. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00.

16.3.3 PRoW surveys were undertaken in August and September 2012 to establish the nature of the PRoW and their usage by pedestrians, cyclists and riders (non-motorised users). The surveys included PRoW and roads in the vicinity of the route of the AP2 revised scheme. Surveys were undertaken at seven PRoW within the Whittington to Handsacre area. Five of the PRoW were used by fewer than ten people a day. The routes with the greatest usage were Whittington Footpath 16 (in Whittington Common golf course) with 26 users per day and Streethay Footpath 6 (near Hill Farm) with 14 users per day. The AP2 revised scheme will not cross any roads with footways.

16.3.4 There is one strategic route that passes through the area; the A38 dual carriageway, which the HS2 route passes beneath, runs broadly in a south-west/north-east direction past Lichfield, Streethay and Fradley. There are two partial junctions to the south and north of Streethay: the A5192 Capper's Lane provides access to south-facing slip roads; and the A5127 Burton Road provides access to north-facing slip roads. There is a junction at Wood End Lane to serve the Fradley area. To the south, the A38 has a junction with the A5026 and the A5148 and then continues south to the A5 and M6 Toll at Carroway Head.

16.3.5 The main local roads affected by the AP2 revised scheme, from south to north, will be:

- Lichfield Road (locally also known as Whittington Common Road), which runs in a broadly west/east direction and connects the A51 Tamworth Road with Church Street just to the west of Whittington;
- Darnford Lane, which has a west/east alignment and connects Lichfield with Whittington;
- Capper's Lane, which runs in a broadly north-west/south-east direction and connects the east of Lichfield with Church Street just outside of Whittington;
- Broad Lane (locally also known as Park Lane), which has a west/east alignment and links Capper's Lane west of Huddlesford with Burton Road in the north of Whittington;
- Wood End Lane, which runs in a west/east alignment and connects the A515 Lichfield Road with the A38 east of Fradley Business Park at Hilliard's Cross;
- the A515 Lichfield Road (locally also known as Tewnal's Lane), which has a broadly south-west/north-east alignment and links the A51 Stafford Road with Kings Bromley;

- Netherstowe Lane, which connects east Lichfield with Curborough and Wood End Lane in the north-east; and
- Shaw Lane, which lies to the south-east of Handsacre and travels in a south-west/north-east direction, linking the B5014 Lichfield Road with the A515 Lichfield Road.

16.3.6 Safety and accident data for the road network subject to assessment has been obtained from Staffordshire County Council for the three-year period up to 2012. This has been assessed and any identified clusters have been examined. Analyses of the data have shown no accident clusters, although a total of 14 accidents occurred on the A38, over a stretch of approximately 2.3km.

16.3.7 There are four public bus services that pass through the Whittington to Handsacre area. These services provide a combined service frequency of up to five buses per hour. The communities served by bus services that will be affected by the AP2 revised scheme include:

- bus numbers 765 and 785 – Whittington and Lichfield to Tamworth and Nuneaton; and
- bus numbers 7 and X12 – Streethay, Fradley and Lichfield to Burton upon Trent and Sutton Coldfield.

16.3.8 The AP2 revised scheme will pass beneath the existing WCML between Lichfield and Tamworth and will connect to the WCML at Handsacre. This line is used by Virgin Trains services from London Euston to Holyhead, Wrexham General, Liverpool Lime Street, Manchester Piccadilly and Glasgow Central. Virgin operates a minimum of seven rail services per hour to these destinations. The WCML is also used by the London Euston to Crewe services operated by London Midland, with an average off-peak frequency of one service per hour. The WCML is also extensively used for freight services.

16.3.9 The AP2 revised scheme will also pass beneath the SSL north of Lichfield, which is a freight-only route and only used by the Cross-City Line passenger services (operated by London Midland) as an alternative route when there is engineering disruption.

16.3.10 One navigable waterway, the Trent and Mersey Canal, which the AP2 revised scheme passes alongside and crosses once, will be directly affected in the Whittington to Handsacre area. A usage of five boats per day was identified during a survey undertaken of the Trent and Mersey Canal. The AP2 revised scheme will also cross the end of the Wyrley and Essington Canal, which is a short spur off the Coventry Canal.

Future baseline

16.3.11 The future baseline traffic volumes have been calculated by applying growth factors based on TEMPRO for the years of assessment 2021 and 2026 and an extrapolation to 2041, which takes into account any major locally consented schemes. No other changes to the traffic and transport baseline are anticipated in this area.

Construction (2021)

16.3.12 Individual construction activities have been assessed against 2021 baseline traffic flows, irrespective of when they occur during the construction period. Future baseline traffic volumes in the peak hours are forecast to grow by around 11% by 2021 compared to 2012.

Operation (2026)

16.3.13 Future baseline traffic volumes in the peak hours are forecast to grow by around 18% by 2026 compared to 2012.

Operation (2041)

16.3.14 Future baseline traffic volumes in the peak hours are forecast to grow by around 38% by 2041 compared to 2012.

16.4 Effects arising during construction

Avoidance and mitigation measures

16.4.1 The following measures have been included as part of the engineering design of the AP2 revised scheme in this area and will avoid or reduce effects on transport users:

- construction materials and equipment will be transported along the haul road adjacent to the AP2 revised scheme alignment, where reasonably practicable, to reduce lorry movements on the public highway;
- the majority of roads crossing the AP2 revised scheme will be kept open during construction resulting in limited diversions of traffic onto alternative routes;
- the AP2 revised scheme will include permanent realignments or diversions of PRoW, or temporary re-routeing as necessary, to reduce loss of connectivity;
- temporary road closures will be limited to overnight and/or weekends;
- HGV routeing along the strategic road network and using designated routes for access, as shown in SES and AP2 ES map TR-03-122 (Volume 5, Map Book, Traffic and Transport); and
- provision of on-site accommodation and welfare facilities to reduce daily travel by site workers.

16.4.2 The draft CoCP (see main ES Volume 5: Appendix CT-003-000) includes measures that seek to reduce the impacts and effects of deliveries of construction materials and equipment, including reducing construction lorry trips during peak background traffic periods. The draft CoCP includes HGV management and control measures.

16.4.3 Where reasonably practicable, the number of private car trips to and from each site (both workforce and visitors) will be reduced by encouraging alternative modes of transport or vehicle sharing. This will be supported by an over-arching framework

travel plan[74] that will require travel plans to be used along with a range of potential measures to mitigate the impacts of traffic and transport movements associated with construction of the AP2 revised scheme. As part of this, a construction workforce travel plan will be put into operation with the aim of reducing workforce commuting by private car, especially sole occupancy car travel. Where reasonably practicable, this will encourage the use of sustainable modes of transport.

16.4.4 The draft CoCP includes measures to manage the volumes and routes for heavy goods vehicles, to reduce the impact of road based construction traffic. In order to achieve this, generic and site specific traffic management measures will be implemented during the construction of the AP2 revised scheme on or adjacent to public roads, footpaths and other PRoW affected by the AP2 revised scheme as necessary.

16.4.5 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 half of work journeys to the construction sites take place within the morning and evening peak hours to reflect a reasonable worst case scenario) (draft CoCP, Section 5); and
- excavated material will be reused wherever reasonably practicable along the alignment of the AP2 revised scheme which will reduce the effects of construction vehicles on the public highway (draft CoCP, Section 15).

16.4.6 The need for rail possessions will be managed so that these take place for limited durations overnight and at weekends, where possible with only two of the four WCML tracks closed at any one time and services maintained.

Assessment of impacts and effects

Temporary effects

16.4.7 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the AP2 revised scheme.

16.4.8 The temporary traffic and transport impacts within this CFA will be:

- construction vehicle movements to and from the main compounds and satellite compounds;
- rail possessions to construct the overbridges to enable the WCML and SSL to pass over the AP2 revised scheme and to enable connections to be made to the WCML;
- overnight closures of the Trent and Mersey Canal to enable safe construction works to take place;

[74] 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.

- road closures and associated overnight and/or weekend traffic diversions; and
- traffic management and overnight closures on the A38.

16.4.9 Construction vehicle movements required to construct the AP2 revised scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips.

