In Parliament – Session 2022 - 2023

HS2

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement

Volume 3: Route-wide effects

Q18

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Department for Transport

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Structure of the HS2 Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement

This report is part of the suite of documents that make up the SES1 and AP1 ES for High Speed Rail (Crewe – Manchester). The SES1 and the AP1 ES are separate documents, however, they are bound together and presented in a number of volumes shown in Figure 1 and described below:

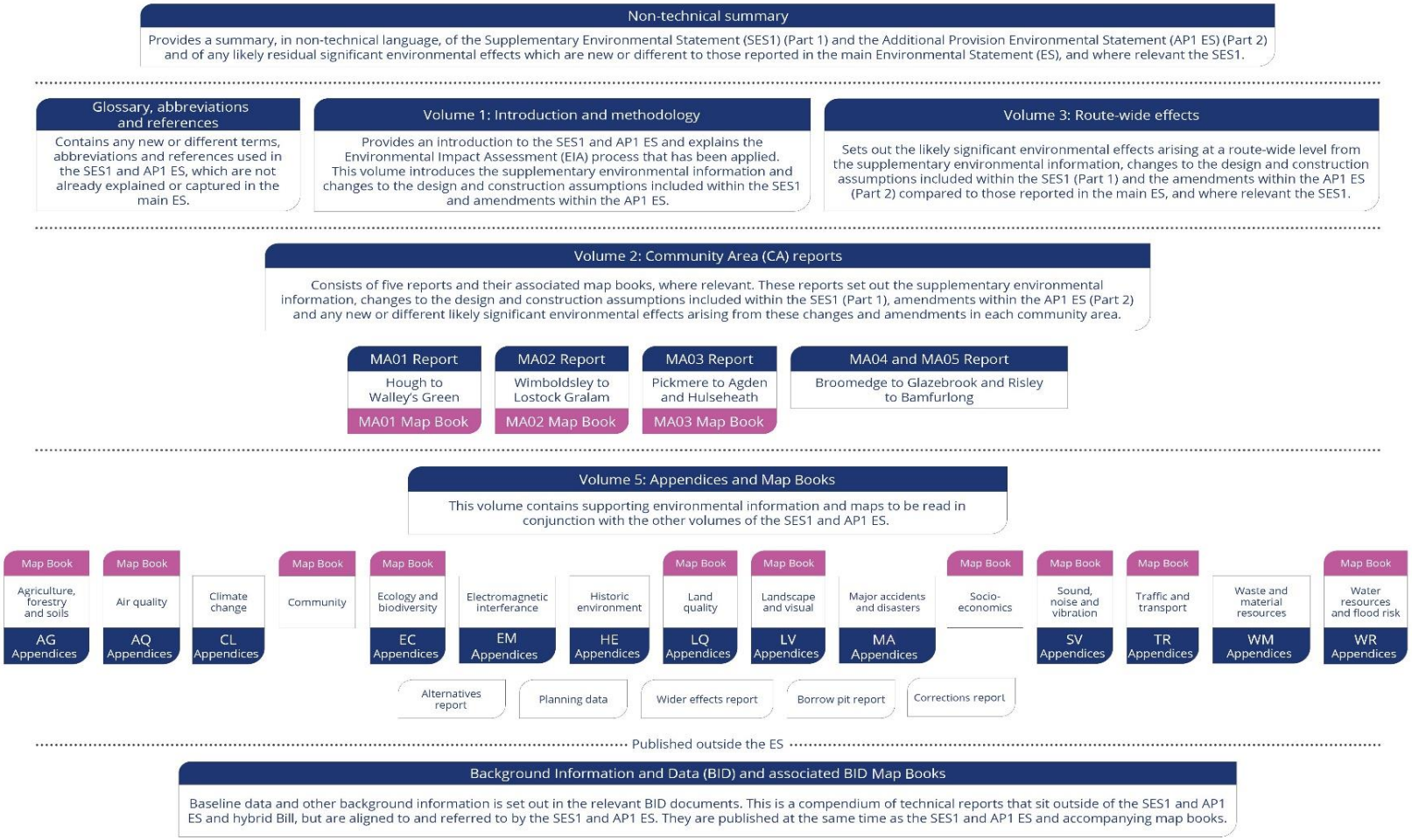
- Non-technical summary (NTS). This provides a summary in non-technical language of the SES1 (Part 1) and the AP1 ES (Part 2). It presents a summary of any likely residual significant environmental effects (i.e. effects which are likely to remain after mitigation measures are put in place), both beneficial and adverse, which are new, different or have been removed compared to those reported in the ES submitted to Parliament in January 2022 in support of the hybrid Bill for the HS2 Phase 2b Western Leg ('the main ES');
- Glossary of terms, list of abbreviations and references. This contains any new or different terms and abbreviations used throughout the SES1 and the AP1 ES which are not already explained in the main ES and provides the references cited in each of the volumes listed below;
- Volume 1: Introduction to the SES1 and the AP1 ES. This introduces the supplementary environmental information and changes to the design and to the construction assumptions included within the SES1 and amendments within the AP1 ES. The report explains the environmental impact assessment (EIA) process which has been applied;
- Volume 2: Community Area reports and map books. These report the supplementary environmental information and changes to the design and to the construction assumptions included within the SES1 (Part 1), amendments within the AP1 ES (Part 2) and any new, different or removed likely significant environmental effects arising from these changes and amendments in the following community areas:
  - MA01: Hough to Walley's Green;
  - MA02: Wimboldsley to Lostock Gralam;
  - MA03: Pickmere to Agden and Hulseheath;
  - MA04: Broomedge to Glazebrook; and
  - MA05: Risley to Bamfurlong.
- These effects are compared to those reported in the main ES (as amended by the SES1 for the AP1 amendments). The maps relevant to each community area are provided in separate Volume 2 map books and should be read in conjunction with the relevant community area report;
- The community area reports for MA04: Broomedge to Glazebrook and MA05 Risley to Bamfurlong are combined into one report for Volume 2 of the SES1 and AP1 ES;

- Note that changes to the design and to the construction assumptions and environmental baseline information for the remaining community areas (MA06: Hulseheath to Manchester Airport, MA07: Davenport Green to Ardwick, MA08: Manchester Piccadilly Station) will be reported in a separate, future SES2 and AP2 ES;
- Volume 3: Route-wide effects. This describes any new or different likely significant environmental effects arising at a route-wide level from the supplementary environmental information and changes to the design and to the construction assumptions included within the SES1 (Part 1) and the amendments within the AP1 ES (Part 2) compared to those reported in the main ES (as amended by the SES1 for the AP1 amendments); and
- Volume 5: Appendices and map book. These contain supporting environmental information and associated maps.

A Volume 4: Off-route effects report was produced as part of the main ES. An Off-route effects report has not been produced as part of this SES1 and AP1 ES. Any new or different off-route effects will be reported as part of SES2 and AP2 ES.

Certain reports and maps containing background information and data (BID) have been produced, which do not form part of the SES1 and AP1 ES. These documents are available online at https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement. The BID documents and maps present background survey information and other relevant background material.

Figure 1: Structure of the SES1 and AP1 ES



Structure of this report

This report is Volume 3 of the Supplementary Environmental Statement 1 (SES1) and Additional Provision 1 Environmental Statement (AP1 ES) for High Speed Two (HS2) Phase 2b Western Leg between Crewe and Manchester. It describes the likely significant environmental effects arising at a route-wide level from the supplementary environmental information, and changes to the design and construction assumptions included within the SES1 (Part 1) and amendments within the AP1 ES (Part 2) compared to those reported in the main ES. This report comprises the following sections:

Part 1 provides supplementary environmental information, where relevant, relating to any route-wide effects of:

- updated and new baseline information with respect to environmental surveys completed and additional information received since the main ES;
- changes to the design and construction assumptions that do not require changes to the Bill; and
- corrections relating to information within the main ES.

Part 2 provides environmental assessment information relating to route-wide effects of proposed amendments to the design that have resulted in the need to alter the powers conferred by the Bill.

Parts 1 and 2 also include the following, where relevant:

- a description of the SES1 changes (Part 1) or the proposed AP1 amendments (Part 2) that have triggered the need for reassessment of route-wide effects;
- an assessment of the environmental effects of the SES1 changes (Part 1) or the proposed AP1 amendments (Part 2) for relevant environmental topics, considering the:
  - scope, assumptions and limitations of the assessment;
  - environmental baseline;
  - effects arising during construction;
  - effects arising from operation; and
  - mitigation and residual effects.
- a summary of any new or different likely residual significant route-wide effects as a result of the SES1 changes (Part 1) and the proposed AP1 amendments (Part 2).

1 Introduction

1.1 The SES1 and AP1 ES

1.1.1 The High Speed Rail (Crewe – Manchester) Bill ('the Bill') was submitted to Parliament together with an Environmental Statement ('the main ES') in January 2022. Since the main ES, a number of updates or changes to environmental baseline information, the design, and construction assumptions have been identified, which may lead to new or different significant route-wide effects. These effects, depending on the type of change, are reported in SES1 or AP1 ES, which form Part 1 and Part 2 of this document respectively.

1.1.2 The Bill and the Additional Provision 1 to the Bill described above, if enacted by Parliament, will provide the powers to construct, operate and maintain the HS2 Phase 2b Western Leg. Changes made through the SES1 and AP1 ES do not change the principle of the 'original scheme' (i.e. the Bill scheme which was assessed in the main ES) in terms of provision of a route between Crewe and Manchester and the essential components of the construction and operation of that scheme.

1.1.3 SES1 contains updated environmental baseline information and scheme information relating to changes within the current limits and powers of the Bill, which therefore do not require an additional provision to the Bill. The SES1 changes of relevance to the route-wide assessment include:

- additional environmental baseline information for climate change and waste and material resources;
- changes to the design and construction assumptions which do not require changes to the Bill; and
- corrections to the main ES.

1.1.4 These changes are described in Part 1 and are assessed on a topic by topic basis using the same approach adopted in the main ES.

1.1.5 The purpose of SES1 is to describe the assessment and identify any new or different likely significant environmental effects arising from the changes.

1.1.6 The AP1 ES (Part 2) describes the likely significant route-wide effects of amendments to the design of the scheme which require the use of land outside the original limits of the Bill, additional access rights, or other extensions to the powers conferred by the Bill, making it necessary to submit an additional provision to the Bill.

1.1.7 The standard measures that will be used to mitigate likely significant adverse environmental effects during construction and operation of the scheme are described in Section 9 of

Volume 1 of the main ES and in the draft Code of Construction Practice (CoCP)[1] submitted in support of the Bill. Implementation of these measures has been assumed in this SES1 and AP1 ES.

1.2 Terminology used to describe the scheme

1.2.1 The following terms are used to differentiate between changes included in SES1 and those included in the AP1 ES:

- 'SES1 design changes' – changes to the scheme design reported in the SES1 that do not require additional powers;
- 'SES1 changes' – all changes reported in the SES1 that do not require additional powers. This may include new baseline information, changes to the design and construction assumptions, and corrections; and
- 'AP1 amendments' – changes to the scheme reported in the AP1 ES that include requirements for additional powers in the Bill.

1.2.2 In addition, the following terms are used to differentiate between the original scheme described in the main ES and subsequent changes and amendments:

- 'the SES1 scheme' – the original scheme with any changes described in SES1 that are within the existing powers of the Bill; and
- 'the AP1 revised scheme' – the original scheme as amended by SES1 changes and AP1 amendments.

1.3 Scope of this report

1.3.1 SES1 changes and AP1 amendments have been considered to determine their potential to give rise to any new or different likely significant route-wide environmental effects. Route-wide effects reported in this volume are those considered to be appropriately assessed at a geographical scale greater than that presented within Volume 2 of the SES1 and AP1 ES.

1.3.2 This route-wide assessment has been updated from the main ES based on SES1 changes and AP1 amendments in the following community areas:

- MA01: Hough to Walley's Green;
- MA02: Wimboldsley to Lostock Gralam;
- MA03: Pickmere to Agden and Hulseheath;
- MA04: Broomedge to Glazebrook; and
- MA05: Risley to Bamfurlong.

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 5: Technical appendices, draft Code of Construction Practice (Appendix CT-002-00000).* Available online at: https://www.gov.uk/government/publications/draft-code-of-construction-practice-ct-002-00000.

1.3.3 The SES1 changes and AP1 amendments for the community areas above are described in detail in the relevant SES1 and AP1 ES Volume 2 Community area reports. The SES1 changes are described in Part 1 of the Volume 2 reports and the AP1 amendments are described in Part 2 of the Volume 2 reports. In this report the titles and reference numbers of the SES1 changes and AP1 amendments are included (for example: Removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001)), where relevant.

1.3.4 Changes to the design and construction assumptions and environmental baseline information for the remaining community areas and off-route works will be included in a separate, future Supplementary Environmental Statement 2 (referred to as SES2) and Additional Provision 2 ES (referred to as AP2 ES).

1.3.5 The SES1 and AP1 ES route-wide assessment only assesses SES1 changes and AP1 amendments in community areas MA01 – MA05. A route-wide assessment of the remaining community areas and off-route works will be included in SES2 and AP2 ES. When information from all community areas and off-route works are available at SES2/AP2 full route-wide assessments will be reported, including for operational traffic and transport and updates to greenhouse gas assessment.

1.3.6 A scoping exercise was undertaken for each topic to determine if any of the SES1 changes or AP1 amendments would be likely to result in any new or different significant effects from those reported in the main ES.

1.3.7 The climate change, electromagnetic interference, major accidents and disasters, and waste and material resources assessments are reported only at a route-wide level rather than within the community area reports (Volume 2) of the SES1 and AP1 ES. This follows the approach taken in the main ES. For these route-wide topics, assessment has been carried out to determine whether there are any new or different likely significant route-wide effects as a consequence of the SES1 changes and AP1 amendments.

1.3.8 As a result of the scoping exercise, for topics where it was considered that there was potential for new or different likely significant route-wide effects as a consequence of the SES1 changes and AP1 amendments, further assessment has been carried out. For SES1, agriculture, forestry and soils, ecology and biodiversity, health, historic environment, socio-economics, traffic and transport, and water resources and flood risk are reported. For the AP1 ES, the following environmental topics are reported: agriculture, forestry and soils, ecology and biodiversity, health, historic environment, socio-economics, traffic and transport and water resources and flood risk. In each of these sections, the environmental topic is introduced and conclusions are presented.

1.3.9 A number of environmental topics have been scoped out of further route-wide assessment. This is where effects arising from the SES1 changes and AP1 amendments are localised in extent and no new or different likely significant route-wide effects have been identified. The environmental topics scoped out from SES1 are: air quality, community, land quality, landscape and visual, and sound, noise and vibration. The environmental topics scoped out from the AP1 ES are: air quality, community, land quality, landscape and visual, and sound, noise and vibration.

1.3.10 Some route-wide topic assessments of the SES1 changes and AP1 amendments have been assessed collectively due to the nature of the topic assessment methodology. These assessments are reported in Part 2 of this document.

1.4 Methodology for the route-wide assessment

1.4.1 The methodology for each environmental topic assesses effects in a way appropriate to that environmental topic, therefore the approach to assessment of route-wide effects varies between environmental topics. The Scope and Methodology Report (SMR)[2] (see Volume 5: CT-001-00001 of the main ES) presents the basis of the route-wide assessment for each topic.

1.4.2 Following the approach taken in the main ES, committed developments are considered within the assessments, but only referred to if there is the potential for new or different likely significant route-wide cumulative effects.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 5, Environmental Impact Assessment Scope and Methodology Report (CT-001-00001).* Available online at: https://www.gov.uk/government/collections/cross-topic-technical-appendices-for-high-speed-rail-crewe-manchester-environmental-statement#environmental-impact-assessment-scope-and-methodology-report.

Part 1: Supplementary Environmental Statement

2 Agriculture, forestry and soils

2.1 Introduction

2.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on agriculture, forestry, and soils arising from the construction and operation of the original scheme. It reported route-wide effects on best and most versatile (BMV) land in England and prime agricultural land in Scotland, and impacts on farm businesses, as a result of the original scheme.

2.1.2 This section of the report identifies any new or different significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

2.1.3 The changes in the areas of agricultural and BMV land that will be required temporarily and permanently for the AP1 revised scheme are detailed in Section 13 of this volume.

2.2 Changes to the assessment

2.2.1 A correction to the route-wide assessment reported in Volume 3 of the main ES has been identified. Table 1 provides a description of the correction, replicates the text from Volume 3 of the main ES, and provides the revised text.

Table 1: Summary of corrections to Section 2, Agriculture, forestry and soils of Volume 3: Route-wide effects of the main ES

Reference in the main ES	Reason for correction	Text in the main ES	Revised text	Change to significant effects and mitigation
Agriculture, forestry and soils Paragraph 2.5.9 Volume 3, Route-wide effects	Incorrect values applied in the main ES	Paragraph 2.5.9 Of this total requirement, approximately 30ha (3%) will be used for newly planted woodlands on agricultural land for visual screening and habitat creation to mitigate environmental effects arising from the Proposed Scheme. This mitigation is	Paragraph 2.5.9 Of this total requirement, approximately 115ha (12%) will be used for newly planted woodlands on agricultural land for visual screening and habitat creation to mitigate environmental effects arising from the Proposed Scheme. This mitigation is	No change to route-wide effects

Reference in the main ES	Reason for correction	Text in the main ES	Revised text	Change to significant effects and mitigation
		described in Volume 2, Ecology and biodiversity and Volume 2, Section 7, Landscape and visual.	described in Volume 2, Ecology and biodiversity and Volume 2, Section 7, Landscape and visual.	

2.2.2 A scoping exercise was undertaken to determine if the SES1 changes would be likely to result in any new or different significant effects on agriculture, forestry and soils from those reported in the main ES.

Assessment of effects during construction

2.2.3 This section identifies any new or different likely significant effects on agriculture, forestry and soils during construction as a result of the SES1 changes compared to those reported in Volume 3 of the main ES.

Temporary effects

2.2.4 The main ES reported that a total of approximately 1,995ha of agricultural land would be within the original scheme. The total agricultural land within the SES1 scheme is approximately 1,052ha with the majority of the reduction as a result of the Removal of the HS2 WCML connection (SES1-004-001).

2.2.5 The main ES reported that a total of approximately 1,995ha of agricultural land would be temporarily required within the original scheme, of which 856ha is BMV land. The SES1 scheme will temporarily require an area of agricultural land in England of approximately 1,052ha, of which approximately 474ha is BMV land.

2.2.6 The total area required temporarily for the construction of the SES1 scheme, which will be restored to agriculture, will be approximately 556ha.

2.2.7 However, the SES1 changes do not result in any new or different temporary significant route-wide level effects on agriculture, forestry or soils.