16.4.10 Details of construction compounds and phasing of the works are provided in Section 6.3. The duration of busy transport activity at each site is shown in Table 24. Some compounds only have traffic movements to other locations within the construction area. This table presents the busy periods when the construction traffic flows will be greater than 50% of the peak construction traffic flows. Also shown is the estimated number of daily vehicle trips during the peak month of activity; the lower end of the range shows the average number of trips in the busy period and the upper end of the range shows the peak month flows. The assessment scenario has assumed the peak month for the combination of activities, i.e. not necessarily the peak activity at each individual site.

Table 24: Typical vehicle trip generation for construction site compounds in this area

Compound type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars / LGV	HGV
Satellite	Lichfield Road Underbridge Compound	Lichfield Road/A51 Tamworth Road/A5206 London Road/A38	2018	1.5	4	60-84	74-100
Satellite	Darnford Lane Overbridge Compound	Haul route via Lichfield Road Underbridge Satellite Compound	2018	3	-	Few external movements	
Satellite	Capper's Lane Viaduct (South) compound	Haul route via Capper's Lane Main Compound	2018	2	-	Few external movements	
Satellite	Capper's Lane Viaduct (West) compound	Haul route via Capper's Lane Main Compound	2018	2		Few external movements	
Satellite	Capper's Lane Overbridge Compound	Haul route via Capper's Lane Main Compound	2018	3	-	Few external movements	

Compound type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars / LGV	HGV
Satellite	Capper's Lane auto-transformer Compound	Capper's Lane/A38	2022	1	6	28-40	2-2
Satellite	WCML Overbridge South Compound	Haul route via Capper's Lane Main Compound	2018	2	-	Few external movements	
Satellite	WCML Overbridge North Compound	A38 or haul route via Capper's Lane Main Compound	2018	3.5	-	Few external movements	
Satellite	WCML Overbridge (East) Compound (Rail Systems)	A38 or haul route via Capper's Lane Main Compound	2019	1.5	16	44-74	2-2
Satellite	WCML Overbridge (West) Compound (Rail Systems)	Haul route via Capper's Lane Main Compound	2019	1.5	16	44-74	2-2
Roadhead	A38 Southbound North and South Roadheads	A38 temporary slip roads	2018	4	15	Few external move-ments	320-380
Main	Capper's Lane Main Compound	Capper's Lane/A38	2018	5	22	160 -210	136-190
Satellite	A38 Overbridge (South East) Compound	A38 or haul route via Capper's Lane Main Compound	2018	1	-	Few external movements	
Satellite	A38 Overbridge (South West) Compound	A38/A5127 Southbound slip road via A38 overbridge north east satellite compound	2019	1	-	Few external movements	

Compound type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars / LGV	HGV
Satellite	A38 Overbridge (North East) Compound	Farm route via Capper's Lane main compound (light vehicles only). A38/A5127 Southbound slip road. Exit via A5127/A5192/A38	2018	2	16	30-40	46-76
Satellite	South Staffordshire Line Compound (Rail Systems)	Farm route via Capper's Lane main compound (light vehicles only). A38/A5127 Southbound slip road. Exit via A5127/A5192/A38	2019	1.5	-16	44-74	2-2
Satellite	A38 Overbridge Viaduct (North-West) Compound	A38/A5192/A5127. Exit via A38/A5127 northbound slip road	2019	2	21	50	36-52
Satellite	Mare Brook package substation Compound	Nanscawen Road/Wood End Lane/A38	2022	<1	<1	Few external movements	
Satellite	Curborough Dive-under Compound	Wood End Lane to A38	2018	3	13	130-144	74-110
Satellite	Curborough Brook Viaduct compound	Wood End Lane to A38	2018	4	13	94	106-146
Roadhead	Wood End Lane Eastbound Roadhead	Wood End Lane to A38	2019	4	13	Few external movements	590-720
Satellite	Trent and Mersey canal Viaduct Compound	Haul route via Curborough Diveunder Compound	2018	1.5	-	Few external movements	

Compound type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars / LGV	HGV
Satellite	Lyntus auto-transformer station Compound	Wood End Lane to A38	2022	1	6	28-40	2-2
Satellite	Kings Bromley Package Sub Station Compound (Rail Systems)	Wood End Lane to A38	2022	1	-	Few external movements	
Satellite	A515 Lichfield Road Underbridge Compound	A515 Lichfield Road	2018	1.5	14	-	24-38
Main	A515 Lichfield Road Main Compound	A515 Lichfield Road	2018	5.5	26	150-220	46-62
Main	Handsacre Main Compound (Rail Systems)	A515 Lichfield Road	2021	5	10	138-138	0
Satellite	Harvey's Rough Flyover Compound	Shaw Lane/B5014 Lichfield Road/A515 Lichfield Road	2019	1	-	Few external movements	
Satellite	Shaw Lane Compound (Rail Systems)	Shaw Lane/B5014 Lichfield Road/A515 Lichfield Road	2023	1	4	64-64	0-2

16.4.11 It is proposed that the A38 will provide the primary HGV access and egress route in this area. Roads linking to the A38, and other roads, used as construction traffic routes include the A5206 London Road, A51 Tamworth Road, A5192 Capper's Lane, A5127 Burton Road, Wood End Lane and A515 Lichfield Road.

16.4.12 Construction of the AP2 revised scheme will result in changes in traffic flows from workers and construction vehicles accessing compounds, as well as from temporary road closures and diversions.

16.4.13 There will be restricted access arrangements and temporary, overnight and/or weekend closures on Lichfield Road (Whittington), Darnford Lane, Capper's Lane, Broad Lane, A38, A515 Lichfield Road and Wood End Lane. The effects of these

measures on traffic flows and delays to vehicle occupants, as a result of the diversions or traffic congestion, are not considered significant.

16.4.14 Construction will result in increased HGV traffic through the A38/Wood End Lane junction resulting in a major adverse significant effect in relation to increases in congestion and delays for vehicle users at the junction between Wood End Lane and the connection to the southbound slip roads.

16.4.15 Construction of the AP2 revised scheme is forecast to result in substantial increases in daily traffic flow (i.e. more than 30% for HGV or all vehicles), causing significant increases in traffic-related severance[75] for non-motorised users in the following locations:

- the A38 from its junction with the A5126 to the south of Lichfield to its junction with Wood End Lane to the north-east of Lichfield at Hilliard's Cross (moderate adverse significant effect due to HGV traffic flow increase);
- Wood End Lane from its junction with the A38 at Hilliard's Cross to Nanscawen Road (minor adverse significant effect) and from Nanscawen Road to the Wood End Lane roadhead west of Gorse Lane (major adverse significant effect) due to HGV traffic flow increases; and
- Capper's Lane for 150 metres east of the A38 on-slip road (major adverse significant effect due to HGV traffic flow increase).

16.4.16 Utilities works (including diversions) have been assessed in detail only where there are major works and where the traffic and transport impacts from the works separately, or in combination with other works, are greater than other construction activities arising from such works, in association with the AP2 revised scheme, within the area. Minor utilities works are expected to result in only localised traffic and pedestrian diversions that will be of short duration. These are not expected to result in significant additional adverse effects.

16.4.17 The effect of the AP2 revised scheme on accident and safety risks will not be significant. On one road, the A38, where there are existing highway safety issues, the overall change in traffic flow will not be sufficient to raise additional safety concerns.

16.4.18 It is not expected that the construction of the AP2 revised scheme will require any bus route diversions, as road closures are mostly overnight when bus services will not be operational. Construction of the AP2 revised scheme is not expected to result in any loss of pedestrian access to public transport. There are no stations/interchanges that will be affected by the AP2 revised scheme in this area.

16.4.19 There will be five minor adverse significant effects on journey ambience for non-motorised users of PRoW within this area. These are on Kings Bromley Footpath 0.392, where users will have to cross roads utilised by construction traffic; and Whittington Footpath 17, Streethay Footpath 6, Alrewas Footpath 31 and Alrewas Footpath 44, where construction vehicles will operate alongside the footpaths.

[75] In the context of this traffic and transport section, severance is used to relate to a change in ease of 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.

16.4.20 Rail possessions will be required to make the connection between the AP2 revised scheme and the WCML. These possessions will be planned to help limit any disruptions to passenger and freight services. As the possessions will be for only limited duration, the effect on public transport delay is considered to be not significant. The possessions required on the SSL are not expected to affect passenger services.