Permanent effects

2.2.8 The original scheme permanently required 927ha of agricultural land.

2.2.9 The total area of agricultural land in England permanently required for the SES1 scheme will be approximately 496ha, of which approximately 184ha is BMV land (Grade 2 and Subgrade 3a), compared to 311ha of BMV land (Grade 1, Grade 2 and Subgrade 3a) in the original scheme. The majority of the reduction is as a result of the Removal of the HS2 WCML connection (SES1-004-001).

2.2.10 The main ES (as corrected) reports that approximately 115ha[3] of agricultural land would be used for newly planted woodland or trees for visual screening or habitat, and approximately 12ha of agricultural land would be used for floodplain storage. For the SES1 scheme, a total of approximately 73ha of land will be used for newly planted woodland or trees on agricultural land for visual screening or habitat. Approximately 2ha will be used for providing floodplain storage.

2.2.11 The main ES reports that there is no commercial forestry within the study area, or within a 4km reference area along the route of the proposed Scheme. No changes in the assessment of impacts on forestry land have been made as a result of the SES1 scheme.

2.2.12 However, the SES1 changes do not result in any new or different permanent significant route-wide level effects on agriculture, forestry or soils.

[3] Note correction in Table 1 in relation to newly-planted woodlands on agricultural land.

3 Climate change

3.1 Introduction

3.1.1 Volume 3 of the main ES reported the route-wide greenhouse gas (GHG) emissions arising from the construction and operation of the original scheme. It also reported the assessment of in-combination climate change impacts and climate change resilience of the original scheme during construction and operation.

3.2 Changes to the assessment

3.2.1 The SES1 changes have been assessed together with AP1 amendments and their GHG emissions impact reported at a route-wide level in Section 14. This is because the global atmosphere is the receptor of all GHG emissions contributing to climate change. It is also our professional judgement that GHG data for SES1 changes and AP1 amendments separately would not make any discernible different to the effects reported in the main ES.

3.2.2 A scoping exercise was undertaken to determine if the SES1 changes would be likely to result in a material difference to the assessment of in-combination climate change impacts or the climate change resilience reported in Volume 3 of the main ES. This determined that there would be no changes to the outcome of the in-combination climate change impacts assessment or the climate change resilience assessment, as reported in the main ES.

4 Ecology and biodiversity

4.1 Introduction

4.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on ecology and biodiversity arising from the construction and operation of the original scheme.

4.1.2 This section of the report identifies any new or different significant effects to those reported in Volume 3 of the main ES due to the SES1 changes for designated sites. New or different significant effects relating to other ecological resources, i.e. habitats and species, are identified in the SES1 and AP1 ES Volume 2 community area reports, however they are not reassessed at a route-wide level in this report.

4.2 Changes to the assessment

Designated sites

Statutory designations

4.2.1 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different likely significant effects on ecology and biodiversity from those reported in Volume 3 of the main ES.

4.2.2 The SES1 changes will not result in any new or different likely significant effects on statutory designated nature conservation sites compared to those reported in Volume 3 of the main ES.

Non-statutory designations

4.2.3 There are three Local Wildlife Sites (LWS) that are non-statutory nature conservation sites that have been designated since publication of the main ES that are relevant to the SES1 scheme. In addition, the status of four other relevant LWSs have been amended. Information on the impacts for the newly-designated sites is provided in the following sections and listed in Table 2 and details of the changes for both newly designated sites and those where they have been amended are provided in SES1 and AP1 ES Volume 5: Appendix EC-001-00000 and Map Series EC-01.

Table 2: New LWS relevant to the SES1 scheme

Site name	Community area	Change	Distance from the SES1 scheme
Heath Farm Marshy Grassland	MA01: Hough to Walley's Green	LWS designated since publication of the main ES	229m south of the SES1 scheme
Bank Hall Farm Flush	MA02: Wimboldsley to Lostock Gralam	LWS designated since publication of the main ES	Partially within SES1 scheme - directly affected

Site name	Community area	Change	Distance from the SES1 scheme
Veteran Ash Tree, Bank Hall Farm	MA02: Wimboldsley to Lostock Gralam	LWS designated since publication of the main ES	30m south-east of the SES1 scheme

4.2.4 The direct effect on Bank Hall Farm Flush LWS is a new adverse effect that is significant at the county/metropolitan level. There are no significant adverse effects on either of the other two LWS that have been designated since publication of the main ES, or the four LWS where the status has been amended.

4.2.5 Removal of the HS2 WCML connection (SES1-004-001) will result in the avoidance of effects reported in the main ES at Fox Covert and Meadows Site of Biological Importance (SBI), within the Broomedge to Glazebrook area (MA04), and Gorse Covert Mounds LWS, Silver Lane Ponds LWS, Eleven Acre Common LWS and Ponds Near Lightshaw Lane SBI within the Risley to Bamfurlong area (MA05).

4.2.6 As a result, there will be 30 non-statutory nature conservation sites affected by the SES1 scheme, four less than the 34 identified in the main ES. The overall number of LWS where there will be significant effects, taking into account the new effect on Bank Hall Farm Flush LWS, is reduced from 30 to 28, and the number of SBIs where there will be significant effects is reduced from four to two. However, the regional level effect identified in the main ES will not be changed by the reduction in the number of sites significantly affected.

4.2.7 Change to the diversion of a Scottish Power 132kV underground route, near Belt Wood (SES1-003-001) will remove the loss of woodland habitat (400m^2) from Belt Wood Ancient Woodland Inventory site (AWI) which was reported in the main ES. Removal of the HS2 WCML connection (SES1-004-001) will also remove the loss of ancient woodland at Coroner's Wood AWI (0.5ha) that was reported in the main ES. The number of AWIs where there will be a significant adverse effect at the national level is therefore reduced from 17, as reported in the main ES, to 15.

Species

4.2.8 The removal of the HS2 WCML connection (SES1-004-001) will remove the effects on species in the Broomedge to Glazebrook (MA04) and Risley to Bamfurlong (MA05) areas reported in the main ES. In addition, this SES1 design change will remove the effects on the following species in the Pickmere to Agden and Hulseheath area (MA03):

- meta-population (GCNMP1.3.11) of great crested newt in a network of 10 ponds located north of High Legh;
- population (GCNP1.3.12) of great crested newt in a pond located south-west of Hale in the will also be removed as a result of this SES1 design change;
- bat assemblage between the M56, the River Bollin and the Bridgewater Canal within the Pickmere to Agden and Hulseheath area (MA03) and Broomedge to Glazebrook area (MA04); and

- wintering bird assemblage between Park Farm and Agden Brow and the breeding bird assemblage between Pownallgreen Farm and Park.

4.2.9 The SES1 changes do not result in any new or different significant route-wide level effects on species.

Habitats

4.2.10 The Removal of the HS2 WCML connection (SES1-004-001) will avoid the loss of all habitats in the Broomedge to Glazebrook (MA04) and Risley to Bamfurlong (MA05) areas reported in the main ES.

4.2.11 There will be at least 22 veteran trees lost as a result of the SES1 scheme, compared to at least 24 in the original scheme.

4.2.12 The SES1 scheme will result in the following losses to the most notable habitats that are described in the main ES:

- ancient woodland – the SES1 scheme will result in the loss of 5.1ha of ancient woodland, compared to 5.7ha in the original scheme;
- semi-natural broadleaved woodland – the SES1 scheme will result in the loss of 20.7ha of semi-natural broadleaved woodland, compared to 53.5ha in the original scheme;
- grassland – the SES1 scheme will result in the loss of 24.9ha of unimproved and semi-improved grassland, compared to 27.8ha in the original scheme;
- hedgerow – the SES1 scheme will result in the loss of 245.9km of hedgerows, compared to 323.3km in the original scheme; and
- ponds – the SES1 scheme will result in the loss of 265 ponds, compared to 313 in the original scheme.

4.2.13 The SES1 changes do not result in any new or different significant route-wide level effects on habitats.

5 Electromagnetic interference

5.1 Introduction

5.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on electromagnetic interference (EMI) arising from the construction and operation of the original scheme. It summarised the route-wide effects on human health, electrical equipment, third party assets and infrastructure running parallel to the original scheme, for example other railway infrastructure, metallic fences, pipelines, overhead power cables and telecommunications cables on motorways.

5.1.2 Volume 3 of the main ES identified a likely significant effect to three third-party receptors on a precautionary basis. These were Pickmere Radio Telescope, Manchester Airport and The Christie NHS Foundation Hospital, which contain very sensitive equipment or systems.

5.1.3 This section of the report identifies any new or different significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

5.2 Changes to the assessment

5.2.1 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different likely significant effects on EMI from that reported in Volume 3 of the main ES.

5.2.2 SES1 and AP1 ES Volume 5, Appendix: EMI-001-00000, describes the EMI assessment and documents the differences to effects to potentially affected receptors as a result of the SES1 design changes and updated baseline data.

5.2.3 The SES1 changes, including updated baseline data are not considered to result in any new or different likely significant route-wide effects from those presented in Volume 3 of the main ES.

6 Health

6.1 Introduction

6.1.1 Volume 3 of the main ES reported the route-wide impacts and likely effects on health arising from the construction and operation of the original scheme. It reported route-wide effects on the health of people within the population across the route as a result of the original scheme.

6.1.2 This section of the report identifies any new or different effects to those reported in Volume 3 of the main ES due to the SES1 changes.

6.2 Changes to the assessment

6.2.1 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different potential health effects from those reported in Volume 3 of the main ES.

6.2.2 The SES1 changes and the route-wide assessment on health as a result of operational airborne noise have not been considered on an individual basis as it is not possible to separate out the impacts and effects of each change. It is not feasible to present a separate assessment for the SES1 scheme and the AP1 scheme, as road traffic information, which is a key input to the operational airborne noise model, is not produced separately for the SES1 scheme and the AP1 scheme. Consequently, the SES1 changes have been combined with AP1 amendments and their airborne noise impact on health reported at a route-wide level in Section 17.

Employment and income

6.2.3 The main ES reported that the original scheme would have a route-wide beneficial health effect associated with increased opportunities for employment and training. This effect was due to the creation of an estimated 87,800 person years of construction employment (equivalent to 8,800 permanent full time construction jobs) at construction work sites along the HS2 route. Depending on skills, communities within commuting distance of the original scheme would benefit from new employment opportunities, as well as from the training opportunities provided by HS2's apprenticeship scheme.

6.2.4 The SES1 changes will reduce the amount of new employment created by the construction of the SES1 scheme to 67,800 person years of construction employment (equivalent to 6,800 permanent full-time construction jobs). This will result in a different (reduced) beneficial health effect compared with the main ES.

Transport

6.2.5 The main ES reported an adverse health effect associated with a temporary increase in levels of stress experienced by public transport users during the construction of the original scheme, as a result of rail possessions of up to 54 hours and blockades of up to nine days, affecting the West Coast Main Line (WCML), the Sandbach to Northwich Line and the Mid Cheshire Line. As described in Section 21 Traffic and Transport, the SES1 changes will result in a minor reduction in the number of possessions and blockades in the Hough to Walley's Green area (MA01) and Wimboldsley to Lostock Gralam area (MA02), and the removal of all possessions and blockades affecting the WCML Crewe to Carlisle between Golborne junction and Springs Bank junction in the Risley to Bamfurlong area (MA05). As a result of the changes to the possessions and blockades in these three community areas, there will be a different (reduced) adverse route-wide effect on traveller stress to the effect reported in the main ES.

Housing

6.2.6 The main ES reported that the construction of the original scheme would have a route-wide adverse health effect as a result of the demolition of 87 residential properties and subsequent relocation of residents. The majority of these residents would be likely to experience some degree of adverse effect on their wellbeing resulting from the requirement to move, such as an increase in stress.

6.2.7 The SES1 changes will reduce the number of residential demolitions reported in the main ES by 24 properties, to 63 properties. This will result in a different (reduced) route-wide adverse health effect compared with the main ES.

7 Historic environment

7.1 Introduction

7.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on the historic environment arising from the construction and operation of the original scheme. It provided a summary of the heritage assets assessed across all community areas and reported that there would be no significant route-wide effects on the historic environment as a result of the original scheme.

7.1.2 This section of the report identifies any new or different significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

7.2 Changes to the assessment

7.2.1 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different likely significant effects on historic environment assessment from those reported in Volume 3 of the main ES.

7.2.2 SES1 and AP1 ES Volume 5, Appendix: HE-002-00000 provides a description of the differences to the assessment in relation to heritage assets as a result of the SES1 changes. No new or different route-wide effects are predicted in relation to the historic environment.

8 Major accidents and disasters

8.1 Introduction

8.1.1 Volume 3 of the main ES reported an assessment of the route-wide impacts and likely significant effects arising directly from the construction and operation of the original scheme if it were to be affected by a major accident and/or disaster.

8.1.2 This section of the report identifies any new or different likely significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

8.2 Changes to the assessment

8.2.1 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different likely significant effects on the vulnerability of the SES1 scheme to major accidents and disasters from that reported in Volume 3 of the main ES.

8.2.2 Foreseeable risks have been recorded in a risk register, as required under the Construction (Design and Management) (CDM) 2015 Regulations[4]. Foreseeable risks recorded within the risk register include those attributable to SES1 changes and AP1 amendments, in addition to foreseeable risks identified as part of the ongoing CDM risk assessment process.

8.2.3 A review of the risk register has been undertaken. This review has identified an additional route-wide risk event, for which impact on an environmental receptor (including members of the public who are not employees or passengers of HS2) has the potential to be a major accident, relating to risk of striking high voltage utility cables/structures during construction. This additional route-wide risk event has been identified and recorded as part of the ongoing CDM risk assessment process, and is not introduced as a direct result of any SES1 change or AP1 amendment. This risk event is presented in Table 3.

8.2.4 A full record of risk identification, risk screening and final risk assessment is provided in Major accidents and disasters risk screening in SES1 and AP1 ES Volume 5: Appendix MA-001-00000.

Table 3: Assessment of potential major accident and/or disaster event during construction

ID	Risk event	Reasonable worst case if event did occur	Summary of key risk management and mitigation measures present to demonstrate risks to be ALARP (refer to SES1 and AP1 ES Volume 5 MA-001-00000 for full details).
C17	Striking high voltage utility cables/structures	Utility outage and direct injury and fatality/injury to member(s) of public	Consultation with National Highways, local authorities, and other asset owners, to manage interfaces and define appropriate control measures.

[4] *The Construction (Design and Management) Regulations 2015.* (SI 2015 No. 51). Her Majesty's Stationery Office, London. Available online at: http://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf.

ID	Risk event	Reasonable worst case if event did occur	Summary of key risk management and mitigation measures present to demonstrate risks to be ALARP (refer to SES1 and AP1 ES Volume 5 MA-001-00000 for full details).
			The draft CoCP requires route-wide, local area and site-specific traffic management measures to be implemented during the construction of the scheme on or adjacent to public roads, bridleways, footpaths and other PRoW affected by the scheme as necessary. Priority will be given to the use of the main road network and site haul routes for construction traffic, and transportation via rail. Planning of delivery routes and timing of deliveries will be undertaken. The land required for the construction has been established to provide adequate space for construction plant.

8.2.5 No new or different likely residual significant flood risk effects or changes to the climate change resilience assessment from those reported in Volume 3 of the main ES have been identified as a result of the SES1 changes.

8.2.6 The SES1 changes do not result in any new or different likely significant effects.

9 Socio-economics

9.1 Introduction

9.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects in relation to socio-economics arising from the construction and operation of the original scheme. It reported route-wide effects as a result of the original scheme in relation to:

- route-wide construction employment created (direct and indirect);
- employment in businesses directly and indirectly affected by construction;
- operational employment; and
- operational effects on existing business employment.

9.1.2 This section of the report identifies any new or different significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

9.2 Changes to the assessment

9.2.1 There are a number of corrections to the route-wide assessment reported in Volume 3 of the main ES. Table 4 provides a description of the correction, replicates the text from Volume 3 of the main ES, and provides the revised text.

Table 4: Summary of corrections to Section 12, Socio-economics of Volume 3: Route-wide effects of the main ES

Reference in the main ES	Reason for correction	Text in the main ES	Revised text	Change to significant effects and mitigation
Socio-economics Paragraph 12.7.19 Table 28, Volume 3, Route-wide effects	The summary of the route-wide construction socio-economic assessment reported in Volume 3 of the main ES reported an incorrect magnitude for Construction employment created (direct)	Paragraph 12.7.19, Table 28: Construction employment created (direct) - **Medium magnitude.**	Paragraph 12.7.19, Table 28: Construction employment created (direct) - **High magnitude.**	No change to route-wide effects or mitigation reported in the main ES.
Socio-economics Paragraph 12.8.3 Table 29, Volume 3 Route-wide effects	The number of direct operational jobs created at the Crewe North rolling stock depot reported in Volume 3 of the main ES was incorrect.	Paragraph 12.8.3 Along the HS2 network there will be an estimated 4,180 direct operational jobs created. Table 29 presents the number of	Paragraph 12.8.3 Along the HS2 network there will be an estimated 4,200 direct operational jobs created. Table 29 presents the number of	No change to route-wide effects or mitigation reported in the main ES. Despite the increased number of direct operational jobs created at the Crewe North

Reference in the main ES	Reason for correction	Text in the main ES	Revised text	Change to significant effects and mitigation
		operational jobs by location. Paragraph 12.8.3, Table 29, third entry **Total employment (estimated): 330**	operational jobs by location. Paragraph 12.8.3, Table 29, third entry **Total employment (estimated): 350**	rollingstock depot, the direct operational employment created remains a major beneficial effect, as reported in the main ES.

9.2.2 A scoping exercise was undertaken to determine if the SES1 changes would be likely to result in any new or different significant effects in relation to socio-economics from those reported in the main ES.

Construction effects

9.2.3 There will be a reduction from 87,800 person years of construction employment (equivalent of 8,800 permanent full-time construction jobs) reported in the main ES to 67,800 person years of construction employment (equivalent of 6,800 permanent full-time construction jobs) for the SES1 scheme. There will be no change to the major beneficial significant effect reported in the main ES as a result of the SES1 changes.

9.2.4 As a result of the SES1 changes, the total number of jobs displaced by construction of the original scheme (6,500 jobs) will fall to 6,210 displaced jobs when compared to the main ES. This is as a result of the SES1 design change for the Removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001), meaning that jobs in the Risley to Bamfurlong area (MA05) will no longer be displaced.

9.2.5 The main ES reported that in total, approximately 1,100 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase. With the SES1 changes, 1,050 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase. The significance of effect will remain moderate adverse as reported in the main ES.