16.4.21 The effects of construction of the permanent works over the Trent and Mersey Canal will not be significant, as any stoppage of the waterway, if required, would only be overnight.

Cumulative effects

16.4.22 The assessment includes cumulative effects of planned development during construction by taking this into account within the background traffic growth.

16.4.23 The assessment above also includes in-combination effects by taking into account traffic and transport impacts in CFA22 of works being undertaken in other CFAs.

Permanent effects

16.4.24 Any permanent effects of the AP2 revised scheme have been considered in "Effects arising from operation" below. 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

16.4.25 The implementation of the CoCP (see main ES Volume 5: Appendix CT-003-000/1) in combination with the construction workforce travel plan will, to some degree, mitigate the transport related effects during construction of the AP2 revised scheme. The reductions in effects arising from these travel plan measures have not been included in the assessment, which will mean the adverse effects may be over-stated.

16.4.26 It is expected that a junction improvement scheme will be implemented at the A38/Wood End Lane junction (Hilliard's Cross) to mitigate the impact of construction traffic on the priority junction on the western side of the A38. This would mitigate the major adverse significant effect which results without the improvement. Appropriate measures to mitigate this adverse effect are expected to be brought forward either in a subsequent AP or by direct agreement with the local highway authority.

16.4.27 Rail replacement services will be provided as necessary during rail possessions.

16.4.28 No further traffic and transport mitigation measures during construction of the AP2 revised scheme are considered necessary, based on the outcomes of this assessment.

Summary of likely residual significant effects

Temporary residual effects

16.4.29 The most intensive peak periods of construction will cause increases in traffic that will result in significant adverse residual effects on pedestrians, cyclists and equestrians crossing and using: the A38 between its junction with the A5126 to the south of Lichfield and its junction with Wood End Lane at Hilliard's Cross; Wood End Lane from its junction with the A38 at Hilliard's Cross to the compounds west of its junction with

Gorse Lane and a short stretch of Capper's Lane between A38 and the main compound.

16.4.30 Construction will result in a significant adverse residual effect in relation to increases in congestion and delays for vehicle users of the junction between Wood End Lane and the connection to the southbound slip roads, although it is expected that the further mitigation described above will remove this effect.

16.4.31 There will be five minor adverse significant effects on journey ambience for non-motorised users of PRoW within this area.

16.4.32 The significant effects that result from construction of the AP2 revised scheme are shown in SES and AP2 ES Map TR-03-122, Volume 5, Map Book Traffic and Transport.

Permanent residual effects

16.4.33 Any permanent effects of the AP2 revised scheme have been considered in "Effects arising from operation" below.

16.5 Effects arising from operation

Avoidance and mitigation measures

16.5.1 The following measures have been included as part of the design of the AP2 revised scheme and will avoid or reduce impacts on transport users:

- retaining the majority of roads crossing the AP2 revised scheme in, or very close to, their current locations;
- retaining PRoW crossing the AP2 revised scheme, with any realignments kept to a minimum where reasonably practicable;
- modifications to the WCML to accommodate additional train movements; and
- provision of a new connection between Shaw Lane and the A515 Lichfield Road.

Assessment of impacts and effects

16.5.2 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the AP2 revised scheme.

16.5.3 The operational traffic and transport impacts within this area will include:

- permanent realignment of six roads;
- permanent closure of one road (part of Shaw Lane);
- permanent realignment of eight PRoW; and
- traffic accessing the areas of the AP2 revised scheme for maintenance purposes.

16.5.4 There will be localised permanent realignments of six roads – Darnford Lane, Broad Lane, Capper's Lane, Wood End Lane, Watery Lane and Netherstowe Lane.

16.5.5 There will be no significant traffic and transport effects with the realignment of Darnford Lane.

16.5.6 Broad Lane/Park Lane users will broadly face the same journey distance as the current situation and there would be no significant effects. Capper's Lane traffic using the realigned Capper's Lane would have an increase in journey distance of 300m, which will not have a significant effect.

16.5.7 Wood End Lane, between Watery Lane and Gorse Lane, is realigned along the north side of the route before reconnecting with its existing alignment at Watery Lane. The realignment increases the distance travelled by 100m, which will have no significant effect. There is also a minor realignment of Watery Lane at its junction with the realigned Wood End Lane but this will have no significant effect.

16.5.8 Netherstowe Lane is realigned to run parallel to the route using the old Wood End Lane alignment and to connect with the realigned Wood End Lane at its junction with Watery Lane. The realignment of Netherstowe Lane results in diverted traffic having an increase in travel distance of 2km which results in a moderate adverse significant effect. Traffic flows are though expected to be at a very low level as Netherstowe Lane is a single lane road with passing places. There would also be a minor adverse significant effect to non-motorised users of Netherstowe Lane who have a shorter diversion route via the Curborough Brook underbridge, compared with motorised users.

16.5.9 The AP2 revised scheme includes the closure of Shaw Lane and the extension of Tuppenhurst Lane in an easterly direction, from Shaw Lane, to a new junction with the A515 Lichfield Road. The use of the Tuppenhurst Lane extension will result in an in increased journey distance of 2.2km for users of Shaw Lane resulting in a minor adverse significant effect.

16.5.10 Traffic flows are expected to be similar to those forecast without the AP2 revised scheme in both 2026 and 2041. The only scheme related changes to traffic will be occasional traffic that may access areas of the AP2 revised scheme for maintenance purposes. However, these vehicle movements are expected to be infrequent and will therefore have no significant effect.

16.5.11 The effect on accident and safety risks will not be significant as there are no substantial increases in traffic due to the operation of the AP2 revised scheme.

16.5.12 The AP2 revised scheme will have no effect on the four bus services that will be crossed by the alignment of the AP2 revised scheme.

16.5.13 Eight PRoW will be realigned within this area. Five of these, namely Whittington Footpath 16, Whittington Bridleway 17, Whittington Bridleway 20, Streethay Footpath 6 and Kings Bromley Footpath 6 will be increased in length by less than 100m and the effects will not be significant. Alrewas Footpath 44 is diverted by 150m which also has no significant effect. There will be a minor adverse significant effect on two footpaths: Alrewas Footpath 31 (in Fradley Park), due to an increase in length of 225m and on Kings Bromley Footpath 0.392 (near Black Slough) due to an increase in length of 440m. During surveys undertaken for this assessment no usage of either of these PRoW were recorded.

Cumulative effects

16.5.14 The assessment includes for the cumulative effects of planned development during operation, by taking this into account within the background traffic growth.

16.5.15 The assessment also considers in-combination effects by taking into account of traffic and transport movements from other CFAs. However, there will be no in-combination effects for this area.

Other mitigation measures

16.5.16 No further mitigation measures for the operation of the AP2 revised scheme are considered necessary based on the outcomes of this assessment.

Summary of likely residual significant effects

16.5.17 Two Footpaths (Alrewas 31 and Kings Bromley 0.392) will be realigned with increased journey times for pedestrians and residual minor adverse significant effects.

16.5.18 The closure of Shaw Lane results in a residual minor adverse significant effect due to increased travel distance and journey times for road users.

16.5.19 The realignment of Netherstowe Lane results in a residual moderate adverse significant effect due to increases in distance travelled by road users and a residual minor adverse significant effect to non-motorised users.

16.5.20 The significant effects that will result from the AP2 revised scheme are shown in SES and AP2 ES Map TR-04-122 (Volume 5, Map Book, Traffic and Transport).

17 Water resources and flood risk assessment

17.1 Introduction

17.1.1 This section provides a description of the current and future baseline for water resources including surface water, groundwater, and the baseline conditions for flood risk. It then reports on the likely impacts and significant effects on these aspects as a result of the construction and operation of the AP2 revised scheme.