9.2.6 The total number of jobs that are estimated to be lost due to businesses being displaced as a result of in-combination or isolation effects is expected to reduce from a total of 550 jobs to 470 jobs as a result of the SES1 scheme. This will reduce the magnitude of impact from high to medium, therefore changing the effect of that reported in the main ES, from moderate to a minor adverse effect, which is not significant.

Operation effects

9.2.7 There will be a reduction from 4,200 direct operational jobs created as reported in the main ES[5] to 2,720 direct operational jobs due to the SES1 design change for the Removal of the HS2 WCML connection (SES1-004-001), which includes changes to operational jobs associated with off-route works at Annandale depot, Carlisle Station and Preston Station[6]. Further information is provided in SES1 and AP1 ES Volume 1. Table 5 presents the number of operational jobs by location for the SES1 scheme. There will be no change to the major beneficial significant effect for direct operational employment reported in the main ES as a result of the SES1 changes.

Table 5: SES1 scheme: direct operational employment

Location of operational employment	Total estimated employment (main ES)[7]	Total estimated employment (main ES and SES1)
Manchester Airport High Speed station	160	160
Manchester Piccadilly High Speed station	230	230
Crewe North rolling stock depot	350	220
Annandale depot	160	0
Carlisle Station (train crew)	400	0
Preston Station (train crew)	750	200
Crewe Station	320	320
Birmingham Curzon Street	420	420
London Euston	340	320
Edinburgh Waverley	140	0
Glasgow Central	190	120
Liverpool Lime Street	100	130
Manchester Piccadilly (traincrew)	430	390
Manchester Airport (retail employment)	60	60
Manchester Piccadilly (retail employment)	150	150
Total	**4,200**	**2,720**

9.2.8 The total number of jobs that are estimated to be created route-wide through indirect effects as a result of the operational phase will change by a small degree, however such change is considered to be negligible in a route-wide context and will not change the conclusions of the assessment.

[5] Note correction in Table 4 in relation to total operational employment.

[6] A full assessment of off-route works will be reported in Volume 4 of the SES2 and AP2 ES.

[7] Note corrections in Table 4 in relation to employment at Crewe Station and total operational employment.

Conclusion

9.2.9 The proposed SES1 changes will result in the removal of a significant effect in relation to job displacement as a result of in-combination and isolation effects during construction.

10 Traffic and transport

10.1 Introduction

10.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on traffic and transport arising from the construction and operation of the original scheme.

10.2 Changes to the assessment

10.2.1 The SES1 changes and AP1 amendments have been considered together as it is not possible to separate out the impacts and effects of each change within the modelling. This is because alterations in construction traffic flows cannot generally be directly attributed to particular SES changes or amendments. Consequently, the SES1 changes have been combined with AP1 amendments and their traffic and transport impact reported at a route-wide level in Section 21.

11 Waste and material resources

11.1 Introduction

11.1.1 Volume 3 of the main ES reported an assessment of the route-wide impacts and likely significant effects associated with the off-site disposal to landfill of solid waste that will be generated by the construction and operation of the original scheme.

11.1.2 This section of the report identifies any new or different likely significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

11.2 Changes to the assessment

11.2.1 An assessment has been undertaken for the SES1 changes to identify if they would generate new or different quantities of solid waste compared to those reported in the main ES and to identify any new or different likely significant effects on waste requiring off-site disposal to landfill from that reported in Volume 3 of the main ES.

11.2.2 The SES1 changes are considered likely to change the quantities of waste generated during construction and operation of the SES1 scheme, when compared with the quantities reported for the original scheme in Volume 3 of the main ES. However, the majority of the changes are generally considered to have a low impact with respect to waste and material resources.

11.2.3 The SES1 changes with more substantial impacts on waste generation, considered relevant to the assessment of the likely significant environmental route-wide effects associated with waste and material resources during construction are as follows:

- Enhancement of landscape mitigation at Walley's Green embankment (SES1-002-001); and
- Removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001).

11.2.4 Due to the integrated route-wide approach to managing waste and excavated materials, it is not possible to disaggregate changes to waste generation resulting from SES1 changes from those arising due to AP1 amendments. In particular, excavated materials will be shared freely between construction elements and community areas to optimise the use of these materials, replacing the requirement for off-site disposal and imported fill. This integrated approach precludes a separate assessment of the SES1 changes from the AP1 amendments.

11.2.5 Therefore, the SES1 changes and the resulting changes to waste arisings during construction and operation are assessed in combination with the AP1 amendments in Section 22, as part of changes to the AP1 revised scheme.

12 Water resources and flood risk

12.1 Introduction

12.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on water resources and flood risk arising from the construction and operation of the original scheme. It reported route-wide effects on surface water and groundwater resources (quality and quantity) and flood risk as a result of the original scheme.

12.1.2 This section of the report identifies any new or different significant effects to those reported in Volume 3 of the main ES due to the SES1 changes.

12.2 Changes to the assessment

12.2.1 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different likely significant effects on water resources and flood risk from those reported in Volume 3 of the main ES.

12.2.2 None of the SES1 changes have been identified as likely to result in any new or different significant route-wide effects on surface water and groundwater resources (quality and quantity) from those presented in Volume 3 of the main ES.

12.2.3 An assessment of the effects of the SES1 changes in relation to the objectives of the Water Framework Directive (WFD) is reported below.

Water Framework Directive compliance

12.2.4 An assessment was undertaken to determine if the SES1 changes would likely result in any new or different effects on the current status and/or future achievement of status objectives of the WFD water bodies affected by the HS2 route, from those effects reported in Volume 3 of the main ES. Full details of all the changes are provided in SES1 and AP1 ES Volume 5: Appendix WR-001-00000.

12.2.5 A summary is provided below of the changes in WFD water bodies affected by the SES1 scheme and any adverse (amber) effects, which have the potential to result in a non-compliance with the statutory objectives of the WFD Regulations.

Water bodies affected

12.2.6 A total of 30 WFD water bodies were identified as being affected by the original scheme in the main ES, including 26 surface water bodies and four groundwater bodies.

12.2.7 The Removal of the HS2 WCML connection (SES1-004-001) removes all effects reported in the main ES on those water bodies that are contained entirely within the Broomedge to Glazebrook (MA04) and Risley to Bamfurlong (MA05) community areas. These are:

- Bridgewater Canal (GB71210001);
- Mersey/Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin) (GB112069061011);
- Sinderland Brook (GB112069060980);
- Glaze (GB112069061420);
- Spittle Brook (GB112069061020);
- Hey/Borsdane Brook (GB112069064520); and
- Sankey and Glaze Carboniferous Aquifers (GB41202G100100).

12.2.8 Accordingly, these seven WFD water bodies are no longer affected and have been removed from the WFD assessment.

Adverse effects on current status

12.2.9 Volume 3 of the main ES identified adverse (amber) effects with the potential to cause a deterioration in the current status of six surface water bodies and two groundwater bodies. These include:

- Wistaston Brook (GB112068055280);
- Weaver (Marbury Brook to Dane) (GB112068060460);
- Puddinglake Brook (GB112068060220);
- Wade Brook (GB112068060370);
- Hey/Borsdane Brook (GB112069064520);
- Timperley Brook (GB112069061260);
- Weaver and Dane Quaternary Sand and Gravel Aquifers (GB41202G991700); and
- Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers (GB41201G101700).

12.2.10 The SES1 changes remove a number of adverse (amber) effects that were identified in the main ES, associated with six water bodies. These are summarised below.

12.2.11 The Removal of the HS2 WCML connection (SES1-004-001) removes the adverse (amber) effects associated with the following water bodies and scheme components:

- Hey/Borsdane Brook (GB112069064520) – multiple culverts;
- Weaver and Dane Quaternary Sand and Gravel Aquifers (GB41202G991700) – Manchester Ship Canal viaduct foundations;
- Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers (GB41201G101700) – Lowton cutting.

12.2.12 The Removal of MA02 Borrow Pit D (SES1-002-002) removes the adverse (amber) effects associated with this scheme component on the following water bodies:

- Puddinglake Brook (GB112068060220);
- Weaver and Dane Quaternary Sand and Gravel Aquifers (GB41202G991700).

12.2.13 The assessment has concluded that the SES1 changes will not cause any new adverse (amber) effects that may pose a risk of deterioration of the current status of any surface or groundwater water bodies.

Adverse effects on future achievement of status objectives

12.2.14 Volume 3 of the main ES identifies adverse (amber) effects with the potential to prevent the future achievement of the status objectives of two surface water bodies and one groundwater body:

- Timperley Brook (GB112069061260);
- Hey/Borsdane Brook (GB112069064520); and
- Lower Mersey Basin and North Merseyside PermoTriassic Sandstone Aquifers (GB41201G101700).

12.2.15 The Removal of the HS2 WCML connection (SES1-004-001) removes two of the adverse (amber) effects that were identified in the main ES, associated with the following water bodies and scheme components:

- Hey/Borsdane Brook (GB112069064520); and
- Lower Mersey Basin and North Merseyside PermoTriassic Sandstone Aquifers (GB41201G101700).

12.2.16 The adverse (amber) effects identified in the main ES on the Timperley Brook (GB112069061260) water body therefore remain at this stage. These effects relate to a potential worsening of existing urban diffuse pollution pressures, and the potential to inhibit the implementation of measures identified to address these pressures, associated with highway drainage discharges.

12.2.17 The assessment has concluded that the SES1 changes will not cause any new adverse (amber) effects that may pose a risk of preventing the future achievement of the status objectives of any surface or groundwater water bodies.

Summary of compliance

12.2.18 The assessment has concluded that the SES1 changes will not cause any new or different adverse effects that pose a risk of causing a deterioration of the current status of any surface or groundwater water body, or preventing any water body from achieving its status objectives.

12.2.19 Moreover, the SES1 changes remove a number of the adverse (amber) effects identified in the main ES that had the potential to cause a deterioration in water body status and/or prevent the future achievement of water body status objectives.

12.2.20 Adverse (amber) effects identified in the main ES remain, however, for the following surface water bodies:

- Wistaston Brook (GB112068055280);
- Weaver (Marbury Brook to Dane) (GB112068060460);
- Puddinglake Brook (GB112068060220);
- Wade Brook (GB112068060370);
- Timperley Brook (GB112069061260).

12.2.21 These adverse effects relate to impacts from highway drainage discharges and may give rise to the potential risk of the SES1 scheme being non-compliant with the statutory objectives of the WFD.

12.2.22 In order to avoid the necessity of seeking an exemption under the WFD Regulations, additional mitigation measures are therefore still required to manage the risk of status deterioration within these water bodies. A range of mitigation measure options have been identified in consultation with the Environment Agency with the aim to ensure no residual risks of status deterioration. Potential measures are detailed in Volume 3 and Volume 5 (Appendix WR-01-00000) of the main ES.

12.2.23 While it is currently anticipated that it will be feasible to develop and implement mitigation measures to ensure that there is no residual risk of deterioration in status for these water bodies, further detailed work is required to inform the best suitable solution. If these risks cannot be mitigated, a Regulation 19 exemption assessment will be required for each affected water body and submitted for approval by the Environment Agency (as the competent regulatory authority). Further details of the Regulation 19 exemption assessment process are provided in Annex M of Volume 5 (Appendix CT-001-00001_Part 3) of the main ES.

12.2.24 Whilst every effort will be made to ensure a Regulation 19 exemption assessment is not required, where unavoidable an assessment will be prepared on a route-wide and/or specific water body basis, as appropriate, in consultation with the Environment Agency and reported to Parliament during passage of the Bill.

Flood risk

12.2.25 An assessment was undertaken to determine if the SES1 changes would be likely to result in any new or different likely significant effects from those reported in Volume 3 of the main ES.

12.2.26 Volume 3 of the main ES identifies the potential for significant adverse effects related to flood risk at three locations along the HS2 route, requiring development of additional mitigation in order to fully comply with the requirements of the Exception Test, i.e. to ensure that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, to reduce flood risk overall.

12.2.27 Removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001) will remove the potential for a significant adverse effect on flood risk at the commercial, industrial and

residential receptors associated with the retaining walls on the north and south banks of the Manchester Ship Canal.

12.2.28 The SES1 design changes do not affect the additional mitigation currently proposed for the Palatine Road vent shaft at Northenden (in the MA07 area) and the diversion of tributaries of Birkin Brook due to the Ashley Railhead (in the MA06 area). Therefore, the SES1 scheme remains aligned with the principles of the Sequential Test and Exception Test policies in the National Planning Policy Framework (NPPF).

Part 2: Additional Provision Environmental Statement

13 Agriculture, forestry and soils

13.1 Introduction

13.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on agriculture, forestry and soils arising from the construction and operation of the original scheme. It reported route-wide effects on best and most versatile (BMV) land in England and prime agricultural land in Scotland, and impacts on farm businesses, as a result of the original scheme.

13.1.2 This section of the AP1 ES identifies any new or different likely significant effects on agriculture, forestry and soils as a result of the AP1 amendments compared to those reported in Volume 3 of the main ES, as amended by SES1.

13.2 Changes to the assessment

13.2.1 An assessment was undertaken to determine if the SES1 changes and AP1 amendments will be likely to result in any new or different likely significant effects on agriculture, forestry and soils from those reported in Volume 3 of the main ES.

Assessment of effects during construction

13.2.2 This section of the AP1 ES identifies any new or different likely significant effects on agriculture, forestry and soils during construction as a result of the AP1 revised scheme compared to those reported in Volume 3 of the main ES.

Temporary effects

13.2.3 An area of 1,052ha of agricultural land, including approximately 474ha of BMV land in England, would be required temporarily for the construction of the original scheme, as amended by SES1.

13.2.4 The AP1 revised scheme will temporarily require an area of agricultural land in England of approximately 1,060ha, of which approximately 417ha is BMV land in England, which is an increase of 8ha of agricultural land, compared to the original scheme, as amended by SES1.

13.2.5 The original scheme, as amended by SES1, would restore approximately 556ha to agriculture. The total area required temporarily for the construction of the AP1 revised scheme, which will be restored to agriculture, will be 564ha.

13.2.6 However, the AP1 revised scheme does not result in any new or different temporary significant route-wide level effects on agriculture, forestry or soils.

Permanent effects

13.2.7 The original scheme, as amended by SES1, will permanently require 496.14ha of agricultural land. The total area of land required permanently required for the AP1 revised scheme will be 496.46ha, of which approximately 146ha is BMV land (Grade 2 and Subgrade 3a).

13.2.8 The original scheme, as amended by SES1, will permanently require 72.78ha of agricultural land for newly planted woodland or trees for visual screening or habitat, and 2ha for floodplain storage. The AP1 revised scheme will permanently require a total of 72.96ha of agricultural land for newly planted woodland or trees for visual screening or habitat, and 2ha for floodplain storage.

13.2.9 No changes in the assessment of impacts on forestry land have been made as a result of the AP1 revised scheme.

13.2.10 However, the AP1 revised scheme does not result in any new or different permanent significant route-wide level effects on agriculture, forestry or soils.

14 Climate change

14.1 Introduction

14.1.1 Volume 3 of the main ES reported the assessment of the GHG emissions for the original scheme during construction and operation. It also reported the assessment of in-combination climate change impacts and climate change resilience during construction and operation.

14.1.2 This section of the AP1 ES identifies any material changes to the GHG assessment reported in Volume 3 of the main ES due to SES1 changes and AP1 amendments combined (referred to below as the AP1 revised scheme).

14.2 Changes to the assessment

14.2.1 An assessment was undertaken to determine if the combination of SES1 changes and AP1 amendments have the potential, combined, to result in a material difference to the GHG assessment reported in Volume 3 of the main ES. The SES1 changes have been assessed together with AP1 amendments since all GHG emissions, irrespective of their source, contribute to climate change. It is our professional judgment that reporting GHG emissions for SES1 changes and AP1 amendments separately would not make any discernible difference to the effects reported in the main ES.

GHG scope and methodology

14.2.2 The methodology used to assess the AP1 revised scheme's GHG emissions remains the same as in the main ES. Data were collected from design teams covering elements such as: volumes of construction material and waste, water consumption, energy consumption, mass haul distances and changes in land use for example. Volume 5: Appendix CL-004-0000 of the main ES presents the GHG calculation methodology in detail. However, some of the underlying assumptions and data sources behind the GHG assessment methodology have been updated:

- The Department for Business, Energy and Industrial Strategy (BEIS) 2020 GHG conversion factors[8] were updated to reflect the latest 2021 publication[9];

[8] Department for Business, Energy and Industrial Strategy (2020), *Greenhouse gas reporting: conversion factors 2020.* Available online at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020.

[9] Department for Business, Energy and Industrial Strategy (2021), *Greenhouse gas reporting: conversion factors 2021 – revised January 2022.* Available online at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021.

- Operational rolling stock energy consumption figures were updated to reflect the updated train service specification (TSS) resulting from Removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001); and
- The land use change assessment was updated to reflect the latest data by Natural England[10] relating to carbon storage and sequestration rates of natural habitats in the British Isles. Further details on the carbon storage and sequestration rates selected and underlying assumptions are included in SES1 and AP1 ES Volume 5: Appendix CL-003-00000.

14.2.3 An assessment of GHG emissions from modal shift (i.e. changes in GHG emissions associated with car, conventional rail and domestic aviation trips switching to high speed rail) will be included in the future Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) and cover all community areas and off route works. Modal shift impacts fall under the 'benefits and loads beyond project boundaries' life cycle stage in Table 7.

GHG implications of SES1 changes and AP1 amendments

14.2.4 Operational GHG emissions are expected to gradually decrease as the UK grid decarbonises over time. This is reflected in the per passenger kilometre emissions (gCO_2e/p.km) associated with the operation of the rolling stock in Table 6. The Removal of the HS2 WCML connection (SES1-004-001) and updated TSS has altered the rolling stock fleet mix resulting in a slight increase in GHG emissions per passenger kilometre compared to the original scheme.

Table 6: The AP1 revised scheme's operational GHG emissions for 2038 (proposed opening year) and 2050

	GHG emissions	2038	2050
Original scheme	gCO_2e/p.km	2.08	1.10
AP1 revised scheme	gCO_2e/p.km	2.18	1.16

14.2.5 Table 7 compares the GHG emissions of the original scheme reported in the main ES against the change in emissions from the AP1 revised scheme. GHG emissions are reported twice, the first covering the period between 2038 (proposed opening year) and 2050, and the second time over 120 years to reflect the assumed design life of the railway.

14.2.6 Further details of the GHG assessment are included in SES1 and AP1 ES Volume 5: Appendix CL-003-00000.

[10] Natural England (2021), *Carbon storage and sequestration by habitat: a review of the evidence (second edition)*. Available online at: http://publications.naturalengland.org.uk/publication/5419124441481216.