17.1.2 The main environmental features of relevance to water resources and flood risk that are present across the Whittington to Handsacre area (CFA22) include:

- Mare Brook, Curborough Brook and Bourne Brook will be crossed by the AP2 revised scheme and are classified as Main Rivers;
- tributaries of the River Trent and a tributary of Mare Brook, a tributary of Fisherwick Brook and an un-named watercourse, which are ordinary watercourses, will be crossed by the AP2 revised scheme;
- the Wyrley and Essington Canal and the Trent and Mersey Canal (artificial waterbodies) will be crossed by the AP2 revised scheme;
- feeder drains to the Trent and Mersey Canal will be crossed by the AP2 revised scheme;
- ponds north of Rough Stockings and north of Big Lyntus Wood will be intersected by the AP2 revised scheme;
- the Bromsgrove Sandstone Formation and Kidderminster Formation, which are classified as Principal aquifers, underlie much of the AP2 revised scheme in the southern half of the Whittington to Handsacre area;
- a number of Secondary aquifers;
- numerous minor springs within the study area; and
- four licensed groundwater abstractions within the study area, two of which are used for public supply.

17.1.3 Key environmental issues relating to water resources and flood risk include:

- the need to realign part of the Wyrley and Essington Canal at Mill Farm where it will be crossed by the AP2 revised scheme;
- the need to culvert and realign part of a tributary of the Mare Brook at Nanscawen Road, due to the AP2 revised scheme passing directly over the alignment of the existing watercourse;
- the need to culvert and realign a tributary of the Mare Brook at Rough Stockings - Streethay, where it will be crossed by the AP2 revised scheme;
- the need to culvert and a major diversion of the Mare Brook at Fulfen Wood

where it will be crossed by the AP2 revised scheme;

- the need to culvert tributaries of the River Trent north-west of Ashton Hayes Farm, East of the B5014 and at White Gables;
- dewatering associated with cuttings (Swinfen, Whittington Common, Streethay) which will lower groundwater levels and have the potential to affect baseflow and spring flows within the zone of influence of dewatering;
- the potential impact of changes in groundwater flow to issues, springs and on groundwater dependent ecological receptors, such as in the vicinity of retaining walls; and
- the potential flood risk impact of the viaduct crossings over Bourne Brook, Curborough Brook, the Wyrley and Essington Canal and the Trent and Mersey Canal, as well as the potential works in floodplains.

17.1.4 Main ES 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 WFD[76] compliance assessment (which has been updated as detailed below to take account of field surveys during 2014); and
- a route-wide Flood Risk Assessment (FRA).

17.1.5 Detailed reports on water resources and flood risk within the Whittington to Handsacre area are also contained in the SES and AP2 ES Volume 5 appendices. These include:

- Appendix WR-002-022: Water Resources Assessment report;
- Appendix WR-003-022: Flood Risk Assessment;
- a WFD compliance assessment; and
- Appendix WR-004-015: River Modelling Report.

17.1.6 Map series WR-01 and WR-02 are contained in the SES and AP2 ES Volume 5: Map Book – Water resources. Relevant information is also shown on Map Series WR 03, WR 05 and WR 06 within the main ES Volume 5 Map Book - Water Resources.

17.1.7 Discussions have been held with the Environment Agency, Staffordshire County Council as the lead local flood authority, and the Canal and River Trust (formerly British Waterways).

[76] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, European Parliament and European Council, Strasbourg.

17.2 Scope, assumptions and limitations

17.2.1 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are set out in main ES, Volume 1, Section 8 and in the SMR and its addendum (Volume 5: Appendices CT-001-000/1 and CT-001-000/2) and appendices presented in Volume 5: WR-002-022 and WR-003-022 of the main ES. This report follows the standard assessment methodology.

17.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. Outside these distances, it is unlikely that direct impacts upon the water environment will be attributable to the AP2 revised scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this is defined as the study area.

17.2.3 Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the AP2 revised scheme, or within the calculated zone of influence have been detailed in the baseline in this assessment.

17.2.4 WFD classification data have been made available by the Environment Agency. For surface water bodies that do not have a WFD status class shown in the relevant river basin management plan (RBMP), the status class has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant RBMP, these are referred to as 'not assessed by the Environment Agency' in the summary of geology and hydrogeology in Table 26.

17.2.5 Groundwater level data from the Environment Agency and other monitored locations such as private abstractions are limited in the study area. It is assumed that groundwater levels vary in a similar fashion to topography throughout the study area, with groundwater level contours roughly parallel to topographic contours. In the absence of more detailed information, it has been generally assumed that groundwater levels are within 1m of the ground surface.

17.2.6 The limitations associated with flood risk within this study area are described in detail in the SES and AP2 ES Volume 5: Appendix WR-003-022.

17.3 Environmental baseline

Existing baseline surface water resources

Surface water features

17.3.1 All water bodies within the study area fall within the Humber River Basin District (RBD). The exception is the Coventry and Ashby Canals waterbody (which includes the Birmingham and Fazeley and Coventry Canals) which is located within the Severn RBD as set out within the RBMP[77,78]. Apart from the Coventry and Ashby Canals, all water

[77] Environment Agency (2009), River Basin Management Plan, Humber River Basin District.

bodies within the study area fall within the Tame Anker and Mease or the Staffordshire Trent Valley sub-catchment. Watercourses within the study area include Bourne Brook, Curborough Brook, Pyford Brook and Mare Brook.

17.3.2 The current surface water baseline is shown in SES and AP2 ES Volume 5: Maps WR-01-037 to WR-01-038 and all surface water features within the study area are assessed within SES and AP2 ES Volume 5: Appendix WR-002-022. Table 25 includes features potentially affected by the AP2 revised scheme.

Table 25: Surface water features potentially affected by the AP2 revised scheme

Water feature	**Location description (map reference[79])**	**Watercourse classification[80]**	**WFD water body name and number and current overall status**	**WFD status objective (by 2027* as per Humber River Basin Management Plan, unless stated)**	**Receptor value[81]**
Drain feeder to Fisherwick Brook	At Mill Farm (SWC-CFA22-001)	Ordinary watercourse	East Lichfield catchment – tributary of Tame (GB104028047020) – Moderate Status	Good Status	Moderate
Wyrley and Essington Canal (under restoration)	At Canal Cottage Capper's Lane (SWC-CFA22-002)	Artificial watercourse			Moderate
Mare Brook	At Fulfen Wood (SWC-CFA22-003)	Main River	River Tame from River Anker to River Trent (GB104028047050) – Poor Status	Good Status	Moderate
Tributary of Mare Brook	At Rough Stockings – Streethay (SWC-CFA22-004)	Ordinary watercourse			Moderate
Pond	North of Rough Stockings (SWC-CFA22-005)	Not applicable			Refer to Ecology Volume 2, CFA22 Report, Section 10
Tributary of Mare Brook	At Nanscawen Road – Hilliard's Cross (SWC-CFA22-006)	Ordinary watercourse	River Tame from River Anker to River	Good Status	Moderate

78 Environment Agency (2009), River Basin Management Plan, Severn River Basin District.
79 Refer to main ES Appendix 5: Map Book - Water resources, maps WR-01- 37 and WR-01-38.
80 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.
81 For examples of receptor value see Table 43 in the SMR.

Water feature	Location description (map reference[79])	Watercourse classification[80]	WFD water body name and number and current overall status	WFD status objective (by 2027* as per Humber River Basin Management Plan, unless stated)	Receptor value[81]
Tributary of Mare Brook	South of Little Lyntus Wood (SWC-CFA22-007)	Ordinary watercourse	Trent (GB104028047050) – Poor Status		Moderate
Drain Feeder 1 to Trent and Mersey Canal	At Fradley Wood (Manchester spur) SWC-CFA22-008)	Ordinary watercourse	Trent and Mersey Canal, summit to Alrewas (GB70410142) – Good Potential	Good Potential (by 2015)	Low
Drain Feeder 2 to Trent and Mersey Canal	At Fradley Wood (Manchester spur) SWC-CFA22-009)	Ordinary watercourse			Low
Drain feeder 3 to Trent and Mersey Canal	At Fradley Wood (Manchester spur) SWC-CFA22-010)	Ordinary watercourse			Low
Trent and Mersey Canal	At Brokendown Wood Fradley Wood (Manchester spur) (SWC-CFA22-011	Artificial watercourse	Trent and Mersey Canal, summit to Alrewas (GB70410142) – Good Potential	Good Potential (by 2015)	Moderate
Pond	North of Big Lyntus Wood (SWC-CFA22-012)	Not applicable			Refer to Ecology Volume 2, CFA22 Report, Section 7
Curborough Brook	At Wood End Farm (SWC-CFA22-013)	Main river	Pyford Brook Catchment – tributary of Trent (GB104028047250) – Moderate Potential	Good Potential	High
Drain	At Ravenshaw Wood SWC-CFA22-014)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) – Moderate Potential	Good Potential	Low
Bourne Brook	At John's Gorse (SWC-CFA22-015)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) – Good Status	Good Status (by 2015)	Moderate