Table 7: The original scheme's GHG emissions from construction and operation as reported in the main ES and as a result of the AP1 revised scheme

Work stage	Life cycle stage	Original scheme GHG emissions (tCO_2e)		AP1 revised scheme GHG emissions (tCO_2e)	
		Up to 2050	120 years	Up to 2050	120 years
Construction	Before use stage	5,022,000		3,921,000	
Operation	Use stage	391,000	5,769,000	200,000	2,996,000
	Benefits and loads beyond project boundaries[11]	-618,000	-3,888,000	n/a	n/a

14.2.7 Construction GHG emissions are estimated to reduce by 22% (1,101,000 tCO_2e) in comparison to the main ES due to the AP1 revised scheme and changes/amendment to: viaducts, overbridges, electricity distribution systems, highway works signalling and communication assets.

14.2.8 Operational GHG emissions are projected to reduce by 49% (-191,000 tCO_2e) between 2038 (opening year) and 2050, and 48% (-2,773,000 tCO_2e) over the 120-year design life. Operational emissions include the maintenance, repair and replacement of construction material, and assets over the scheme's lifetime, as well as the operation of the rolling stock, stations, depots and other assets. The changes to operational train flows that will arise from the Removal of the HS2 WCML connection (SES1-004-001) account for approximately 95% of operational emissions reduction.

Conclusions

14.2.9 The AP1 revised scheme has an impact on the GHG emissions reported in the main ES. Compared to what was reported in Volume 3 of the main ES, construction GHG emissions have decreased by 1,101,000 tonnes of carbon dioxide (tCO_2e), and operational emissions by 2,773,000 tCO_2e over the scheme's 120-year design life. An assessment of GHG emissions from benefits and loads beyond project boundaries will be included in the future SES2 and AP2 ES.

14.2.10 As a result of the AP1 revised scheme there will be a 22% decrease in construction GHG emissions, and 49% decrease in operational GHG emissions between 2038 (scheme opening year) and 2050, however, this change in GHG emissions does not alter the conclusions presented in the main ES.

[11] This represents the modal shift from road, rail and air transport on to HS2 as a result of the scheme.

15 Ecology and biodiversity

15.1 Introduction

15.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on ecology and biodiversity arising from the construction and operation of the original scheme.

15.1.2 Section 4 of this volume reports the new or different significant effects due to the SES1 changes.

15.1.3 This section of the AP1 ES identifies any new or different likely significant effects on ecology and biodiversity compared to those reported in Volume 3 of the main ES, as amended by the SES1 changes, due to the AP1 amendments.

15.2 Changes to the assessment

15.2.1 An assessment was undertaken to determine if the AP1 amendments would be likely to result in any new or different likely significant effects on ecology and biodiversity from those reported in Volume 3 of the main ES, as amended by SES1.

Designated sites

15.2.2 On a precautionary basis, the Additional land permanently required for the realignment and extension of Crewe tunnel (AP1-001-001) will result in a new significant effect on one additional statutory site of nature conservation importance (Sandbach Flashes Site of Special Scientific Interest (SSSI)) that was not reported in Volume 3 of the main ES. It has not been possible to rule out potential effects on water dependant habitats due to changes in surface-water flows. HS2 Ltd will continue to investigate this issue, and will develop appropriate measures to mitigate or compensate for this effect if required. On a precautionary basis, the AP1 revised scheme will therefore result in significant adverse effects to two SSSIs rather than one as reported in the main ES.

15.2.3 The AP1 amendments will not result in any new or different significant effects on non-statutory sites of nature conservation importance to those reported in Volume 3 of the main ES, as amended by SES1.

Species

15.2.4 The Additional land permanently required for the realignment and extension of Crewe tunnel (AP1-001-001) will result in the loss of one additional pond in the Hough to Walley's Green area (MA01) that contains lesser silver water beetle. This is a new significant effect at the regional level, compared to the main ES.

15.2.5 New ponds and areas of wet grassland will be created within ecological compensation areas close to the areas lost. The habitats will be established in accordance with the Ecological

Principles of Mitigation within the SMR. Where reasonably practicable, and if it can be demonstrated to be effective, additional measures including translocation of sediment and vegetation along with adult silver water beetles and larvae will be undertaken as appropriate following discussions with Natural England and other relevant stakeholders. Following implementation of these measures, the adverse effect on the lesser silver water beetle population north of Parkers Road will be reduced to a level that is not significant.

15.2.6 On a precautionary basis, there will be new significant effects on bats due to loss of bat roosts in trees in areas that were not affected by the original scheme as a result of Additional land required for modifications to the A54 Chester Road/A530 Croxton Lane junction (AP1-002-007) and Additional land permanently required for modifications to the A54 Middlewich Road and Chester Road junction (AP1-002-009). Both of these effects are significant at the district/borough level, however this does not result in a new or different route-wide level effect.

15.2.7 To replace roosts that will be lost to construction, artificial roosts will be provided in retained areas of suitable habitat as close to the roost being lost as possible, in accordance with the Ecological Principles of Mitigation within the SMR. Following the implementation of these measures, the effects of the potential loss of roosts on these bat assemblages will be reduced to a level that is not significant.

Habitats

15.2.8 The Additional land permanently required for the realignment and extension of Smoker Brook viaduct at the A556 Shurlach Road and Winnington Wood (AP1-002-012) will reduce the loss of ancient woodland within Leonards and Smoker Wood by 53m^2 and Winnington Wood by 10m^2. The amendment will also reduce the area affected at Leonard's and Smoker Wood LWS by 53m^2, and at Winnington Wood LWS by 342m^2. Although the amount of habitat loss is reduced, there is no change to the level of significance of the effects for these two ancient woodlands reported in the main ES, as amended by SES1.

15.2.9 There will be at least 22 veteran trees lost as a result of the AP1 revised scheme.

15.2.10 The AP1 revised scheme will result in the following losses to the most notable habitats that are described in the main ES, as amended by SES1:

- ancient woodland – the AP1 revised scheme will result in the loss of 5.1ha of ancient woodland, which is the same as the original scheme, as amended by SES1.
- semi-natural broadleaved woodland – the AP1 revised scheme will result in the loss of 20.8ha of semi-natural broadleaved woodland, compared to 20.7ha in the original scheme, as amended by SES1;
- grassland – the AP1 revised scheme will result in the loss of 24.5ha of unimproved and semi-improved grassland likely to qualify as a habitat of principal importance, compared to 24.9ha in the original scheme, as amended by SES1;
- hedgerow – the AP1 revised scheme will result in the loss of 246.0km of hedgerows, compared to 245.9km in the original scheme, as amended by SES1; and

- ponds – the AP1 revised scheme will result in the loss of 263 ponds, compared to 265 in the original scheme, as amended by SES1.

15.2.11 The AP1 amendments do not result in any new or different significant route-wide level effects on habitats.

16 Electromagnetic interference

16.1 Introduction

16.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on electromagnetic Interference (EMI) arising from the construction and operation of the original scheme. It summarised the route-wide effects on human health, electrical equipment, third party assets and infrastructure running parallel to the original scheme for example other railway infrastructure, metallic fences, pipelines, overhead power cables and telecommunications cables on motorways.

16.1.2 Section 5 of this volume reports that the SES1 changes would result in no changes from those reported in the main ES.

16.1.3 This section of the AP1 ES identifies any new or different likely significant effects on EMI compared to those reported in Volume 3 of the main ES, as amended by the SES1, due to the AP1 amendments.

16.2 Changes to the assessment

16.2.1 An assessment was undertaken to determine if the AP1 amendments would be likely to result in any new or different likely significant effects on EMI from those reported in Volume 3 of the main ES, as amended by the SES1.

16.2.2 SES1 and AP1 ES Volume 5, Appendix: EMI-001-00000, describes the EMI assessment and documents the differences to effects to potentially affected receptors as a result of the AP1 amendments.

16.2.3 The AP1 amendments are not considered to result in any new or different likely significant route-wide effects from those presented in Volume 3 of the main ES.

17 Health

17.1 Introduction

17.1.1 Volume 3 of the main ES reported the assessment of effects on health as a result of airborne noise for the original scheme during construction and operation.

17.1.2 This section of the AP1 ES identifies any new or different potential health effects as a result of airborne noise reported in Volume 3 of the main ES due to SES1 changes and AP1 amendments combined (i.e. the AP1 revised scheme).

17.2 Changes to the assessment

17.2.1 An assessment was undertaken to determine if the combination of SES1 changes and AP1 amendments have the potential, combined, to result in any new or different potential health effects as a result of operational airborne noise reported in Volume 3 of the main ES.

Airborne noise

Health burden of noise within the study area

17.2.2 An assessment of existing ambient sound levels reported in the main ES, identified that residential properties within the airborne sound study area (defined as 1km either side of the HS2 route in rural areas and 500m either side in urban areas) are currently exposed to a health impact due to noise resulting in a loss of approximately 5,142 Disability-Adjusted Life Years (DALYs) over a 60-year appraisal period. The main ES reported an estimated additional 64 DALYs, or a 1% increase in DALYs lost due to noise within the airborne sound study area, taking the total in the airborne sound study area to 5,206 DALYs over a 60-year appraisal period.

17.2.3 The SES1 changes and AP1 amendments are estimated to result in a reduction of 23 DALYs, or a 0.4% decrease in DALYs lost due to noise within the airborne sound study area, taking the total in the airborne sound study area to 5,119 DALYs over a 60-year appraisal period. This represents an improvement of 87 DALYs lost due to noise within the airborne sound study area compared to the figures reported in the main ES. Figure 2 presents the DALYs in days per person for each health pathway in 50m distance bands from the HS2 route for the AP1 revised scheme. Increases in DALYs resulting from adverse increases in noise have been separated from decreases in DALYs resulting from beneficial noise reductions. The overall resultant change in DALYs with distance is also shown. Figure 2 includes several dwellings that are likely to qualify for an offer of noise insulation. If accepted, this could help reduce the estimated health effect due to noise from both the AP1 revised scheme and existing sources of sound. It can be seen that a combination of adverse and beneficial noise changes contribute to a varying relationship between the risk of a noise induced health effect and distance from the AP1 revised scheme. The majority of beneficial impacts are associated

with the introduction of noise barriers along the western side of the existing and realigned West Coast Main Line (WCML) at Leighton, Crewe, the realignment of the A556 at Lostock Green and road network changes at Ashley, Store Street and Union Street in Manchester. As shown in Figure 2, in some distances bands the beneficial health burden from the AP1 revised scheme outweighs the adverse health burden such that overall, there is a reduction in the number of DALYS. Furthermore, the change in DALYs tends to reduce with distance from the AP1 revised scheme. some distances from the AP1 revised scheme these beneficial health effects will be greater than the adverse health effects.

17.2.4 Figure 3 presents the number of residential dwellings within the airborne noise study area in 50m distance bands from the HS2 route for the AP1 revised scheme. As a result of designing the route to avoid residential properties, where reasonably practicable, it can be seen that the majority of dwellings are located between 175m and 1km of the HS2 route.

Figure 2: Health burden due to operational noise from the Proposed Scheme as changes in DALYs lost (days per person)

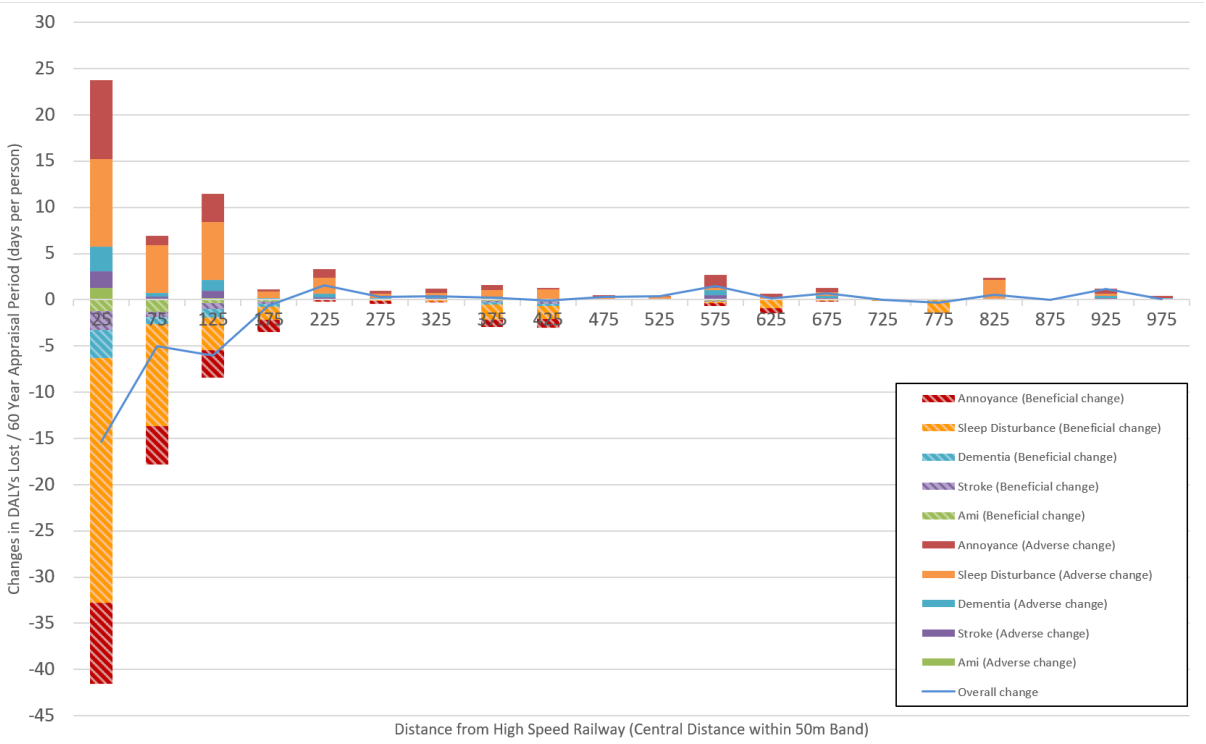
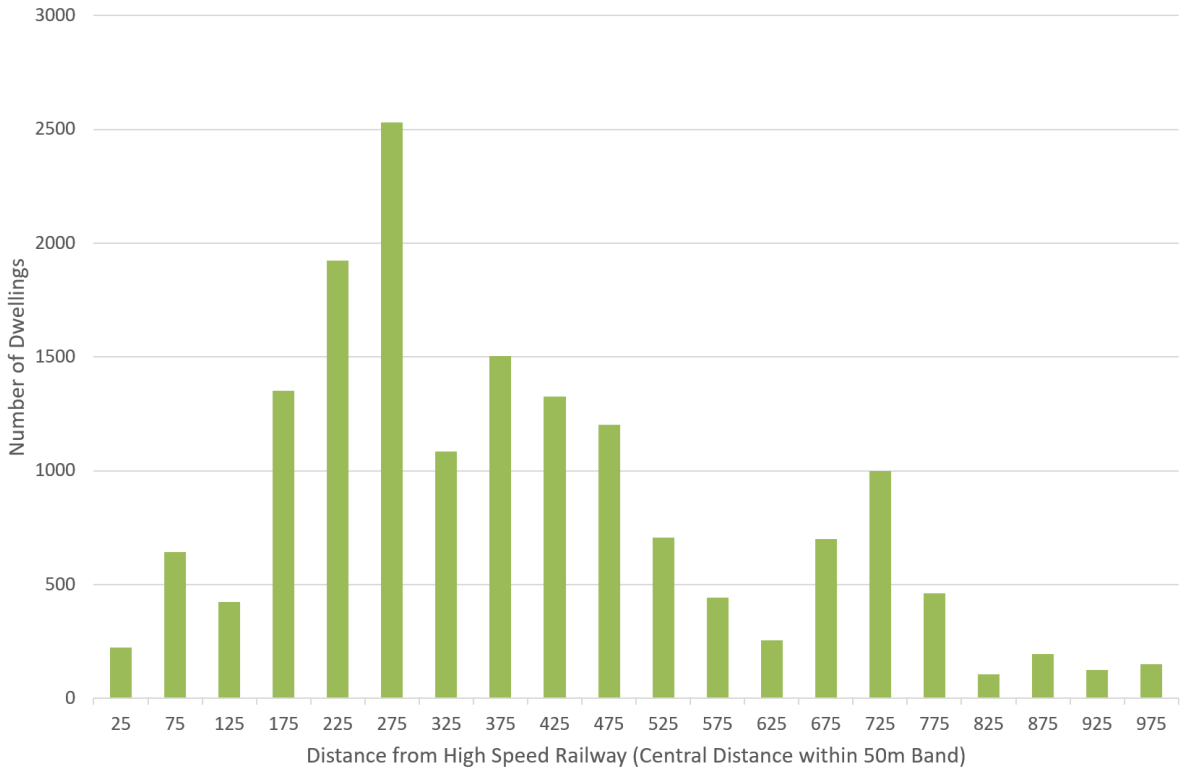


Figure 3: Number of residential properties within the operational airborne noise study area



Sleep disturbance

17.2.5 The main ES identified approximately 1,900 dwellings where the original scheme has the potential to decrease sleep disturbance and approximately 1,500 dwellings where the original scheme has the potential to increase sleep disturbance. The health impact of sleep disturbance due to noise at these dwellings is a loss of approximately 30 DALYs over a 60 year appraisal period.

17.2.6 The SES1 changes and AP1 amendments result in approximately 1,300 dwellings with the potential to decrease sleep disturbance and approximately 1,100 dwellings with the potential to increase sleep disturbance. The magnitude of the sleep disturbance health impact at each dwelling is not necessarily equal. For example, dwellings closer to the line will typically be assessed as having greater magnitude beneficial or negative health impacts. Large magnitude beneficial impacts close to the AP1 revised scheme at Crewe and Lostock result in an overall decrease in the health impact of sleep disturbance due to noise to an approximate increase of 18 DALYs over a 60 year appraisal period, which represents a reduction of 48 compared to the main ES.

Annoyance

17.2.7 The main ES identified approximately 1,350 dwellings where the original scheme has the potential to reduce noise annoyance and approximately 2,600 dwellings where the original scheme has the potential to cause or increase noise annoyance. The health impact of

annoyance due to noise at these dwellings is a loss of approximately 23 DALYs over a 60 year appraisal period.

17.2.8 The SES1 changes and AP1 amendments result in approximately 1,050 dwellings with the potential to reduce noise annoyance and approximately 1,100 dwellings with the potential to cause or increase noise annoyance. The magnitude of the annoyance health impact at each dwelling is not necessarily equal as dwellings closer to the line will typically be assessed as having greater magnitude beneficial or negative health impacts. Overall the SES1 changes and AP1 amendments represent a reduction in the overall health impact of annoyance due to noise to an approximate increase of five DALYs over a 60 year appraisal period.

Noise and cardiovascular effects

Hypertension

17.2.9 The main ES identified approximately 1,200 dwellings where the original scheme has the potential to reduce noise-induced hypertension, reducing the risk of stroke or dementia and approximately 1,150 dwellings where the original scheme has the potential to increase that risk. Based on this, the assessed health impact of hypertension (stroke and dementia) due to noise at these dwellings is a loss of approximately five DALYs over a 60-year appraisal period.

17.2.10 The SES1 changes and AP1 amendments result in 600 dwellings with potential to reduce noise-induced hypertension, reducing the risk of stroke or dementia and approximately 800 dwellings where the AP1 revised scheme has the potential to increase that risk. The magnitude of the noise-induced hypertension health impact at each dwelling is not necessarily equal as dwellings closer to the line will typically be assessed as having greater magnitude beneficial or negative health impacts. Overall the SES1 changes and AP1 amendments represent a reduction in the overall assessed health impact of hypertension (stroke and dementia) due to noise to a loss of approximately one DALY over a 60 year appraisal period.

Acute myocardial infarctions

17.2.11 The main ES has identified approximately 1,100 dwellings where the original scheme has the potential to reduce the risk of acute myocardial infarctions (AMI) due to noise and approximately 500 dwellings where the original scheme has the potential to increase the risk of AMI. The health impact of AMI due to noise at these dwellings is a loss of approximately two DALYs over a 60-year appraisal period.

17.2.12 The SES1 changes and AP1 amendments result in approximately 450 dwellings with the potential to reduce the risk of AMI due to noise and approximately 350 dwellings with the potential to increase the risk of AMI. The magnitude of the AMI health impact at each dwelling is not necessarily equal as dwellings closer to the line will typically be assessed as having greater magnitude beneficial or negative health impacts. Overall the SES1 changes and AP1 amendments represent a reduction in the overall health impact of AMI due to noise

at these dwellings to an increase of approximately four DALYs over a 60-year appraisal period.

18 Historic environment

18.1 Introduction

18.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on historic environment arising from the construction and operation of the original scheme. It provided a summary of the heritage assets assessed in more than one community area and reported that there would be no significant route-wide effects on the historic environment as a result of the original scheme.

18.1.2 Section 7 of this volume reports that the SES1 changes would result in no changes from those reported in Volume 3 of the main ES.

18.1.3 This section of the AP1 ES identifies any new or different likely significant effects on the historic environment compared to those reported in Volume 3 of the main ES, as amended by the SES1, due to the AP1 amendments.

18.2 Changes to the assessment

18.2.1 An assessment was undertaken to determine if the AP1 amendments would be likely to result in any new or different likely significant effects on historic environment from those reported in Volume 3 of the main ES, as amended by the SES1.

18.2.2 SES1 and AP1 ES Volume 5, Appendix: HE-002-00000 provides a description of the differences to the assessment in relation to heritage assets. No new or different route-wide effects are predicted in relation to the historic environment.

19 Major accidents and disasters

19.1 Introduction

19.1.1 Volume 3 of the main ES reported an assessment of the route-wide impacts and likely significant effects arising directly from the construction and operation of the original scheme if it were to be affected by a major accident and/or disaster.

19.1.2 Section 8 of this volume reports that the SES1 changes would result in no changes to the effects reported in the main ES.

19.1.3 This section of the report identifies any new or different likely significant effects to those reported in Volume 3 of the main ES, as amended by the SES1, due to the AP1 amendments.

19.1.4 A route-wide assessment of changes to hazards and vulnerability of the AP1 revised scheme to major accidents and disasters associated with hazardous sites and assets, including major hazard sites, major accident hazard pipelines, explosives sites, and nuclear sites will be reported in the future Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) and will include all community areas and off-route works as relevant.

19.2 Changes to the assessment

19.2.1 An assessment was undertaken to determine if the AP1 amendments would be likely to result in any new or different likely significant effects on the vulnerability of the AP1 revised scheme to major accidents and disasters from that reported in Volume 3 of the main ES, as amended by the SES1.

19.2.2 A review of the foreseeable risks associated with the AP1 revised scheme, recorded in a risk register as required under the CDM 2015 Regulations, has been undertaken. This review concluded that the AP1 amendments are not considered to result in new or different likely significant effects from those reported in Volume 3 of the main ES, as amended by the SES1.

19.2.3 A full record of risk identification, risk screening and final risk assessment is provided in Major accidents and disasters risk screening in SES1 and AP1 ES Volume 5, Appendix: MA-001-00000.

19.2.4 No new or different likely residual significant flood risk effects or changes to the climate change resilience assessment have been identified as a result of the AP1 amendments.

19.2.5 The AP1 revised scheme does not result in any new or different likely significant effects.

20 Socio-economics

20.1 Introduction

20.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on socio-economics arising from the construction and operation of the original scheme. It reported route-wide effects as a result of the original scheme in relation to:

- route-wide construction employment created (direct and indirect);
- employment in businesses directly and indirectly affected by construction;
- operational employment; and
- operational effects on existing business employment.

20.1.2 Section 9 of this volume reports that the SES1 changes will result in the removal of a significant effect in relation to job displacement as a result of in-combination and isolation effects during construction.

20.1.3 This section of the AP1 ES identifies any new or different likely significant socio-economic effects compared to those reported in Volume 3 of the main ES, as amended by the SES1, due to the AP1 amendments.

20.2 Changes to the assessment

20.2.1 As a result of the AP1 amendments, the total number of jobs displaced by construction of the original scheme as amended by the SES1 (6,210 jobs) will fall to 5,400 displaced jobs. This change is as a result of jobs no longer being displaced within Wimboldsley to Lostock Gralam area (MA02), as under AP1 amendment for Additional land permanently required for the provision of a power supply to Crewe tunnel (AP1-001-002), there is no longer the requirement for land from Bentley Motors Ltd (MA01/127)12 on Pyms Lane to construct the scheme.

20.2.2 As reported in Section 9, in total approximately 1,050 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase of the original scheme as amended by the SES1. With the AP1 amendment for Additional land permanently required for the provision of a power supply to Crewe tunnel (AP1-001-002), this will reduce to 920 jobs directly and indirectly affected during the construction phase. This will reduce the magnitude of effect from high to medium, therefore changing the significance of effect from moderate adverse to a minor adverse effect, which is not significant.

[12] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 5: Appendix CT-004-00000 Planning data.* Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1046859/M101.pdf.

20.2.3 The AP1 amendments to the original scheme, as amended by the SES1, will therefore result in the removal of a significant effect in relation to job displacement as a result of direct and indirect construction effects.

21 Traffic and transport

21.1 Introduction

21.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on traffic and transport arising from the construction and operation of the original scheme. It reported route-wide effects as a result of the original scheme in relation to:

- construction - the substantial number and extended duration of possessions and blockades that would affect users of the West Coast Main Line (WCML) and would lead to a major adverse significant effect on rail passengers and freight during the construction of the original scheme; and
- operation - journey time and accessibility benefits, reduced crowding and congestion on the conventional rail network, substantial changes in overall use of rail services and mode shift from private car and air travel during the operation of the original scheme.

21.1.2 This section of the AP1 ES identifies any new or different likely significant effects on traffic and transport during construction as a result of the SES1 changes and AP1 amendments combined (referred to as the AP1 revised scheme) compared to those reported in Volume 3 of the main ES.

21.1.3 An assessment of route-wide effects on traffic and transport during operation will be provided in the future Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) and will include an assessment of all community areas and off-route works, where relevant.

21.2 Changes to the assessment

21.2.1 The SES1 design changes will result in different likely significant route-wide temporary or permanent effects during construction of the SES1 scheme from those reported in the main ES.

Assessment of the effects of construction

Impacts arising on the highway network during construction

21.2.2 The impacts of construction traffic are primarily focussed on the road network close to the original scheme, which includes the principal routes for movement of excavated material. These local impacts are considered within the Volume 2, Community Area reports, Section 14 of the main ES. These assessments consider the effects of construction activity on roads extending from the original scheme to the strategic road network (SRN).

21.2.3 The AP1 revised scheme results in a net reduction in total number of construction HGVs compared to the original scheme. The following SES1 design changes and AP1 amendments, make a particular contribution to the changes in traffic flows:

- Removal of the HS2 WCML connection (SES1-004-001), which results in the removal of all compounds and associated HGVs in the Broomedge to Glazebrook (MA04) and Risley to Bamfurlong (MA05) areas and four compounds and associated HGVs in the Pickmere to Agden and Hulseheath area (MA03);
- Removal of MA02 Borrow Pit D, north of Moss Lane (SES1-002-002); and
- Additional land permanently required for the realignment and extension of Crewe tunnel (AP1-001-001) (additional spoil from the extension in AP1 will be exported by rail from the Crewe RSD area).

21.2.4 Traffic generated by construction on roads from the AP1 revised scheme to the SRN has been assessed in the SES1 and AP1 ES Volume 2, Community Area reports, with measures proposed to mitigate the effect of this traffic. However, at a route-wide level the combined effects across community areas are not considered to represent a significant effect, which is unchanged from the main ES. In addition, the impacts on the SRN across and outside community areas are not considered likely to result in any route wide effects, which is also unchanged from the main ES.

Impacts on the railway network during construction

21.2.5 The type and number of possessions required for the original scheme on existing railway lines are summarised in Table 32, Section 14 of Volume 3 of the main ES.

21.2.6 The main ES reported that connections to the WCML south of Wigan via the HS2 WCML connection would require possessions and blockades on the WCML Crewe to Carlisle between Golborne junction and Springs Bank junction in the Risley to Bamfurlong area (MA05). These works comprised three blockades of between four and six days duration plus a series of associated 27-hour, 54-hour and 72-hour weekend possessions. Removal of the HS2 WCML connection (SES1-004-001) results in the removal of these possessions and blockades and the consequential removal of the significant major adverse effects on rail passengers and freight associated with these, as reported in the main ES.

21.2.7 In addition, there is a reduction in the number of blockades in the Hough to Walley's Green area (MA01) from three to two as a result of a removal of one nine-day blockade associated with signalling commissioning for the Crewe Northern Connection. These changes are summarised in Table 8.

Table 8: SES1 and AP1 Summary of differences in likely route-wide possession and blockades to the main ES

Route-wide possessions and blockades affecting WCML users with the potential for route-wide effects	27-hour (Difference between original scheme and AP1 revised scheme)	54-hour (Difference between original scheme and AP1 revised scheme)	72-hour (Difference between original scheme and AP1 revised scheme)	100-hour (Difference between original scheme and AP1 revised scheme)	Blockades (Difference between original scheme and AP1 revised scheme)
Hough to Walley's Green area (MA01)	3	0	0	0	-1
Wimboldsley to Lostock Gralam area (MA02)	0	1	0	0	0
Risley to Bamfurlong area (MA05)	-4	-29	-1	0	-3
Total	**-1**	**-28**	**-1**	**0**	**-4**

21.2.8 The changes between the original scheme and the AP1 revised scheme as set out in Table 8 indicates that there are only minor differences in possessions and blockades in the Hough to Walley's Green area (MA01) and Wimboldsley to Lostock Gralam area (MA02).

21.2.9 However, at a route-wide level, the conclusion of the main ES that the substantial number and extended duration of the possessions and blockades will lead to a significant major adverse effect on WCML rail passengers and freight, is unchanged as a result of the AP1 revised scheme.

22 Waste and material resources

22.1 Introduction

22.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on waste and material resources arising from the construction and operation of the original scheme. It reported that for inert and hazardous landfill capacity, the effect during construction would be minor adverse, which does not comprise a significant environmental effect. For non-hazardous landfill capacity, the main ES reported a moderate adverse effect, which is considered to constitute a significant effect. The main ES reported a negligible impact on non-hazardous landfill during operation.

22.1.2 Section 11 of this volume reports that whilst the SES1 changes would result in changes to the quantities of waste generated, it is not possible to disaggregate changes to waste generation resulting from SES1 changes, from the those arising due to AP1 amendments. This section of the AP1 ES therefore considers both the SES1 changes and AP1 amendments together.

22.2 Changes to the assessment

22.2.1 An assessment was undertaken to determine if the SES1 changes and AP1 amendments would be likely to result in any new or different likely significant effects on waste and material resources from those reported in Volume 3 of the main ES.

Policy framework

National policy framework

22.2.2 The national policy framework in relation to waste management is as set out in Volume 3 of the main ES, with the exception of The Waste Management Plan for England[13], which was updated by the Department for Environment Food and Rural Affairs (Defra) in 2021. The Waste Management Plan for England provides an analysis of the current waste management situation in England as at the start of 2021, supports the implementation of the Waste (England and Wales) Regulations 2011[14], and brings current waste management policies under the umbrella of one national plan. The Waste Management Plan for England identifies an ongoing Defra workstream exploring how the commitment to extended producer responsibility will be applied to materials in the construction and demolition sector.

[13] Department for Environment Food and Rural Affairs (2021), *Waste Management Plan for England*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/955897/waste-management-plan-for-england-2021.pdf.

[14] *The Waste (England and Wales) Regulations 2011*. Available online at: https://www.legislation.gov.uk/uksi/2011/988.

Local policy framework

22.2.3 A summary of the local policy framework applicable to this assessment is set out within the SES1 and AP1 ES Route-wide policy review and benchmarks (BID WM-002-00000)[15,16].

Environmental baseline

Waste arisings and management

22.2.4 Since the development of the environmental baseline with respect to waste and material resources in Volume 3 of the main ES, a further year of data has been published for 2020, which has been taken into account in establishing the baseline and future baseline against which the AP1 amendments have been assessed. Where the inclusion of this data materially affects the baseline and future baseline, the effects of the new data have been reported.

Construction, demolition and excavation

National construction, demolition and excavation waste

22.2.5 Latest available data shows that a total of 119,429,377 tonnes of construction, demolition and excavation waste (CDEW)[17] was generated in England in 2018[18]. Of this amount, 61,375,974 tonnes comprised of non-hazardous waste from construction and demolition activities, of which 57,546,197 tonnes (approximately 94%) were recovered. It has been forecast that of the 119,429,377 tonnes of CDEW generated in England in 2018, 30,620,969 tonnes (approximately 26%) were sent to landfill. Eurostat data[19] shows an average annual CDEW growth trend of approximately 2.5%. Based on this growth, the projected quantity of CDEW in England during the construction phase of the AP1 revised scheme (2025 to 2038) has been calculated (see Table 9) to develop the baseline and future baseline.

[15] This includes the local policy framework applicable to the Dumfries and Galloway Council area to account for the construction of the off-route works at Annandale depot.

[16] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement, Background Information and Data, Route-wide waste and material resources policy review and benchmarks*, BID WM-002-00000 SES1 and AP1 ES. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement.

[17] European Competition Commission (2010), CDEW is defined as NACE Code F (Construction category). Available online at: http://ec.europa.eu/competition/mergers/cases/index/nace_all.html. The UK Government report to the EU using the NACE classification system (NACE: Nomenclature générale des activités économiques dans les Communautés Européennes; equivalent in English is General Industrial Classification of Economic Activities within the European Communities).

[18] Department for Environment, Food & Rural Affairs (2021), *ENV23 - UK statistics on waste*. Available online at: https://www.gov.uk/government/statistical-data-sets/env23-uk-waste-data-and-management.

[19] Eurostat (2021), *Generation of waste by waste category, hazardousness and NACE Rev. 2 activity*. Available online at: http://ec.europa.eu/eurostat/web/products-datasets/-/env_wasgen.

Table 9: Baseline and future baseline national CDEW arisings

Year	Landfill (tonnes)	Diverted from landfill (tonnes)	Total (tonnes)
2022	33,746,697	97,873,795	131,620,492
2025 - 2038	597,991,652	1,734,324,181	2,332,315,834

Regional construction, demolition and excavation waste

22.2.6 No update to the data used in developing the regional baseline and future baseline for the North West region has been published, and these remain as set out in Volume 3 of the main ES.

Local construction, demolition and excavation waste

22.2.7 Local CDEW arisings and management for the year 2022 (baseline) and the period 2025 to 2038 (future baseline) are presented in detail in the SES1 and AP1 ES Route-wide Waste and Material Resources Assessment in Volume 5: Appendix WM-001-00000.

Commercial and industrial waste

National commercial and industrial waste

22.2.8 Since development of the national commercial and industrial waste baseline in Volume 3 of the main ES, a new year of data has been published by Defra[20] for 2019, which has been taken into account in establishing the baseline and future baseline against which the AP1 amendments have been assessed. The latest available data shows that the quantity of commercial and industrial (C&I) waste produced in England in 2019 remains unchanged from the quantity reported for 2018 in Volume 3 of the main ES.

22.2.9 Annual estimates of waste generation by the C&I sectors in England have been calculated by Defra between 2010 and 2019 as part of the Waste Statistics Regulations returns, published by Eurostat[19]; the Defra estimates show an average annual C&I waste increase of 1.75%. Based on this growth, the projected quantity and management of C&I waste in England during the construction phase of the AP1 revised scheme (2025 to 2038), and during the first full year of operation of the AP1 revised scheme (2039) has been calculated to develop the baseline and future baseline (see Table 10).

Table 10: Baseline and future baseline national C&I waste arisings

Year	Landfill (tonnes)	Diverted from landfill (tonnes)	Total (tonnes)
2022	9,385,363	30,492,446	39,877,809
2025 - 2038	155,360,830	504,757,419	660,118,248
2039	12,611,059	40,972,527	53,583,586

[20] Department for Environment, Food and Rural Affairs (2021), *UK Statistics on Waste– 15 July 2021*. Available online at: https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste.

Regional commercial and industrial waste

22.2.10 No update to the data used in developing the Regional baseline and future baseline for the North West region has been published, and these remain as set out in Volume 3 of the main ES.

Local commercial and industrial waste

22.2.11 Local C&I waste arisings and management for the baseline year 2022, the future baseline period 2025 to 2038 (for construction) and 2039 (for first full year of operation) are presented in detail in the SES1 and AP1 ES Route-wide Waste and Material Resources Assessment in Volume 5: Appendix WM-001-00000.

Waste infrastructure

General

22.2.12 Since development of the environmental baseline for waste infrastructure in Volume 3 of the main ES, a new year of data has been published, extending the available baseline information from 2019 to 2020. This has been taken into account in establishing the baseline and future baseline against which the AP1 amendments have been assessed.

22.2.13 Latest available information at the time of writing, published by the Environment Agency for the 2020 data year[21] has been used with historic data to inform the baseline and future baseline with respect to waste infrastructure capacity within each of the county and former regional planning areas through which the AP1 revised scheme will pass. National waste infrastructure capacity is not provided as it is not required for use in this assessment.