Water feature	Location description (map reference[79])	Watercourse classification[80]	WFD water body name and number and current overall status	WFD status objective (by 2027* as per Humber River Basin Management Plan, unless stated)	Receptor value[81]
Tributary of River Trent	North-west of Ashton Hayes Farm (SWC-CFA22-016)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) – Poor Potential	Good Potential	Moderate
Tributary of River Trent	East of B5014 (SWC-CFA22-017)	Ordinary watercourse			Moderate
Tributary of River Trent	At White Gables (SWC-CFA22-018)	Ordinary watercourse			Moderate
12 further ponds	Located within the land required for the construction and operation of the AP2 revised scheme.	Not applicable			Low

Water Framework Directive status

17.3.3 The Environment Agency notes that the overall WFD classification of both the River Trent and River Tame is Poor Status. The overall WFD classification of the East Lichfield Catchment is Moderate Status and for the Pyford Brook it is Moderate Potential. The overall WFD classification of the Bourne-Bilson Brook is Good Status and the Trent and Mersey Canal is Good Potential. The WFD status/potential objective of all these water bodies is Good by 2027 and by 2015 for the Trent and Mersey Canal and Bourne-Bilson Brook.

17.3.4 The WFD status and objectives of water bodies that are not crossed by the route is shown in SES and AP2 ES Volume 5: Appendix WR-002-022.

Abstractions and permitted discharges

17.3.5 There are 12 locations where surface water is abstracted within 1km of the AP2 revised scheme in this study area, according to data from the Environment Agency[82] (details in SES and AP2 ES Volume 5: Appendix WR-002-022).

17.3.6 Information from Lichfield District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

17.3.7 There is potential for further unlicensed abstractions to exist as a licence is not required for abstraction volumes below 20 cubic metres per day.

[82] Surface water abstractions for public supply are not included.

17.3.8 Envirocheck data indicate that there are 27 active permitted surface water discharges within 1km of the AP2 revised scheme in this study area (details in SES and AP2 ES Volume 5: Appendix WR-002-022).

Existing baseline – groundwater resources

Geology and hydrogeology

17.3.9 The locations of abstractions and geological formations are shown in SES and AP2 ES Volume 5: Map WR-02-022.

17.3.10 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 26. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 26: Summary of geology and hydrogeology in the vicinity of AP2 revised scheme in CFA22

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value
Superficial deposits						
Glaciofluvial sheet deposits	Located around the northern part of the route and across the Manchester spur	Sand and Gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Alluvium	Spatially limited deposits	Clay, silt, sand and gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Undiffer-entiated deposits (Head)	Small (20ha) area north-west of Streethay	Clay, Silt, Sand and Gravel	Secondary (Undifferentiated)	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
River Terrace Deposits	Situated along Mare Brook and tributaries, between Lichfield and Fradley South	Sand and Gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Bedrock						
Kidderminster Formation	Relatively small outcrop of Kidderminster Formation in the south of the study area	Conglomerates and sandstones	Principal aquifer	Tame Anker Mease – PT Sandstone Birmingham Lichfield (GB40401G301000) Poor Status	Good status by 2027	High

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value
Bromsgrove Sandstone Formation	Underlies the southern extent of the study area	Sandstones, commonly pebbly or conglomeratic at the bases of beds, interbedded siltstones and mudstones	Principal aquifer	Tame Anker Mease – PT Sandstone Birmingham Lichfield (GB40401G301000) Poor Status	Good status by 2027	High
Mercia Mudstone Group	Underlies the northern half of the route in the study area	Mudstones and subordinate siltstones	Secondary B aquifer	Tame Anker Mease – Secondary Combined (GB40402G990800) Poor Status	Good Status by 2027	Moderate
				Staffordshire Trent Valley - Mercia Mudstone East & Coal Measures Good Status		

* Year may vary in different RBMPs.

Superficial deposits

17.3.11 Superficial deposits are present intermittently along the AP2 revised scheme, which is underlain by:

- Alluvium comprising clay, silt, sand and gravel, and river terrace deposits (sand and gravel) associated with major surface watercourses;
- Glaciofluvial sheet deposits (comprising sand and gravel with lenses of clay, silt and organic material), which underlie the AP2 revised scheme almost continuously from Gorse Farm at Fradley to the northern end of the study area; and
- Head deposits, variably comprising clay, silt, sand and gravel, present to the north of Streethay.

17.3.12 Where present, Alluvium, River Terrace Deposits and glacial river deposits are classified as Secondary A aquifers.

17.3.13 The groundwater vulnerability of the groundwater within the superficial deposits of the Secondary A and Secondary undifferentiated aquifers within the study area is high.

Bedrock aquifers

17.3.14 The Sherwood Sandstone Group comprises the Kidderminster Formation and the Bromsgrove Sandstone Formation and is classified as a Principal aquifer.

17.3.15 The Mercia Mudstone Group (Mudstone) is classified as a Secondary B aquifer.

17.3.16 Groundwater levels within the Principal and Secondary aquifers are uncertain but are considered likely to be influenced by topography with flow towards rivers.

Water Framework Directive status

17.3.17 No WFD classification has been given by the Environment Agency to the superficial deposits.

17.3.18 The overall WFD status of groundwater in the areas where the Bromsgrove Sandstone Formation, Kidderminster Formation and Mercia Mudstone Group are present is currently poor status and is predicted to be of poor status for 2015.

17.3.19 The reason for the poor status is given in the RBMP for the Humber River Basin District, which states that: "The main reasons for Poor Status are high or rising nitrate concentrations with failures for pesticides and chemicals associated with mine working. The main reason for poor quantitative status is that abstraction levels, mainly for drinking water, exceed the rate at which aquifers recharge".

17.3.20 The groundwater underlying the AP2 revised scheme is classified as at risk from the southern boundary of the study area to Fradley Junction. North of this point the groundwater is classified as probably at risk.

Abstractions and permitted discharges

17.3.21 The locations of licensed abstractions within the study area are shown in SES and AP2 ES Volume 5: Appendix WR-002-022, Table 4. The locations are shown in the SES and AP2 ES Volume 5: Map WR-02-022.

17.3.22 The Environment Agency reports that there are four licensed groundwater abstractions within the study area, two of which are used for public water supply (further details are provided in the SES and AP2 ES Volume 5: Appendix WR-002-022).

17.3.23 No unlicensed potable abstractions have been identified within the study area.

17.3.24 There is potential for further unlicensed abstractions to exist as a licence is not required for abstraction volumes below 20 cubic metres per day.

17.3.25 A groundwater Source Protection Zone 1 (SPZ1) is present in the vicinity of Lichfield Trent Valley Station and is surrounded by an SPZ2 (see SES and AP2 ES Volume 5: Map WR-02-022). A groundwater Source Protection Zone 3 (SPZ3) is designated where the Kidderminster Formation and the Bromsgrove Sandstone Formation Principal aquifers are present in the southern half of the study area.

17.3.26 The study area also encroaches on an SPZ1 and SPZ2 between Tewnals Lane and Hanch Farm to the south-east of Handsacre.

17.3.27 Envirocheck data indicates that there are 18 active permitted discharges to ground within the study area. (Further details are provided in SES and AP2 ES Volume 5: Appendix WR-002-022).

Surface water/groundwater interaction

17.3.28 Surface water/groundwater interaction is widespread throughout the study area in the form of springs and issues (generally a less defined area of rising groundwater than a spring), ponds, sinks, and watercourses. Locations of these features are detailed in SES and AP2 ES Volume 5: Appendix WR-002-022, Table 6.

17.3.29 Ponds which may potentially be affected by the AP2 revised scheme are summarised in Table 26 and listed in full in Table 6 of Volume 5: Appendix WR-002-022 of the SES and AP2 ES. These ponds are assumed to be in hydraulic connectivity with groundwater, unless further assessment suggests that the ponds are situated upon low permeability strata, or lined with an impermeable layer.