Current baseline

22.2.14 Table 11 provides baseline landfill void space capacity data for the North West region[21] through which the AP1 revised scheme will pass. The baseline information presented is based on permitted capacity for the year 2020, as published by the Environment Agency.

[21] Environment Agency (2021), *High level summary tables of wastes received at permitted waste sites in England (and former Government Planning Regions) in 2020 - Version 1*. Available online at: https://environment.data.gov.uk/portalstg/home/item.html?id=9066d9c8675b4d6e8dfe60e4cc988563.

Table 11: Baseline landfill void space capacity, 2020

Facility type	North West region (tonnes)
Inert waste landfill	7,806,000
Non-hazardous waste landfill	23,229,210
Hazardous waste landfill	9,408,000
Total	40,443,210

22.2.15 Table 12 provides baseline capacity and unused capacity data for waste recovery infrastructure (i.e. incineration) for the North West region[21] through which the AP1 revised scheme will pass, as published by the Environment Agency. Unused capacity comprises the difference between the annual inputs and the permitted capacity for the year 2020.

Table 12: Baseline waste recovery infrastructure capacity, 2020

Facility type	Capacity (tonnes)	North West region
		Unused capacity (tonnes)
Municipal solid waste, C&I waste incineration	1,227,100	218,181
Other incineration	792,812	358,391
Total	2,019,912	576,572

22.2.16 Table 13 provides baseline waste transfer, waste treatment and metal recycling infrastructure input data for the North West region[21] through which the AP1 revised scheme will pass. Waste treatment comprises of material recovery facilities, composting and other biological treatment facilities, and other facilities processing waste using physical, physico-chemical, and chemical treatment processes. The baseline information presented is based on site inputs for the year 2020, as published by the Environment Agency.

Table 13: Baseline waste transfer, treatment and metal recycling infrastructure input data, 2020

Facility type	North West region
	Inputs (tonnes)
Waste transfer	5,761,000
Waste treatment	17,653,000
Metal recycling	4,279,000
Total	27,693,000

22.2.17 The data presented in Table 13 is based on the annual waste input quantities provided by the Environment Agency, as separate capacity information is not published. The annual waste throughput capacity of the waste infrastructure facility types is assumed to be at least equivalent to the waste input quantities provided in Table 13.

Inert waste landfill capacity

22.2.18 Using the latest available published data for the year 2020 as a starting point inert waste landfill capacity has been projected for the future baseline period 2025 to 2038 (for construction) and the year 2039 (for first full year of operation). By 2039, there is forecast to

be approximately 5.3 million tonnes of inert waste landfill capacity remaining in the North West region, slightly less than the 5.8 million tonnes of capacity forecast to be remaining in Volume 3 of the main ES.

Non-hazardous waste landfill capacity

22.2.19 Using latest available published data for the year 2020 as a starting point, non-hazardous waste landfill capacity has been projected for the future baseline period 2025 to 2038 (for construction) and the year 2039 (first full year of operation). By 2039, there will be approximately 11.3 million tonnes of non-hazardous waste landfill capacity remaining in the North West region; this is significantly greater than the 7.1 million tonnes of capacity forecast to be remaining in Volume 3 of the main ES.

Hazardous waste landfill capacity

22.2.20 Using the latest available published data for the year 2020 as a starting point, hazardous waste landfill capacity has been projected for the future baseline period 2025 to 2038 (for construction) and the year 2039 (first full year of operation). By 2039, there is projected to be approximately 6.6 million tonnes of hazardous waste landfill capacity remaining in the North West region, a slight increase from the 6 million tonnes of capacity forecast to be remaining in Volume 3 of the main ES.

Waste recovery infrastructure capacity

22.2.21 Using the latest available published data for the year 2020 as a starting point, unused waste recovery infrastructure capacity has been projected for the future baseline period 2025 to 2038 (for construction) and the year 2039 (first full year of operation). By 2039, there is forecast to be approximately 702,000 tonnes per annum of unused incineration waste recovery infrastructure capacity in the North West region, a slight decrease from the 734,000 tonnes of unused capacity forecast in Volume 3 of the main ES.

Waste treatment infrastructure capacity

22.2.22 Using the latest available published data for the year 2020 as a starting point, unused waste treatment infrastructure capacity has been projected for the future baseline period 2025 to 2038 (for construction) and the year 2039 (first full year of operation). By 2039, there is forecast to be approximately 13.2 million tonnes per annum of unused waste treatment infrastructure capacity in the North West region, a slight increase from the 12.6 million tonnes of unused capacity forecast to be available in Volume 3 of the main ES.

Assessment of the effects of construction

Avoidance and mitigation measures

22.2.23 In accordance with the draft CoCP the nominated undertaker and its contractors will be responsible for managing the waste generated from construction activities associated with the AP1 revised scheme.

22.2.24 In addition, the nominated undertaker and its contractors will comply with the requirements set out in the Borrow pit report, Volume 5: Appendix CT-008-00000[22] of the main ES, and the SES1 and AP1 ES Borrow pit report update[23] which relates to the excavation, operation and restoration of borrow pits.

Assessment of impacts and effects

Excavated material

22.2.25 Table 14 presents a route-wide summary of the forecast excavated material quantities for the AP1 revised scheme. This is based on the calculated figures for the integrated earthworks design and reflects the balance of excavated material arising from the AP1 revised scheme design. The nominated undertaker has an ambition to seek beneficial opportunities for the off-site reuse of surplus excavated material. However, it is difficult to make firm commitments for reuse of surplus excavated material in third-party, large-scale schemes due to the uncertainties of those schemes and in the scope and programme of the earthworks activities of the AP1 revised scheme design. For this assessment, it has been assumed as a worst-case scenario that all surplus excavated material will be disposed off-site to landfill.

Table 14: Forecast excavated material quantities for the AP1 revised scheme, 2025 to 2038

Excavated material management methods	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion of AP1 revised scheme total
Quantity of excavated material reused for engineering and environmental mitigation	24,555,865	15,935,972	74.1%

[22] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 5: CT-008-00000 Borrow pit report.* Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1046865/M108.pdf.

[23] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement, Volume 5: CT-008-00000 Borrow pit report update.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement.

Excavated material management methods	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion of AP1 revised scheme total
earthworks (including all topsoil and agricultural subsoil)			
Quantity of surplus excavated material for off-site disposal to landfill[24]	4,796,763	5,583,831	25.9%
Total	**29,352,628**	**21,519,803**	**100.0%**

22.2.26 The AP1 revised scheme will generate approximately 21.5 million tonnes of excavated material during the period 2025 to 2038. This represents a 27% decrease on the quantities reported for the original scheme.

22.2.27 It is estimated that 74% of the excavated material generated by the AP1 revised scheme will be used to satisfy the necessary requirements for fill on a route-wide basis. This represents a decrease from the 84% reported for the original scheme. The decrease in the proportion of excavated material used to satisfy the necessary requirements for fill can largely be attributed to the Removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001). The construction of the scheme in the community areas affected by this SES1 design change predominantly used excavated materials generated elsewhere along the route of the Proposed Scheme. Therefore, the overall effect is of a decrease in opportunities to reuse excavated material, and a subsequent increase in surplus excavated material.

22.2.28 The fill requirement for the AP1 revised scheme comprises predominantly engineering fill for rail and highways use and environmental mitigation fill for bunds, landscaping and borrow pit backfill. Excavated material used as engineering fill material and for environmental mitigation earthworks within the AP1 revised scheme will include the following classes of material as defined by the Specification for Highway Works, Series 600, clause 601, Classification, Definitions and Uses of Earthworks Materials[25]:

- Class 1 and Class 3 general railway fill;
- Class 2 general railway fill and general highway fill;
- Class 2 and 4 environmental mitigation earthworks fill;
- Class 6 selected fill;

[24] All topsoil and agricultural subsoil generated by the AP1 revised scheme is considered as a valuable material resource. The surplus excavated material reported for off-site disposal to landfill, does not include the quantity of topsoil and agricultural subsoil, which is not currently proposed for reuse in the design of the AP1 revised scheme. It is expected that beneficial reuse opportunities will be found for surplus topsoil and agricultural subsoil, either within the AP1 revised scheme, or off-site in nearby development projects.

[25] Department for Transport (2014), *Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highways Works, Series 600 – Earthworks.* Available online at: https://www.standardsforhighways.co.uk/ha/standards/mchw/vol1/index.htm.

- Treated Class U1A and Class U1B[26]; and
- topsoil and agricultural subsoil.

22.2.29 The estimated quantity of surplus excavated material that will not be reused within the construction of the AP1 revised scheme will be approximately 26% of the overall excavated material that will be generated on a route-wide basis, based on the current level of design. This represents an increase from the 16% reported for the original scheme. This will comprise:

- 5,404,064 tonnes of general fill and landscape fill, not required for use in the AP1 revised scheme, which will require off-site disposal to inert landfill; and
- 179,768 tonnes of chemically unacceptable U1B materials[27], which cannot be treated on-site, and will require off-site disposal to non-hazardous landfill.

Borrow pits

22.2.30 As reported in Volume 3 of the main ES, the integrated earthworks design of the AP1 revised scheme results in a shortfall of acceptable engineering material from the excavation of cuttings and other earthworks, for use in embankments and other applications requiring engineering fill.

22.2.31 In order to meet this shortfall, the use of borrow pits has been considered alongside alternative options including import from recycled and secondary sources and external quarries. In a number of locations along the route of the AP1 revised scheme, the use of borrow pits has been chosen as the preferred solution for providing acceptable aggregates.

22.2.32 Borrow pits will be backfilled with materials generated from construction of the AP1 revised scheme which do not have acceptable characteristics for use as engineering fill. In all cases there will be a net balance of material extracted from and backfilled in borrow pits, with the result that there will be no impact on the local or regional landfill capacity.

22.2.33 Removal of the HS2 WCML connection (SES1-004-001) has led to a need to reassess the type and quantity of acceptable engineering materials required to construct the AP1 revised scheme. This reassessment has indicated that a greater proportion of the demand for acceptable engineering materials can be met through the redistribution of acceptable engineering materials from construction activities. As a result, there is no longer a requirement for the majority of high quality granular acceptable engineering materials that

[26] Unacceptable material Class U1A is 'physically' unsuitable as defined in the Specification for Highway Works, Series 601 Classification, Definitions and Uses of Earthworks Materials sub-Clauses 2(i)(a) and 2(i)(b). Unacceptable material Class U1B is 'chemically' unsuitable as defined in the Specification for Highway Works, Series 601 Classification, Definitions and Uses of Earthworks Materials sub-Clause 2(ii)(a).

[27] Materials that are unsuitable for reuse by virtue of an excess concentration of contaminants that render the material 'contaminated' (as defined by statutory Regulation or HS2 project requirements) at the place and environmental setting of its final deposition.

would have been provided by Borrow Pit D, and consequently this borrow pit will be removed from the AP1 revised scheme (SES1-002-002).

22.2.34 Based on the current level of design, and excavation to the mineral depth required to supplement any shortfall of suitable granular and cohesive engineering fill material, it is forecast that 1,538,374 tonnes of material will be excavated from the borrow pits. It is forecast that the same quantity of excavated material, 1,538,374 tonnes, generated from the AP1 revised scheme, will be used to backfill the borrow pits; the quantity of surplus excavated material is reduced accordingly.

22.2.35 The quantity of material extracted from and backfilled in borrow pits in the AP1 revised scheme, represents a 55% decrease on that reported for the original scheme.

Demolition material and waste

22.2.36 Demolition material quantities have been estimated using the Waste & Resources Action Programme 'Demolition bill of quantities estimator'[28], which uses the basic dimensions and typology of buildings to be demolished. Using this methodology, the AP1 revised scheme will generate approximately 476,247 tonnes of demolition material during the construction period of 2025 to 2038. This represents a 16% decrease on the quantities reported for the original scheme.

22.2.37 Table 15 presents a summary of the forecast demolition material and waste quantities for the AP1 revised scheme. More detailed demolition waste forecasts, including the source and quantities of demolition waste generated in each of the community areas along the route of the AP1 revised scheme, are provided in the SES1 and AP1 ES Route-wide Waste and Material Resources Assessment in Volume 5: Appendix WM-001-00000.

Table 15: Forecast demolition material and waste quantities for the AP1 revised scheme, 2025 to 2038

Scheme	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Original scheme	565,201	508,681	56,520
AP1 revised scheme	476,247	428,622	47,625

22.2.38 The quantity of demolition material that will be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 90%. This rate has been selected based on a review of industry good practice landfill diversion rates from other large-scale infrastructure projects in the UK (e.g. the Elizabeth line (formerly Crossrail), London 2012 Olympics and High Speed One). While HS2 Ltd is seeking, in its works contracts, to achieve a landfill diversion of demolition waste of 95%, it is acknowledged that this is an ambitious target. The landfill diversion rate of 90%, used in this assessment is consistent with the assessments carried out for previous phases of HS2, and has been chosen as a reasonable worst-case

[28] Waste and Resources Action Programme (2016), *Net Waste Tool*. No longer available online.

scenario. For this assessment, it has been assumed that the remaining 10% of demolition material will be disposed of off-site to landfill.

22.2.39 The quantity of demolition waste that will require off-site disposal to landfill during the construction period of 2025 to 2038 will be approximately 47,625 tonnes, which represents a 16% decrease on the quantity reported for the original scheme. The remaining 428,622 tonnes is expected to require management at suitable waste recovery and treatment infrastructure.

22.2.40 The Overview of Demolition Waste in the UK[29] uses waste data provided by the National Federation of Demolition Contractors to determine that approximately 91% of demolition waste is reused and recycled. This can be accounted for, in the most part, by the inert fraction of the waste. The report states that of the remaining 9% of demolition waste produced in the UK, approximately 3% is hazardous and 6% is sent to non-hazardous waste landfill. For this assessment, it has been assumed that 60% of the quantity of demolition waste requiring off-site disposal to landfill will be non-hazardous waste and 40% will be hazardous waste.

22.2.41 Based on this assumption, the class of landfill to which demolition waste will be sent for disposal is shown in Table 16.

Table 16: Quantity of demolition waste requiring off-site disposal to landfill (by class of landfill), 2025 to 2038

Class of landfill	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion AP1 revised scheme
Quantity of demolition waste for off-site disposal to inert waste landfill	0	0	0%
Quantity of demolition waste for off-site disposal to non-hazardous waste landfill	33,912	28,575	60%
Quantity of demolition waste for off-site disposal to hazardous waste landfill	22,608	19,050	40%
Total	**56,520**	**47,625**	**100%**

[29] Waste and Resources Action Programme (2009), *Overview of Demolition Waste in the UK*. Available online at: https://slidelegend.com/demolition-waste-wrap_5b24d5e5097c4720058b456b.html.

Construction waste

22.2.42 Construction waste quantities have been estimated based on a waste generation rate derived from industry-wide benchmark performance data procured from the Building Research Establishment Ltd. Using this methodology, the AP1 revised scheme is forecast to generate approximately 1.6 million tonnes of construction waste during the construction period of 2025 to 2038. The benchmarks against which construction waste quantities are forecast have risen. This has led to an increase in forecast construction waste of approximately 5% over the quantity reported for the original scheme in Volume 3 of the main ES.

22.2.43 Table 17 presents a summary of the forecast construction waste quantities for the AP1 revised scheme. More detailed construction waste forecasts, including the source and quantities of construction waste generated in each of the community areas along the route of the AP1 revised scheme, are provided in the SES1 and AP1 ES Route-wide Waste and Material Resources Assessment in Volume 5: Appendix WM-001-00000.

Table 17: Forecast construction waste quantities for the AP1 revised scheme, 2025 to 2038

Scheme	Total quantity of waste (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Original scheme	1,506,631	1,355,968	150,663
AP1 revised scheme	1,587,226	1,428,504	158,723

22.2.44 The quantity of construction waste that will be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 90%. This rate has been selected based on a review of industry good practice landfill diversion rates from other large-scale infrastructure projects, as identified for demolition waste.

22.2.45 It has been assumed, as a reasonable worst-case scenario for this assessment, that the remaining 10% of construction waste generated will be disposed of off-site to landfill. The quantity of construction waste that will require off-site disposal to landfill during the construction period of 2025 to 2038 will be approximately 158,723 tonnes. this represents a 5% increase on the quantity reported for the original scheme.

22.2.46 It has been assumed for this assessment that all of the construction waste requiring off-site disposal to landfill will be sent to non-hazardous waste landfill. This is based on indicative construction waste composition information published by the Building Research Establishment Ltd[30], Construction Leadership Council[31] and Waste & Resources Action

[30] Building Research Establishment (2001), *SMARTWaste case studies: reducing construction waste*. Available online at: https://www.bresmartsite.com/how-we-help/waste-management/.

[31] Strategic Forum for Construction (2011), *Waste: An Action Plan for halving construction, demolition and excavation waste to landfill, Strategic Forum for Construction*.

Programme[32]. These sources suggest that minimal quantities of hazardous waste are generated and that construction waste to landfill is likely to comprise non-hazardous fractions, such as component packaging, insulation materials and mixed construction wastes, which are unsuitable for reuse and recycling.

Worker accommodation site waste

22.2.47 Worker accommodation site waste quantities have been forecast based on a waste generation rate derived from the average annual household waste generation in the UK, according to the number of workers to be accommodated and the duration of occupation. Using this methodology, the AP1 revised scheme will generate approximately 977 tonnes of worker accommodation site waste during the construction period of 2025 to 2038, arising from the construction compounds proposed with temporary worker accommodation. Whilst the number of worker accommodation sites in the AP1 revised scheme remains unchanged from those reported in Volume 3 of the main ES, the expected duration of occupancy has changed slightly. This has led to an increase of approximately 10% over the quantity reported for the original scheme in Volume 3 of the main ES.

22.2.48 Worker accommodation site waste will be managed as C&I waste. More detailed worker accommodation site waste forecasts, including the source and quantities of the worker accommodation waste generated in each of the community areas along the route of the AP1 revised scheme, is provided in the SES1 and AP1 ES Route-wide Waste and Material Resources Assessment in Volume 5: Appendix WM-001-00000.

22.2.49 Table 18 presents a summary of the forecast worker accommodation site waste quantities for the AP1 revised scheme.

Table 18: Forecast worker accommodation site waste quantities for the AP1 revised scheme, 2025 to 2038

Scheme	Total quantity of waste (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Original scheme	887	488	399
AP1 revised scheme	977	537	440

22.2.50 The quantity of worker accommodation site waste that will be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 55%. Waste generated by occupants of worker accommodation sites will be similar in composition to household waste. As such, this rate has been selected based on a review of applicable household waste targets[33]. The quantity of worker accommodation site waste that will require off-site

[32] Waste and Resources Action Programme (2005), *Reference document on the status of wood waste arisings and management in the UK, M.E.L Research Ltd*. Available online at: https://www.environmental-expert.com/articles/reference-document-on-the-status-of-wood-waste-arisings-and-management-in-the-uk-4584.

[33] Aligns with municipal waste recycling target of 55% by 2025, set in the revised EU Waste Framework Directive.

management through waste treatment and recovery infrastructure during the construction period of 2025 to 2038 will be approximately 537 tonnes.

22.2.51 It has been assumed, as a reasonable worst-case scenario for this assessment, that the remaining 45% of worker accommodation site waste will be disposed of off-site to landfill. The quantity of worker accommodation site waste that will require off-site disposal to landfill during the construction period of 2025 to 2038 will be approximately 440 tonnes. This represents approximately a 10% increase over the quantity reported for the original scheme in Volume 3 of the main ES.

22.2.52 It has been assumed for this assessment that all of the worker accommodation site waste requiring off-site disposal to landfill will be sent to non-hazardous waste landfill.

Impact of construction on future baseline waste arisings

Construction, demolition and excavation waste

22.2.53 Table 19 provides a summary of material and waste quantities forecast to be generated by excavation, demolition and construction works for the AP1 revised scheme during the period 2025 to 2038.

Table 19: Summary of material and waste quantities that will be generated by excavation, demolition and construction works of the AP1 revised scheme, 2025 to 2038

Source	Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for on-site local placement (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Excavation	21,519,803	15,935,972	0	5,583,831
Demolition	476,247	428,622	0	47,625
Construction	1,587,226	1,428,504	0	158,723
Total AP1 revised scheme	23,583,276	17,793,098	0	5,790,179
Proportion AP1 revised scheme	100%	75%	0%	25%
Total original scheme	31,424,460	26,420,514	0	5,003,946
% change from original scheme	-25%	-33%	0%	+16%

22.2.54 Table 19 shows that the AP1 revised scheme will generate approximately 24 million tonnes of excavated material, demolition material and construction waste during the period 2025 to 2038. This represents a 25% decrease on the excavated material, demolition material and construction waste reported for the original scheme.

22.2.55 Of the 24 million tonnes of excavated material, demolition material and construction waste expected to be generated, approximately 75% of this quantity will be diverted from landfill via reuse, recycling and recovery, a decrease from approximately 84% reported in Volume 3 of the main ES. The proportion of demolition material and construction waste forecast to be

diverted from landfill is fixed, based on rates developed through reviews of industry practice; however, the proportion of excavated material diverted from landfill is based on the current level of design. The reported decrease in landfill diversion can largely be attributed to the Removal of the HS2 WCML connection (SES1-004-001). The construction of the scheme in the community areas affected by this SES1 design change predominantly used excavated materials generated elsewhere. Therefore, the overall effect of the removal is of a decrease in opportunities to reuse excavated material, and a subsequent increase in surplus excavated material.

22.2.56 The impact of this material and waste generation and its off-site treatment, recovery or disposal to landfill is shown in Table 20 as the percentage difference between future baseline CDEW arisings with and without the AP1 revised scheme.

22.2.57 Future baseline CDEW arisings are presented as the total quantity projected to be generated during the period 2025 to 2038. This is to provide a direct comparison with the total quantity of excavated material, demolition material and construction waste that will be generated during construction of the AP1 revised scheme.

Table 20: Impact of CDEW that will be generated by the AP1 revised scheme, 2025 to 2038

Future baseline scenario with and without the AP1 revised scheme	National change			Regional change[34]		
	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to off-site landfill (tonnes)	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to off-site landfill (tonnes)
Future baseline waste arisings 2025 to 2038 without the AP1 revised scheme	2,332,315,834[35]	1,734,324,181	597,991,652	155,402,544	113,968,875	41,433,669
AP1 revised scheme material and waste arisings 2025 to 2038	23,583,276	1,857,126	5,790,179	23,583,276	1,857,126	5,790,179
Future baseline	2,355,899,110	1,736,181,308	603,781,832	178,985,820	115,826,002	47,223,848

[34] Based on future baseline CDEW arisings and CDEW to landfill for North West region.

[35] Based on the future baseline national CDEW arisings projections as set out in Table 9.

Future baseline scenario with and without the AP1 revised scheme	National change			Regional change[34]		
	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to off-site landfill (tonnes)	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to off-site landfill (tonnes)
waste arisings 2025 to 2038 with the AP1 revised scheme						
Increase in future baseline waste arisings with the AP1 revised scheme	1%	0.1%	1%	15%	2%	14%

22.2.58 Table 20 shows that the total quantity of excavated material, demolition material and construction waste generated by the AP1 revised scheme will be equivalent to approximately 1% of national and 15% of regional future baseline CDEW arisings during the period 2025 to 2038. This represents no change from the original scheme in relation to the projected increase in national construction, demolition and excavation waste arisings and a 5% decrease from the original scheme in relation to the projected increase in regional construction, demolition and excavation waste arisings.

22.2.59 The total quantity of surplus excavated material, demolition waste and construction waste generated by the AP1 revised scheme that will require off-site disposal to landfill has increased by 16% compared with the quantity reported in Volume 3 of the main ES, and will be equivalent to approximately 1% of national and 14% of regional future baseline CDEW arisings to landfill during that time. This represents a negligible change from the original scheme in relation to the projected increase in national construction, demolition and excavation waste to landfill. The projected increase in regional construction, demolition and excavation waste to landfill is forecast to rise by 2% from the original scheme; this increase relates solely to the increase in surplus excavated material, demolition waste and construction waste generated by the AP1 revised scheme that will require off-site disposal to landfill. The regional future baseline with respect to the quantity of construction, demolition and excavation waste to landfill remains unchanged from that reported in Volume 3 of the main ES.

22.2.60 The total quantity of demolition waste and construction waste generated by the AP1 revised scheme that will require off-site management in waste recovery and treatment infrastructure will be equivalent to approximately 0.1% of national and 2% of regional future

baseline CDEW arisings managed in waste recovery and treatment infrastructure during that time. This represents no change from the original scheme.

Commercial and industrial waste

22.2.61 The impact of worker accommodation site waste generation and off-site treatment, recovery or disposal to landfill is shown in Table 21 as the percentage difference between future baseline C&I waste arisings with and without the AP1 revised scheme.

22.2.62 Future baseline C&I waste arisings are presented as the total quantity projected to be generated during the period 2025 to 2038. This is to provide a direct comparison with the total quantity of C&I waste that will be generated during construction of the AP1 revised scheme.

Table 21: Impact of C&I waste arisings generated by the AP1 revised scheme, 2025 to 2038

Future baseline scenario with and without the AP1 revised scheme	National change			Regional change[36]		
	C&I waste arisings (tonnes)	C&I waste arisings to treatment and recovery (tonnes)	C&I waste arisings to off-site landfill (tonnes)	C&I waste arisings (tonnes)	C&I waste arisings to treatment and recovery (tonnes)	C&I waste arisings to off-site landfill (tonnes)
Future baseline waste arisings 2025 to 2038 without the AP1 revised scheme	660,118,248 [37]	504,757,419	155,360,830	109,781,691	93,960,808	15,820,882
AP1 revised scheme material and waste arisings 2025 to 2038	977	537	440	977	537	440
Future baseline waste arisings 2025 to 2038 with the AP1 revised scheme	660,119,225	504,757,956	155,361,270	109,782,668	93,961,345	15,821,322
Increase in future baseline waste arisings with the AP1 revised scheme	0.0001%	0.0001%	0.0003%	0.0009%	0.0006%	0.0028%

22.2.63 Table 21 shows that the total quantity of worker accommodation site waste generated by the AP1 revised scheme will be equivalent to less than 0.01% of national and regional future

[36] Based on future baseline C&I waste arisings and C&I waste to landfill for the North West region.

[37] Based on the future baseline national C&I arisings projections as set out in Table 10.

baseline C&I waste arisings during the period 2025 to 2038. This represents no change from the original scheme.

22.2.64 The total quantity of worker accommodation site waste that will require off-site disposal to landfill will be equivalent to less than 0.01% of national and regional future baseline C&I waste arisings to landfill during that time. This represents no change from the original scheme.

22.2.65 The total quantity of worker accommodation site waste generated by the AP1 revised scheme that will require off-site management in waste treatment and recovery infrastructure will be equivalent to less than 0.01% of national and regional future baseline C&I waste arisings managed in waste treatment and recovery infrastructure during that time. This represents no change from the original scheme.

Likely significant environmental effects

Inert waste landfill capacity

22.2.66 The quantity of inert waste arising from the construction of the AP1 revised scheme that will require off-site disposal to landfill during the period 2025 to 2038 is approximately 5.4 million tonnes (see Table 22). This represents an increase of 839,375 tonnes (16%) over the quantity reported for the original scheme. Whilst the SES1 changes and AP1 amendments result in a net reduction in the quantity of excavated material, the net impact is of an increase in surplus excavated material, primarily comprising of inert waste. The increase in inert surplus excavated material, can primarily be attributed to the Removal of the HS2 WCML connection (SES1-004-001), due to the reduced opportunities to reuse excavated material.

22.2.67 Inert waste will account for approximately 93% of the total waste generated during construction requiring off-site disposal to landfill. The actual quantity of inert waste that will require off-site disposal will be subject to waste acceptance criteria set out in the Landfill Directive[38] and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills, and consequently may be subject to change.

Table 22: Quantity of waste requiring off-site disposal to inert waste landfill, 2025 to 2038

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion AP1 revised scheme
Excavation	4,564,689	5,404,064	100%
Demolition	0	0	0%
Construction	0	0	0%

[38] Commission of the European Communities (2002), Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 and Annex II of Directive 1999/31/EC on the Landfill of Waste (COM/2002/0512 Final). Available online at: http://eur-lex.europa.eu/legal-content/et/TXT/?uri=CELEX:52002PC0512.

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion AP1 revised scheme
Worker accommodation sites	0	0	0%
Total	**4,564,689**	**5,404,064**	**100%**

22.2.68 Off-site disposal of inert surplus excavated material to landfill will result in an overall reduction of inert waste landfill capacity of approximately 5.4 million tonnes.

22.2.69 This will be equivalent to an 87% reduction in inert waste landfill capacity in the North West region, according to the amount of capacity projected to be available at the end of earthworks activities in 2031 (approximately 6.2 million tonnes). On this basis, it is considered that there will be sufficient inert waste landfill capacity available in the North West region to accept the forecast quantity of inert surplus excavated material for off-site disposal to landfill, albeit with a significant decline in available capacity. Each of the waste planning authorities through which the AP1 revised scheme passes, have been consulted which will assist the respective waste planning authorities in meeting their statutory duty to facilitate delivery of sufficient waste infrastructure capacity according to projected waste arisings.

22.2.70 The significance criteria set out in the SMR for inert landfill is based on the difficulty and complexity of replacing the lost capacity, rather than focusing on the percentage of available capacity forecast to be occupied. The significance criteria are predicated on providing new waste management capacity in addition to what is already existing in the study area. Taking into account the relevant consenting requirements, inert landfill is considered to be easier to replace than non-hazardous and hazardous landfills, and this in turn is reflected in the higher upper threshold values for adverse effects for this landfill type.

22.2.71 Approximately 68% of the inert surplus excavated material that will be generated during construction of the AP1 revised scheme, will be collected at rail sidings with direct access to the UK rail network. This may enable the material to be transported off-site for disposal by rail, extending the distance that the material can be practicably transported for disposal, and increasing the ease with which the material can be sent for disposal in neighbouring regions. The West Midlands region (easily accessed by rail from the Crewe Rolling Stock Depot construction sidings in the Hough to Walley's Green area (MA01)) is projected to have 14.1 million tonnes of inert waste landfill capacity at the end of earthworks activities in 2031, and the Yorkshire and Humber region (easily accessed by rail from the Ardwick construction sidings in the Davenport Green to Ardwick area (MA07)) is projected to have 48.7 million tonnes of capacity at the end of earthworks activities in 2031. The capacity of these two regions substantially exceeds the available capacity in the North West, and their use would mitigate the reduction in available inert waste landfill capacity in the North West.

22.2.72 The draw-down of inert waste landfill capacity as a result of the AP1 revised scheme will occur over a period of several years, starting initially with enabling works followed by earthworks such as tunnelling. It is assumed that the generation of surplus excavated

material will take place primarily over a four-year period (2027 to 2031) during the construction of the AP1 revised scheme. This increase from the three and a half year period (2027 to 2030) reported in Volume 3 of the main ES results from changes to the duration of earthworks activities reported in the AP1 construction phase programme.

22.2.73 Whilst the forecast quantities of wastes requiring disposal to landfill are likely to have a considerable impact on available capacity, there are other options for its placement, including as restoration material on non-hazardous or hazardous sites and in other development projects. Waste planning authorities have a statutory responsibility to make provision for sufficient waste infrastructure capacity, and it is therefore likely, that the respective authorities will continue to plan for new inert waste landfill sites and/or to identify other suitable placement locations to enable continued capacity to be available as landfill void space is occupied.

22.2.74 All of the inert waste forecast to arise will be surplus excavated material and assuming that the earthworks take place at a constant rate of generation throughout the assumed four-year period, the total quantity of inert surplus excavated material requiring off-site disposal to landfill will be approximately 1.4 million tonnes per annum.

22.2.75 Significance criteria for inert waste landfill capacity, state that a local scale reduction in inert landfill void space capacity, and a need for additional small-scale disposal capacity of up to 2,000,000 tonnes per annum may be judged to be of low importance.

22.2.76 In accordance with these significance criteria, the likely environmental effects associated with the off-site disposal to landfill of inert surplus excavated material generated by construction of the AP1 revised scheme will be minor adverse, which is not considered to constitute a significant effect. This remains unchanged from the original scheme, as reported in Volume 3 of the main ES.

Non-hazardous waste landfill capacity

22.2.77 The total quantity of non-hazardous waste arising from the construction of the AP1 revised scheme that will require off-site disposal to landfill during the period 2025 to 2038 is approximately 367,506 tonnes (see Table 23). This represents a decrease of 49,542 tonnes (12%) over the quantity reported for the original scheme.

22.2.78 Approximately 49% will comprise of chemically unacceptable excavated materials, which cannot be treated on-site, and approximately 43% will comprise of construction waste. Smaller quantities of non-hazardous waste will be generated by demolition and worker accommodation site activities. The final quantity of non-hazardous waste that will require off-site disposal will be subject to waste acceptance criteria set out in the Landfill Directive[38] and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills, and consequently may be subject to change.

Table 23: Quantity of waste requiring off-site disposal to non-hazardous waste landfill, 2025 to 2038

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion AP1 revised scheme
Excavation	232,074	179,768	48.9%
Demolition	33,912	28,575	7.8%
Construction	150,663	158,723	43.2%
Worker accommodation sites	399	440	0.1%
Total	**417,048**	**367,506**	**100%**

22.2.79 Off-site disposal of non-hazardous surplus excavated material, demolition, construction and worker accommodation site waste will result in an overall reduction of non-hazardous waste landfill capacity of 367,506 tonnes over the 14-year construction period, 2025 to 2038.

22.2.80 This will be equivalent to a 3% reduction in non-hazardous waste landfill capacity in the North West region, according to the amount of capacity projected to be available at the end of construction in 2038 (approximately 11.7 million tonnes). The significance criteria set out in the SMR for non-hazardous landfill is based on the difficulty and complexity of replacing the lost capacity rather than focusing on the percentage of available capacity forecast to be occupied.

22.2.81 On this basis, it is considered that there will be sufficient non-hazardous waste landfill capacity available in the North West region to accept the forecast quantity of non-hazardous surplus excavated material, demolition and construction waste for off-site disposal to landfill.

22.2.82 It is assumed that non-hazardous waste generated by excavation activities will take place at a constant rate over a four-year period; this increase from the three and a half year period (2027 to 2030) reported in Volume 3 of the main ES, results from changes to the duration of earthworks activities reported in the AP1 construction phase programme. It is assumed that non-hazardous waste generated by demolition activities will take place at a constant rate over a five-year period, and that non-hazardous waste generated by all other construction activities will take place at a constant rate throughout the whole construction period between 2025 and 2038. The total quantity of non-hazardous waste requiring off-site disposal to landfill will be approximately 62,026 tonnes per annum.

22.2.83 Significance criteria for non-hazardous waste landfill capacity state that a local-scale reduction in non-hazardous waste landfill capacity of between 50,000 and 250,000 tonnes per annum, may be judged to be of importance in the local planning context.

22.2.84 According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of non-hazardous surplus excavated material, construction and demolition waste generated by the AP1 revised scheme will be moderate adverse, which is considered to constitute a significant effect. This remains unchanged from the original scheme reported in Volume 3 of the main ES.

Hazardous waste landfill capacity

22.2.85 The total quantity of hazardous waste arising from the construction of the AP1 revised scheme requiring off-site disposal to landfill during the period 2025 to 2038 will be approximately 19,050 tonnes (see Table 24). This represents a decrease of 3,558 tonnes (approximately 16%) over the quantity reported for the original scheme. This quantity comprises solely of hazardous waste generated by demolition activities; no Unacceptable Class U2 surplus excavated material is forecast to arise as a result of excavation works associated with the AP1 revised scheme. The final quantity of hazardous waste that will require off-site disposal will be subject to waste acceptance criteria set out in the Landfill Directive[38] and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills, and consequently may be subject to change.

22.2.86 A reasonable worst-case approach has been taken in determining the quantity of hazardous waste for off-site disposal to landfill. However, detailed chemical sampling and laboratory analysis, as part of future ground investigation works, may allow the hazardous waste to be reclassified as non-hazardous waste. This would reduce reliance on hazardous waste landfill capacity.

Table 24: Quantity of waste requiring off-site disposal to hazardous waste landfill, 2025 to 2038

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion AP1 revised scheme
Excavation	0	0	0%
Demolition	22,608	19,050	100%
Construction	0	0	0%
Worker accommodation sites	0	0	0%
Total	22,608	19,050	100%

22.2.87 Off-site disposal of hazardous waste will result in an overall reduction of hazardous waste landfill capacity of approximately 19,050 tonnes throughout the construction period of 14 years.

22.2.88 This will be equivalent to a 0.2% reduction in hazardous waste landfill capacity across the North West region according to the amount of capacity projected to be available at the end of demolition works in 2030 (approximately 7.8 million tonnes). The significance criteria set out in the SMR for hazardous landfill is based on the difficulty and complexity of replacing the lost capacity rather than focusing on the percentage of available capacity forecast to be occupied.

22.2.89 It is assumed that hazardous waste generated by demolition activities will take place at a constant rate over a five-year period. The total quantity of hazardous waste requiring off-site disposal to landfill will be approximately 3,810 tonnes per annum.