Water-dependent habitats

17.3.30 There are no areas with statutory ecological designations in relation to surface water or groundwater in the study area.

17.3.31 There are a number of potentially water-dependent ecological sites within 1km of the route in the Whittington to Handsacre area which are locally designated. These are detailed in Table 7 of SES and AP2 ES Volume 5: Appendix WR-002-022 and include:

- Tomhay Wood (ancient woodland);
- Whittington Heath Golf Course SBI; and
- Fradley Wood Biodiversity Action Site (BAS).

17.3.32 Further information on the above ecological receptors is given in ecology, Section 11.

Existing baseline – flood risk

River flooding

17.3.33 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping. This mapping has been supplemented with the use of site-specific hydraulic modelling at all locations where the AP2 revised scheme will cross watercourses shown on OS mapping.

17.3.34 West of Whittington, the route is on a viaduct that crosses the diverted Wyrley and Essington Canal and a tributary of the Fisherwick Brook. The catchment draining to this location is approximately 15km^2. The course of the tributary has historically been altered to serve the Mill upstream of Capper's Lane. The watercourse is perched on the side of the valley above the floodplain. Flood flows spill out of the watercourse into the valley below, re-joining the watercourse downstream of Capper's Lane. The width of the floodplain has been estimated to be up to 100m, however the proposed viaduct structure will be 120m to allow it to span the watercourse, floodplain and the canal. The flood extents have been modelled and this identifies that there are no residential properties within the floodplain near to the AP2 revised scheme. The land use within the floodplain is agricultural and therefore less vulnerable (moderate value receptor).

17.3.35 The Curborough Brook flows north from Lichfield and passes under the Trent and Mersey Canal north of Wood End Lane. The catchment area draining to this location is

approximately 17km^2. The Environment Agency Flood Zone Mapping indicates that the floodplain is approximately 55m wide at the point where the route will cross the watercourse. The proposed viaduct structure spanning the Curborough Brook is 80m wide. In the vicinity of the AP2 revised scheme, the land use is agricultural, and is, therefore, less vulnerable (moderate value receptor).

17.3.36 To the south east of where the route joins the WCML a viaduct across the Bourne Brook is proposed. The catchment draining to this location is approximately 28km^2. The route will cross approximately 130m of Flood Zone 3. The Bourne Brook flows under the WCML approximately 300m upstream of the route. The land use within the floodplain in the vicinity of the AP2 revised scheme is agricultural and therefore less vulnerable (moderate value receptor).

17.3.37 There are no residential properties within the 1% (1 in 100) flood zones modelled for the AP2 revised scheme within this CFA. For all the watercourses the land use has been identified as less vulnerable in the vicinity of the AP2 revised scheme. The flood risk assessment in SES and AP2 ES Volume 5: Appendix WR-003-022 provides further details of receptors within the flood zones and their vulnerability.

17.3.38 There are residential properties at Mill Farm on Capper's Lane within the Environment Agency Flood Zones 2 and 3 near to the AP2 revised scheme. To the south of Handsacre there are a number of properties on Chestnut Close adjacent to a minor watercourse and whilst they are not designated as within Flood Zone 2 or 3, because of their location, the watercourse has been assessed on the basis that it could affect more vulnerable properties. At the other watercourse crossings the land use has been identified as less vulnerable. The flood risk assessment in SES and AP2 ES Volume 5: Appendix WR-003-022 provides further details of receptors within the flood zones and their vulnerability.

17.3.39 Historical flooding events have been taken from the Environment Agency mapping, the Lichfield Strategic Flood Risk Assessment (SFRA)[83] and the Staffordshire Preliminary Flood Risk Assessment (PFRA)[84]. The Staffordshire PRFA reports that the Council have a record of historical flooding events near where the AP2 revised scheme will cross Capper's Lane. These events have been classed as exceptional and did not affect any properties.

Surface water flooding

17.3.40 The agreed data set for surface water flooding is the Environment Agency's updated Flood Map for Surface Water (uFMfSW), as shown on SES and AP2 ES Volume 5: Maps WR-01-037 and 038.

17.3.41 These maps have been reviewed to form the basis of the assessment of the impact of the AP2 revised scheme on the risk of surface water flooding.

17.3.42 The updated Flood Maps for Surface Water show three event severity bands, more frequent than 1 in 30 (3.3%), between 1 in 30 (3.3%) and 1 in 100 (1%) and between 1 in

[83] Lichfield District Council (20),14), South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment. Completed by Capita.
[84] Staffordshire County Council (2011), Staffordshire Preliminary Flood Risk Assessment. Completed by Royal Haskoning on behalf of Staffordshire County Council.

100 (1%) and 1 in 1000 (0.1%) annual probability events. The area is susceptible to surface water flooding during events more frequent than the 1 in 100 (1%) annual probability event are shown on SES and AP2 ES Volume 5: Maps WR-01-037 and -038. The maps show areas currently at risk of surface water flooding and where surface water is generally collected in rural low points in topography such as following open drainage channel networks associated with the watercourses in the Whittington to Handsacre area.

17.3.43 Some eight areas identified to be at risk of surface water flooding are classified to be at a high risk. The areas at risk of surface water flooding can be categorised into three types:

- areas associated with existing watercourses;
- overland flow paths; or
- isolated areas (e.g. low spots where water collects).

17.3.44 In this study area there are three locations where overland flow paths, which do not follow a watercourse, are evident on the uFMfSW. These are located as follows:

- one to the north-east of Streethay (main ES Volume 5: Map WR-01-037, C5); and
- two between the north of Wood End Farm and Vicar's Coppice (main ES Volume 5: Map WR-01-038, E7 and F6).

17.3.45 Historical flooding events have been taken from the Lichfield SFRA and the Staffordshire PFRA. The Lichfield SFRA indicates that an undated event caused inundation 150m west of the route at Streethay, although the source of this flooding is unknown, given its location, it is likely to be surface water or sewer flooding. The SFRA also indicated historic flooding of the highways since 2008 in close proximity to the Capper's Lane viaduct. The Staffordshire PRFA reports that Lichfield District Council has a record of historical flooding events near where the AP2 revised scheme will cross Capper's Lane. These events have been classed as exceptional but they have not affected any properties.

Sewer flooding

17.3.46 The agreed data sets for sewer flooding are the Lichfield SFRA[83], the Staffordshire PFRA[84]. In this location Severn Trent Water asset mapping has also been used.

17.3.47 The AP2 revised scheme will be in the vicinity of the sewer network in five locations, and therefore there is the potential for flood risk from this source to be affected. At two of these locations, the topography of the area indicates that there are no flow paths from surcharge points to the AP2 revised scheme. At three locations where the sewer network is located in close proximity to the AP2 revised scheme, the potential for restricted flow paths have been identified. Therefore, it is concluded that there is a medium risk of flooding from the sewer network.

17.3.48 Historical events taken from the Lichfield SFRA and the Staffordshire PFRA indicate that there have been no incidents of sewer flooding either at the location of the route or within 1km of the route. The exception to which is the event that caused inundation

150m west of the route at Streethay (as reported in the Lichfield SFRA), although the source of this flooding is unknown, but given its location it is likely to be surface water or sewer flooding.

Artificial water bodies

17.3.49 The agreed dataset for reservoir flooding is the Environment Agency reservoir inundation mapping[85]. OS mapping has been used to determine the location of canals within the study area.

17.3.50 Flooding from artificial systems may occur from failure of a retaining structure that impounds water. The following man-made features have been identified within the FRA (main ES Volume 5: Appendix WR-003-022) as being a potential source of flood risk:

- the canal system; and
- reservoirs.

17.3.51 There are two canals that are crossed by the route in this study area. These are the Wyrley and Essington Canal (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-002) and the Trent and Mersey Canal (SES and AP2 ES Volume 5: Map WR-01-038 SWC-CFA22-011), which are crossed by the Capper's Lane viaduct and Trent and Mersey Canal viaduct (on the Manchester spur) respectively.

17.3.52 Topographic data indicates that the Trent and Mersey Canal (SES and AP2 ES Volume 5: Map WR-01-038, SWC-CFA22-011) is not raised above surrounding ground levels and hence there is no risk of structural breaching when the water level is maintained at the design level. However, the Wyrley and Essington Canal (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-002) is raised above the surrounding ground level. If breaching occurs, flood water will flow along the corridor of the watercourse at this location (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-001) and so will not adversely affect the surrounding area.

17.3.53 The canals will also be overtopped if water levels rise above the design level, however, water levels in canals are maintained and therefore it is unlikely that overtopping will occur. In addition, the AP2 revised scheme will not increase the risk of flooding from this source. The risk from this source of flooding is low.

17.3.54 There are three water bodies that are listed in the Environment Agency Reservoir Inundation Flood Mapping as posing a flood risk to the AP2 revised scheme. These reservoirs, Swinfen Lake, Stowe Pool and Minster Pool, pose a risk at two locations described below. However, the data provided does not indicate flood depths, flow velocities or the time taken for onset of flooding after a breach takes place.

17.3.55 The route crosses a tributary of Fisherwick Brook, which is likely to act as a flow path for reservoir flooding from Swinfen Lake. The route also crosses Curborough Brook, which is likely to act as a flow path for reservoir flooding from Stowe Pool or Minster

[85] Environment Agency. What's in my backyard? Risk of Reservoir Flooding. http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=reservoir. Accessed September 2013.

Pool. At both these locations the inundation extent covers a greater extent than the Flood Zone mapping.

17.3.56 Due to the strict regulations and high level of maintenance associated with reservoirs, breaching is considered very unlikely. In addition, the AP2 revised scheme will not increase the risk of flooding from this source as no works that will affect the integrity of the impounding structures are proposed. Therefore, the risk from this source of flooding is categorised as low.

17.3.57 Historical events taken from the Lichfield SFRA and the Staffordshire PFRA indicate that there have been no incidents of reservoir or canal flooding either at the location of the route or within 1km of the route.

Groundwater flooding

17.3.58 The agreed datasets for groundwater flooding is the Staffordshire County Council PFRA and the Lichfield District Council SFRA.

17.3.59 Lichfield District Council's SFRA and Staffordshire County Council's PFRA state that there have been no observed or recorded incidences of groundwater flooding.

17.3.60 There is reference within the PFRA guidance document to a risk of groundwater flooding from rising groundwater levels within Lichfield There is no evidence that this will impact the route.

Future baseline

17.3.61 Section 6.1 and SES and AP2 ES Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on the route of or close to the AP2 revised scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the AP2 revised 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 AP2 revised scheme.

Construction (2017)

17.3.62 All committed developments are required to comply with the National Planning Policy Framework (NPPF[86]), development plans and other legislation and guidance. As such committed developments are not expected to have a material effect on the water resources and flood risk baseline.

17.3.63 WFD future status objectives are set out in Table 25 and Table 26. This potential change in baseline is not considered to result in significant changes to the reported effects from the AP2 revised scheme.

Operation (2026)

17.3.64 For the reasons stated above for construction, the cumulative development will not result in a change in significance of the effects from operation of the AP2 revised scheme.

[86] Department for Communities and Local Government (2012), National Planning Policy Framework.

Climate change

17.3.65 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the AP2 revised scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, except for flood flows described in this section, these are not considered to result in the reported effects from the AP2 revised scheme changing in significance.

17.3.66 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.

17.3.67 When considering the influence that climate change may have on the future baseline, against which impacts from the AP2 revised 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.

17.3.68 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 the main ES Volume 5: Appendix CT-009-000.

17.4 Effects arising during construction

Avoidance and mitigation measures

17.4.1 The general approach to mitigation is set out in Volume 1 of the main ES.

17.4.2 The following measures will reduce potentially significant adverse effects on water resources and flood risk to levels that will not be significant. Further details are shown in SES and AP2 ES Volume 5: Appendices WR-002-022 and WR-003-022.

17.4.3 Railway drainage will be managed using sustainable drainage techniques. In the study area, surface water discharges are proposed to:

- a drain feeder to Fisherwick Brook at Mill Farm (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-001);
- Mare Brook at Fulfen Wood (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-003);
- tributary of Mare Brook at Rough Stockings (to the west of East Hill) (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-004);
- tributary of Mare Brook south of Little Lyntus Wood (SES and AP2 ES Volume 5: Mao WR-01-037, SWC-CFA22-007) - three discharges via balancing ponds, west of the Auction Centre, south of Little Lyntus Wood and at Wood End Lane;

- Bourne Brook at John's Gorse (SES and AP2 ES Volume 5: Map WR-01-038, SWC-CFA22-015); and
- a tributary of the River Trent at White Gables (SES and AP2 ES Volume 5: Map WR-01-038, SWC-CFA22-018).

17.4.4 Railway run-off will be attenuated with balancing ponds and restricted prior to discharge to emulate the existing environment by reducing run-off to existing greenfield rates, where reasonably practicable.

17.4.5 It is proposed to culvert watercourses in five places where they are crossed by the AP2 revised scheme:

- sections of Mare Brook tributaries at Rough Stockings (SES and AP2 ES Volume 5: Map WR-01-037, SWC- CFA22-004) and Nanscawen Road (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-003 and 006);
- a section of Mare Brook at Fulfen Wood (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-003); and
- sections of River Trent tributaries north-west of Ashton Hayes Farm, East of B5014 and at White Gables (SES and AP2 ES Volume 5: Map WR-01-038, SWC-CFA22-016, 017 and 018).

17.4.6 It is also proposed to culvert watercourses in a number of places where the realignment of a road results in the crossing of a watercourse or the realignment/diversion of a watercourse results in the crossing of a road.

17.4.7 Culvert length will be minimised, wherever possible, and will be designed with invert levels below the firm bed of the watercourse to reduce 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 reasonably practicable, 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)[87] and Environment Agency guidance and in consultation with the Environment Agency. The mitigation specifically for the ecology of the watercourses is considered in section 11, Ecology.

17.4.8 Realignments are proposed along sections of the following watercourses:

- Wyrley and Essington Canal at Mill Farm (SES and AP2 ES Volume 5: Map WR-01-037 reference SWC-CFA22-002);
- tributaries of Mare Brook at Rough Stockings - Streethay and Nanscawen Road - Hilliard's Cross (SES and AP2 ES Volume 5: Map WR-01-037, reference SWC- CFA22-004 and 006); and
- Mare Brook at Fulfen Wood (SES and AP2 ES Volume 5: Map WR-01-037,

[87] Construction Industry Research and Information Association (2010), C689 Culvert Design and Operation Guide.

references SWC-CFA22-003).

17.4.9 The realignment of the section of a tributary of Mare Brook at Nanscawen Road (SES and AP2 ES Volume 5: Map WR-01-037, reference SWC-CFA22-006) is necessary because the AP2 revised scheme directly follows the alignment of the existing watercourse.

17.4.10 The realignment of the Wyrley and Essington Canal at Mill Farm is necessary to retain the clearance required for the navigation under the lowered route.

17.4.11 The realignment of the section of a tributary of Mare Brook at Rough Stockings - Streethay is associated with culverts and landscaping for the AP2 revised scheme.

17.4.12 The diversion of Mare Brook at Fulfen Wood is necessary because it is not possible for the watercourse to pass under the lowered AP2 scheme through a culvert. This is due to there not being sufficient clearance and available gradient to get the watercourse under the new cutting depth, along its natural catchment flow path.

17.4.13 Consideration will be given at detailed design to the objectives of the WFD as described in the RBMP. This may include the use of soft engineering solutions for bank design, and the inclusion of natural forms such as berms or incorporation of a two-stage channel, riffles and pools and marginal planting, where reasonably practicable.

17.4.14 Road realignments are required as part of the AP2 revised scheme in this area (Tuppenhurst Lane, Capper's Lane, Broad Lane, Wood End Lane, Darnford Lane). The watercourses receiving road run-off are as follows:

- Bourne Brook (SES and AP2 ES Volume 5: Map WR-01-038, SWC-CFA22-015) to which it is assumed Tuppenhurst Lane outfalls;
- Curborough Brook at Wood End Farm (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-013) to which it is assumed Wood End Lane outfalls;
- Mare Brook at Fulfen Wood (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-003) to which it is assumed Capper's Lane and Broad Lane outfall; and
- a drain feeder to Fisherwick Brook at Mill Farm (SES and AP2 ES Volume 5: Map WR-01-037, SWC-CFA22-001) to which it is assumed Darnford Lane outfalls.