22.2.90 Significance criteria for hazardous waste landfill capacity state that a local-scale reduction in hazardous waste landfill void space capacity, or need for additional small-scale hazardous

waste disposal capacity of up 20,000 tonnes per annum, may be judged to be of low importance.

22.2.91 According to the significance criteria applicable to hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of hazardous surplus excavated material, construction and demolition waste generated by the AP1 revised scheme will be minor adverse, which is not considered to constitute a significant effect. This remains unchanged from the original scheme reported in Volume 3 of the main ES.

Other mitigation measures

General

22.2.92 Management of CDEW and worker accommodation site waste generated by the AP1 revised scheme will be subject to the Environmental Minimum Requirements (EMR)[39], which set out the environmental and sustainability commitments that will be observed in the construction of the proposed scheme.

22.2.93 It is likely that a large proportion of the hazardous demolition waste will comprise asbestos containing materials. This material could be disposed of at non-hazardous landfill sites within a separate cell for Stable Non-Reactive Hazardous Waste (SNRHW) providing it meets SNRHW waste acceptance criteria in accordance with the Landfill Directive[38] and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills. This will reduce reliance on hazardous waste landfill capacity.

Waste recovery

22.2.94 The total quantity of waste arising from the construction of the AP1 revised scheme that will be diverted from landfill and will require off-site management in waste treatment and recovery infrastructure during the period 2025 to 2038 is approximately 1.9 million tonnes (see Table 25). This represents a decrease of 7,474 tonnes (less than 1%) over the quantity reported for the original scheme. This quantity comprises waste generated by demolition, construction, and worker accommodation sites that will be diverted from landfill through segregation and recovery.

[39] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental minimum requirements.* Available online at: https://www.gov.uk/government/publications/environmental-minimum-requirements-for-hs2-phase-2b-crewe-manchester.

Table 25: Quantity of waste requiring off-site management in waste treatment and recovery infrastructure, 2025 to 2038

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Proportion AP1 revised scheme
Excavation	0	0	0%
Demolition	508,681	428,622	23%
Construction	1,355,968	1,428,504	77%
Worker accommodation sites	488	537	0%
Total	**1,865,137**	**1,857,663**	**100%**

22.2.95 Recognising construction waste is the predominant source of waste requiring off-site management in waste treatment and recovery infrastructure, a constant rate of waste generation throughout the 14-year construction period has been assumed. This estimates that the total quantity of demolition, construction and worker accommodation site waste to be diverted from landfill will be approximately 132,690 tonnes per annum. Off-site management of this waste in waste recovery and treatment infrastructure, will result in an overall reduction equivalent to 1% of unused waste treatment and recovery infrastructure capacity in the North West region according to the amount of unused capacity projected to be available in the final year of construction in 2038 (approximately 13.9 million tonnes).

22.2.96 On this basis, it is considered that there will be sufficient unused waste recovery and treatment infrastructure capacity available in the North West region to accept the forecast quantity of demolition, construction and worker accommodation site waste diverted from landfill.

Summary of likely residual significant environmental effects

22.2.97 Based on the other mitigation measures proposed, the likely residual environmental effects from construction will be:

- minor adverse (not significant) in relation to inert waste landfill capacity;
- moderate adverse in relation to non-hazardous waste landfill capacity, which is a significant effect; and
- minor adverse (not significant) in relation to hazardous waste landfill capacity.

22.2.98 There are no new or different likely residual significant environmental effects compared to those reported for the original scheme in the main ES.

Cumulative effects

AP1 revised scheme and Phase 2a

22.2.99 This assessment considers the cumulative effects during the period in which the construction of the AP1 revised scheme overlaps with the construction of HS2 Phase 2a (Phase 2a). In the Phase 2a Construction Timetable Information Paper[40], it is assumed that construction will be undertaken during a seven-year period between 2021 to 2028. Based on the construction period of the AP1 revised scheme, 2025 to 2038, this presents a potential four-year period during which construction of Phase 2a and the AP1 revised scheme will overlap (2025 to 2028).

22.2.100 The quantities of waste forecast to be generated by the Phase 2a construction works in the North West region remain unchanged from those reported in Volume 3 of the main ES.

22.2.101 It is considered that for inert, non-hazardous and hazardous landfill there will be sufficient capacity available in the North West region, to accept the forecast combined quantity of waste from both the AP1 revised scheme and Phase 2a.

22.2.102 The cumulative effects on the available inert, non-hazardous and hazardous waste landfill capacities are the same as those presented in Volume 3 of the main ES.

AP1 revised scheme and other committed developments

22.2.103 As reported in Volume 3 of the main ES, no further effects on waste and material resources beyond those stated previously in the assessment have been identified.

Assessment of the effects of operation

22.2.104 During the operation of the AP1 revised scheme, non-hazardous waste will be generated from route-wide and off-route works in railway stations and on passenger trains, and by rolling stock maintenance, track maintenance and ancillary infrastructure activities.

22.2.105 None of the AP1 amendments result in an increase to the operational waste generated by the original scheme, as reported in Volume 3 of the main ES. The total quantity of non-hazardous operational waste requiring off-site disposal to landfill in 2039, from the route-wide works associated with the AP1 revised scheme, will be 4,499 tonnes. This represents a decrease of 90 tonnes over the quantity reported for the original scheme (5,002 tonnes). No element of the AP1 revised scheme results in changes to the total quantity of operational waste forecast to require off-site disposal to landfill from the off-route works.

[40] High Speed Two Ltd (2021), *HS2 Phase 2a Information paper – D7: HS2 Phase 2a construction timetable*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/960675/D7_HS2_Phase_2a_Construction_timetable_v1.1.pdf.

22.2.106 This decrease in non-hazardous operational waste requiring off-site disposal to landfill does not result in any new or different likely significant environmental effects with respect to the route-wide or cumulative effects of the AP1 revised scheme. According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely residual route-wide and cumulative environmental effects associated with the off-site disposal to landfill of non-hazardous operational waste generated by the AP1 revised scheme remain minor adverse and not significant, as reported in the main ES.

23 Water resources and flood risk

23.1 Introduction

23.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on water resources and flood risk arising from the construction and operation of the original scheme.

23.1.2 Section 12 of this volume reports the new or different significant effects due to the SES1 changes.

23.1.3 This section of the AP1 ES identifies any new or different likely significant effects on water resources and flood risk compared to those reported in Volume 3 of the main ES, as amended by the SES1, due to the AP1 amendments.

23.2 Changes to the assessment

23.2.1 An assessment was undertaken to determine if the AP1 amendments would be likely to result in any new or different likely significant effects on water resources and flood risk from those reported in Volume 3 of the main ES, as amended by the SES1.

23.2.2 None of the AP1 amendments have been identified as likely to result in any new or different significant route-wide effects on flood risk.

23.2.3 An assessment of the effects of the AP1 amendments in relation to the objectives of the Water Framework Directive (WFD) is reported below.

Water Framework Directive compliance

23.2.4 An assessment was undertaken to determine if the AP1 amendments would likely result in any new or different effects on the current status and/or future achievement of status objectives of the WFD water bodies affected by the HS2 route, from those effects reported in Volume 3 of the main ES, as amended by SES1. Full details of all the changes are provided in SES1 and AP1 ES Volume 5: Appendix WR-001-00000.

23.2.5 A summary is provided below of any changes in adverse (amber) effects, which have the potential to result in a non-compliance with the statutory objectives of the WFD Regulations.

Adverse effects on current status

23.2.6 The SES1 changes remove a number of adverse (amber) effects that were identified in the main ES, associated with six water bodies. These are summarised in Section 12 of this volume.

23.2.7 The combined changes in traffic flow data, which takes account of SES1 changes and AP1 amendments combined, removes adverse (amber) effects from highway drainage on water quality within the following water bodies:

- Wistaston Brook (GB112068055280);
- Weaver (Marbury Brook to Dane) (GB112068060460);
- Puddinglake Brook (GB112068060220).

23.2.8 The assessment has concluded that the AP1 revised scheme will not cause any new or different adverse (amber) effects that may pose a risk of deterioration of the current status of any surface or groundwater water bodies.

Adverse effects on future achievement of status objectives

23.2.9 The SES1 changes remove a number of adverse (amber) effects that were identified in the main ES, associated with six water bodies. These are summarised in Section 12 of this volume.

23.2.10 The assessment has concluded that the AP1 revised scheme will not cause any new or different adverse (amber) effects that may pose a risk of preventing the future achievement of the status objectives of any surface or groundwater water bodies.

Summary of compliance

23.2.11 The assessment has concluded that the AP1 revised scheme will not cause any new or different adverse effects that pose a risk of causing a deterioration of the current status of any surface or groundwater water body, or preventing any water body from achieving its status objectives.

23.2.12 Moreover, the AP1 amendments remove a number of the adverse (amber) effects identified in the main ES, as amended by SES1, that had the potential to cause a deterioration in water body status.

23.2.13 Adverse (amber) effects identified in the main ES, as amended by SES1, remain, however, for the following surface water bodies:

- Wade Brook (GB112068060370); and
- Timperley Brook (GB112069061260).

23.2.14 These adverse effects relate to impacts from highway drainage discharges and may give rise to the potential risk of the AP1 revised scheme being non-compliant with the statutory objectives of the WFD.

23.2.15 In order to avoid the necessity of seeking an exemption under the WFD Regulations, additional mitigation measures are therefore still required to manage the risk of status deterioration within these two water bodies. A range of mitigation measure options have

been identified in consultation with the Environment Agency with the aim to ensure no residual risks of status deterioration. Potential measures are detailed in Volume 3 and Volume 5 (Appendix WR-01-00000) of the main ES.

23.2.16 Whilst it is currently anticipated that it will be feasible to develop and implement mitigation measures to ensure that there is no residual risk of deterioration in status for these water bodies, further detailed work is required to inform the best suitable solution. If these risks cannot be mitigated, a Regulation 19 exemption assessment will be required for each affected water body and submitted for approval by the Environment Agency (as the competent regulatory authority). Further details of the Regulation 19 exemption assessment process are provided in Annex M of Volume 5 (Appendix CT-001-00001_Part 3) of the main ES.

23.2.17 Whilst every effort will be made to ensure a Regulation 19 exemption assessment is not required, where unavoidable an assessment will be prepared on a route-wide and/or specific water body basis, as appropriate, in consultation with the Environment Agency and reported to Parliament during passage of the Bill.

24 Phase One, Phase 2a and Phase 2b Western Leg combined impacts

24.1 Introduction

24.1.1 Volume 3 of the main ES[41] presented a tabulated summary of the potential total impacts (individually and combined) of Phase One, Phase 2a and the Phase 2b Western Leg original scheme on a range of environmental receptors.

24.2 Summary of changes to combined impacts

24.2.1 Table 26 presents a summary of the potential total impacts of Phase One, Phase 2a and the Phase 2b Western Leg AP1 revised scheme on a range of environmental receptors. The Phase One data is taken from the Phase One SES4 and AP5 ES[42]. The Phase 2a data is taken from the Phase 2a SES2 and AP2 ES[43].

24.2.2 The Phase 2b Western Leg AP1 revised scheme data provides the impacts from the AP1 revised scheme, which includes SES1 changes and AP1 amendments for the following community areas only:

- MA01: Hough to Walley's Green;
- MA02: Wimboldsley to Lostock Gralam;
- MA03: Pickmere to Agden and Hulseheath;
- MA04: Broomedge to Glazebrook; and
- MA05: Risley to Bamfurlong.

24.2.3 Impacts from SES changes and AP amendments in the remaining community areas and from off-route works will be reported in the future SES2 and AP2 ES.

[41] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 3: Route-wide effects.* Available online at: https://www.gov.uk/government/publications/volume-3-route-wide-effects--2.

[42] High Speed Two Ltd (2015), High Speed Rail (London – West Midlands), *Supplementary Environmental Statement 4 and Additional Provision 5, Environmental Statement*. Available online at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/481043/Volume_1_Introduction_and_methodology__Volume_2_Community_forum_area_reports__Volume_3_Route-wide_effects__Glossary_of_terms_and_list_of_abbreviations.pdf.

[43] High Speed Two Ltd (2019), High Speed Rail (West Midlands – Crewe), *Supplementary Environmental Statement 2 (SES) and Additional Provision 2 (AP) Environmental Statement, Volume 3, Route-wide effects.* Available online at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/775957/J20_Volume_3_Route-wide_effects_web.pdf.

Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme

	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme total)
Route characteristics (km)				
Total length[44]	216	58	62.1	336.1
Tunnel	49.5	2.9	19.5	71.9
Cutting	74.7	28.3	6.7	109.7
Viaduct	16.3	5.5	4.7	26.5
Embankment	62.5	21.3	18.9	102.7
Property and settlements				
Demolitions (residential)	326 dwellings (218 buildings)	27 dwellings	63 dwellings	416 dwellings
Demolitions (community)	19 community facilities	0 community facilities	5 community facilities[45]	24 community facilities
Demolitions (commercial/retail/ manufacturing/ industrial/ miscellaneous)	372 units (309 buildings)[46]	68 units	144 units	584 units
Total demolitions (including residential)	546 buildings	95 buildings[47]	212 buildings	853 buildings
Employment and housing				
Permanent jobs created	2,200[48]	140	2,720	5,060
Construction jobs created	14,600[49]	1,920[49]	6,800	23,320

[44] Not all route characteristics are defined here hence why the cumulative of route characteristics doesn't equal the total. Characteristics like stations, underground boxes, and tunnel portals are excluded.

[45] This figure has been corrected from that reported in the main ES, attributable to a correction in Manchester Piccadilly community area (MA08). The additional community facility was incorrectly reported in the main ES under Demolitions (commercial/retail/manufacturing/industrial/miscellaneous). There is no change to the overall number of community facilities demolished from that assessed in the main ES. Correction to be reported in the future Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES).

[46] This figure includes some properties which also provide community resources, e.g. public houses, local services.

[47] Includes total of residential, community, commercial and miscellaneous buildings including outbuildings associated with residential properties.

[48] Indicative direct operational employment figure was estimated to the nearest 100 jobs.

[49] Number reported as an approximate equivalent of permanent full time construction jobs.

	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme total)
Jobs displaced[50]	7,950	25	5,400	13,375
Noise				
Monetary valuation of noise impacts[51]	n/a[52]	£-3.12m	£2.8m	n/a
Landscape				
AONB crossed at surface (km)	7.6	0	0	7.6
Historic environment				
Scheduled Monuments directly affected	1	0	0	1
Registered Battlefields directly affected	1	0	0	1
Grade I and II* structures directly affected	2	0	1	3
Grade II structures directly affected	17	4	6	27
Registered Parks and Gardens directly affected	2	0	0	2
Conservation Areas directly affected	2	4	2	8
Biodiversity and wildlife				
Natura 2000 sites adversely affected	0	0	1	1
SSSI directly affected	3	0	2	5

[50] Jobs displaced comprise jobs relocated elsewhere in the UK economy and jobs lost, due to land being acquired for the construction and operation of the Proposed Scheme.

[51] The monetary valuation of noise impacts is calculated using the methodology described in Section 2 'Noise Impacts' of Department for Transport (2013), *TAG Unit 3 Environmental Impact Appraisal published by the* Department for Transport. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/254128/webtag-tag-unit-a3-environmental-impact-appraisal.pdf.

The assessment utilises the latest available Department for Transport (2021), *TAG data book*. Available online at: https://www.gov.uk/government/publications/tag-data-book.

[52] The assessment method has materially changed since that used for the Phase One AP5 revised scheme ES (December 2015) and hence the levels are not directly comparable.

	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme total)
Ancient Woodlands directly affected	32	11	15	58
Water resources and flood risk				
Major[53] rivers diverted	8	0	1	9
Route through Flood Zone 3 (km)	12.0	2.4	1.3	15.7
Station/depot occupation of Flood Zone 3 (ha)	2.1	0.6	0.9	3.6
Cutting or tunnel through SPZ 1 or 2 (km)	6.7	0.6	0	7.3
Land use resources				
Active landfills crossed[54]	0	0	0	0
Grade 1 and 2 agricultural land (km)	22.0	9.9	2.4	34.3
Waste and material resources				
Excavated material (million m^3)	63.4[55]	18.9[56]	9.44[57]	n/a
Concrete (million tonnes)	13.04	2.10	4.38	19.52
Steel (million tonnes)	1.30	0.13	0.44	1.87

[53] Major rivers are defined, in the context of this table, as those with a catchment area greater than 50km^2 at the point of the route crossing. This definition is set out in the Phase 2b Sustainability Statement.

[54] Waste storage facilities located deep underground (100 to 350m below ground level) within salt caverns are excluded as the Proposed Scheme will not prevent such facilities from continuing to operate.

[55] This figure is the total quantity of excavated material that will be generated from the construction of Phase One. This includes excavated material that will be reused in the construction process as well as excavated material that will be made available for use off-site or disposed of on or off site.

[56] This figure is the estimated quantity of excavated material excluding top soil and sub-soil that will be generated from the construction of the Phase 2a as reported in the SES2 and AP2 ES.

[57] This figure includes excavated material from the project's schedule for quantities for the main route, from highways foundation works and from off-route works.

	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme total)
Carbon emissions (tCO_2e) [58]				
Construction	6,125,000	1,451,000	3,890,000	11,466,000
Operation – use stage	2,300,000[59]	315,000	2,999,000	5,614,000
Operation – benefits and loads beyond project boundaries	-5,270,000[60]	-307,000	-3,888,000[61]	-9,465,000

[58] The combined carbon footprint of the construction and operation of Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and the Phase 2b AP1 revised scheme. Whilst it is informative to look across numbers for both phases to get an overall picture of GHG emissions, these numbers are not directly comparable. This is because the scope, assumptions and methodologies differ slightly between phases and should be used with caution. Phase One emissions are reported over the first 60 years of operation whilst the Proposed Scheme emissions are reported over a 120-year design life.

[59] Phase One use stage carbon emissions are over the first 60 years of operation. It does not account for the years 61-120. This figure underestimates the 120-year impact, however the disparity in temporal scope is not expected to result in a significant underestimate given the rate and extent of the UK grid decarbonisation.

[60] Phase One benefits and loads beyond the project boundary carbon emissions are over the first 60 years of operation. It is possible that this figure underestimates the 120-year impact, however the disparity in temporal scope is not expected to result in a significant underestimate given the rate and extent of forecast electric vehicle uptake and decarbonisation or road and air journeys.

[61] An assessment of GHG emissions from modal shift (i.e. changes in GHG emissions associated with car, conventional rail and domestic aviation trips switching to high speed rail) will be included in the future Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) and cover all community areas and off route works.

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