17.4.15 Appropriate sustainable drainage mitigation will be provided for minor roads to address the risks to the receiving watercourses (for both flow and water quality) and will be selected using the Design Manual for Roads and Bridges (particularly HA103)[88] and CIRIA[89] guidance. For the major roads, (identified through the application of the SMR), detailed assessments will be made using the guidance from the Design Manual for Roads and Bridges through the detailed design phase.

17.4.16 Three cuttings within the study area will require drawdown to dewater the cuttings during construction and the amount of permanent passive drainage of groundwater

[88] DMRB. Volume 4 Section 2.
[89] CIRIA (2006), c648 Control of water pollution from linear construction projects.

that will be induced will increase their zone of influence and consequently the impact as follows:

- Swinfen cutting is up to 8m deep resulting in the predicted extent of the zone of influence that will be created through dewatering of the Kidderminster Formation and Bromsgrove Sandstone Formation Principal aquifers being up to approximately 380m. Mitigation measures, including the use of Sustainable Drainage Systems and infiltration are detailed in SES and AP2 ES Appendix WR-002-022;
- Whittington Common cutting is up to the maximum depth of 4.2m resulting in the predicted extent of the zone of influence that will be created through dewatering of the Bromsgrove Sandstone Formation Principal aquifer being up to a maximum of approximately 70m. Mitigation measures, including the use of Sustainable Drainage Systems and infiltration are detailed in SES and AP2 ES Appendix WR-002-022; and
- Streethay cutting is up to 18.8m deep resulting in the predicted extent of the zone of influence that will be created through dewatering of the Bromsgrove Sandstone Formation Principal aquifer and the Mercia Mudstone Group Secondary B aquifer being up to approximately 200m. Mitigation measures, including the use of sustainable drainage systems (SuDS) and infiltration are detailed in SES and AP2 ES Appendix WR-002-022.

17.4.17 Sustainable drainage systems and infiltration trenches will be implemented to facilitate recharge to the groundwater to help maintain groundwater levels within the Principal and Secondary aquifers. Sustainable drainage systems will also reduce the risk of potential contamination from accidental leaks or polluted surface water runoff from reaching the groundwater and, therefore, prevent deterioration in groundwater quality status. These Sustainable drainage systems and infiltration trenches will be located in areas where gravity transfer is achievable.

17.4.18 The realignment of the Wyrley and Essington Canal at Mill Farm will involve construction within the lowest part of the floodplain of the Fisherwick Brook tributary. Unmitigated this will increase flood levels as flow paths during flood events associated with the Fisherwick Brook tributary will be directly impacted. To mitigate this, the floodplain levels adjacent to the realigned canal will be lowered to match the current ground levels in the lowest part of the floodplain. This will ensure there is no significant effect due to the realignment.

17.4.19 Replacement floodplain storage areas have been identified to mitigate the impact of the AP2 revised scheme on river flood risk, in consultation with the Environment Agency.

17.4.20 Section 16 of the draft CoCP sets out the measures and standards of work that will be applied to the construction of the AP2 revised scheme (see main ES Volume 5: Appendix CT-003-000/1). These will provide effective management and control of the impacts during the construction period.

17.4.21 The following measures in the draft CoCP Section 16 will reduce potentially significant adverse effects on water resources and flood risk to levels that will not be significant:

- stationary plant will be used with secondary containment measures such as plant nappies to retain any leakage of oil or fuel and reduce the risk of surface water or groundwater pollution;
- spill kits will also be provided where appropriate such as at: Capper's Lane main compound, A515 Lichfield Road main compound, Handsacre (A515) main compound (rail systems), all satellite compounds and at Capper's Lane auto-transformer station, Lyntus auto-transformer station, Mare Brook package sub-station, King's Bromley package sub-station to reduce the risk of surface water or groundwater pollution particularly in vulnerable areas such as SPZ1 (SES and AP2 ES Volume 2: CFA22 Map Book, Map CT-10);
- the use of oil interceptors, if required, at site offices and work compounds; and
- appropriate measures, such as the use of bunds of non-erodible material or silt or sediment fences adjacent to watercourses, such as Curborough Brook.

17.4.22 Measures defined in the draft CoCP Section 16, including detailed method statements, will ensure that there will be no effect on surface water quality or flows associated with construction; this will include release to surface waters sewers in the surrounding receptors, principally the Severn Trent Water sewer network.

17.4.23 In accordance with the draft CoCP, Section 16, monitoring will be undertaken in consultation with the Environment Agency prior to, during and post construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed temporary and permanent mitigation measures.

Assessment of impacts and effects

17.4.24 This section describes the significant effects following the implementation of avoidance and mitigation measures.

17.4.25 Further details of all the potential impacts is provided in the Water Resources Assessment report in SES and AP2 ES Volume 5: Appendix WR-002-022 and FRA in Volume 5: Appendix WR-003-022.

17.4.26 An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within the route-wide Water Resources Appendix (SES and AP2 ES Volume 5: Appendix WR-001-000).

17.4.27 It is not considered that projected climate change effects, combined with the effects from the construction of the AP2 revised scheme, will alter the significance of any of the reported effects on surface water and groundwater resources (see SES and AP2 ES Volume 3: Route- wide Effects Assessment for further information).

Temporary effects

Surface water

17.4.28 The assessment shows there will be no significant temporary adverse effects on surface water resources during the construction period.

17.4.29 As no significant effects on surface water features have been identified in the assessment, no significant adverse effects on abstractions or discharges will arise.

Groundwater

17.4.30 The assessment shows that there will be no significant temporary adverse effects on groundwater, on licensed abstractions and permitted discharges, or on surface water/groundwater interaction, or on water dependent habitats.

Flood risk

17.4.31 The assessment has identified no significant increase in risks resulting from all sources of flood risk during the construction process and therefore no significant temporary effects will arise.

Cumulative effects

17.4.32 No committed developments have been identified that will result in significant cumulative effects.

Permanent effects

Surface water

17.4.33 The assessment shows that there will be no permanent significant effects on surface water features from the AP2 revised scheme in the construction period.

17.4.34 Further details of the assessment, including the determination of the potential impacts that will not have significant effects are provided in SES and AP2 ES Volume 5: Appendix WR-002-022.

Groundwater

17.4.35 The assessment shows that there will be no likely significant effects on groundwater, to abstractions, and permitted discharges, to surface water/groundwater interaction, or on water-dependent habitats.

Flood Risk

17.4.36 The assessment shows that there will be no likely permanent adverse significant effects on flood risk as a result of the AP2 revised scheme.

17.4.37 Further details of the assessment, including the determination of the potential impacts that will not have significant effects are provided in SES and AP2 ES Volume 5: Appendix WR-003-022.

Cumulative effects

17.4.38 There are no committed developments that have been identified that will result in significant cumulative permanent effects.

Other mitigation measures

17.4.39 No other mitigation measures are envisaged for surface water, groundwater or flooding.

Summary of likely residual significant effects

17.4.40 The assessment shows that there will be no residual significant effects on surface water, groundwater or flood risk during the construction period.

17.5 Effects arising from operation

Avoidance and mitigation measures

17.5.1 Generic examples of design measures that will mitigate potentially significant effects on the quality and flow characteristics of surface watercourses and groundwater bodies during operation and management of the AP2 revised scheme are described in Volume 1.

17.5.2 The sustainable drainage systems used for drainage from the AP2 revised scheme, such as balancing ponds, may have an additional benefit of providing some treatment for water quality of the runoff before it is discharged into the environment.

17.5.3 Generic examples of management measures during operation and management of the AP2 revised scheme that will reduce potentially significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies are described in main ES Volume 1 and in the draft operation and maintenance plan for water resources and flood risk included in main ES Volume 5 Appendix WR-001-000.

17.5.4 Operation and management of the AP2 revised scheme is not likely to have a significant effect on the flood risk anywhere in the catchments through which it passes. Generic examples of management measures that will reduce flood risk are described in main ES Volume 1.

Assessment of impacts and effects

17.5.5 There are considered to be no significant adverse effects to surface water, groundwater or flood risk arising from operation of the AP2 revised scheme.

Other mitigation measures

17.5.6 There are considered to be no further measures required to mitigate adverse effects on surface water resources, groundwater resources or flood risk.

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