

High Speed Rail (Crewe to Manchester and West Midlands to Leeds)

Working Draft Environmental Statement

Volume 3: Route-wide effects

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Department
for Transport

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

High Speed Two (HS2) Limited,
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA

Telephone: 08081 434 434

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.hs2.org.uk

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Preface

The working draft Environmental Statement

This report is Volume 3 of the working draft Environmental Statement (ES) for Phase 2b of High Speed Two (HS2). The purpose of the working draft ES is to provide the public and other stakeholders with an opportunity to review and comment on preliminary environmental information for Phase 2b of HS2, which is based on a stage in the ongoing design development and environmental assessment process. Nothing included at this stage is intended to limit the form of the final scheme that will be presented in the hybrid Bill and formal ES in light of further scheme development and the ongoing discussions with stakeholders such as Transport of the North and Midlands Connect. Consultation on the working draft ES is being undertaken to help inform the ongoing design and environmental assessment in advance of producing a statutory formal ES. The formal ES will accompany the deposit of the hybrid Bill for Phase 2b of HS2.

Phase 2b comprises the section of the proposed HS2 rail network, from Crewe to Manchester (and a connection onto the West Coast Main Line (WCML)) (the western leg), and from the West Midlands to Leeds (and a connection onto, and part electrification of, the Midland Main Line (MML) and a connection onto the East Coast Main Line (ECML)) via the East Midlands and South Yorkshire (the eastern leg). Collectively, this is referred to in this working draft ES as the 'Proposed Scheme'. The working draft ES describes the Proposed Scheme and reports its likely significant environmental effects and the measures proposed to mitigate those effects, based on a stage in the ongoing design and environmental assessment.

The hybrid Bill for Phase One of the HS2 network, between London and the West Midlands, was the subject of an ES deposited in November 2013, followed by ESs deposited with Additional Provisions to that Bill in 2014 and 2015. The Phase One hybrid Bill received Royal Assent in February 2017 and pre-construction work on Phase One commenced in July 2017.

The hybrid Bill for Phase 2a of the HS2 network, between the West Midlands and Crewe, was the subject of an ES deposited in July 2017, followed by a subsequent ES deposited with an Additional Provision to that Bill in March 2018. The Phase 2a Bill is expected to receive Royal Assent in 2019.

Consultation on the working draft Environmental Statement

The public has an opportunity to comment on this working draft ES. The period of public consultation is taking place during October 2018 – December 2018; the first day of the consultation period being the date the Secretary of State for Transport formally announces the consultation and the publication of the working draft ES documents on www.gov.uk/hs2.

Structure of the working draft Environmental Statement

This report is Volume 3 of the working draft ES for Phase 2b of HS2. The working draft ES describes the design of the Proposed Scheme and reports the likely significant environmental effects of the construction and operation of the Proposed Scheme and proposed mitigation and monitoring measures, based on a stage in the ongoing design and environmental assessment process. The report will be updated for the formal ES to reflect further work on the design, assessment and mitigation and monitoring measures between now and when the hybrid Bill is deposited. The structure of the working draft ES is shown in Figure 1.

This working draft ES has been prepared by persons who have sufficient expertise to ensure the completeness and technical quality of the statement.

The working draft ES comprises the following documents:

Non-technical summary

This provides a summary in non-technical language of the following, identified at a stage in the ongoing design and environmental assessment:

- the Proposed Scheme and the reasonable alternatives studied;
- the likely significant beneficial and adverse effects of the Proposed Scheme;
- the means to avoid or reduce likely significant environmental effects; and
- an outline of the monitoring measures to manage the effects of construction and the effectiveness of mitigation post construction, as well as appropriate monitoring during operation.

Glossary of terms and list of abbreviations

This contains terms and abbreviations, including units of measurement, used throughout the working draft ES.

Volume 1: Introduction and methodology

This provides:

- a description of HS2, the environmental impact assessment (EIA) process and the approach to consultation and engagement;
- details of the permanent features of the Proposed Scheme and general construction techniques, based on a stage in the ongoing design;
- a summary of the scope and methodology for the environmental topics;
- an outline of the general approach to mitigation;
- an outline of the approach to monitoring, including measures to manage the effects of construction, the effectiveness of mitigation post construction, as well as the approach to monitoring during the operational phase, based on a stage in the ongoing design; and

- a summary of the reasonable alternatives studied (including local alternatives studied prior to the Government's announcement of the preferred route in July 2017). Local alternatives studied post July 2017 are reported in the relevant Volume 2: Community area reports.

Volume 2: Community area reports and map books

These cover the following community areas:

- western leg: MA01 Hough to Walley's Green; MA02 Wimboldsley to Lostock Gralam; MA03 Pickmere to Agden and Hulseheath; MA04 Broomedge to Glazebrook; MA05 Risley to Bamfurlong; MA06 Hulseheath to Manchester Airport; MA07 Davenport Green to Ardwick; MA08 Manchester Piccadilly Station; and
- eastern leg: LA01 Lea Marston to Tamworth; LA02 Birchmoor to Austrey; LA03 Appleby Parva to Ashby-De-La-Zouch; LA04 Coleorton to Kegworth; LA05 Ratcliffe-on-Soar to Long Eaton; LA06 Stapleford to Nuthall; LA07 Hucknall to Selston; LA08 Pinxton to Newton and Huthwaite; LA09 Stonebroom to Clay Cross; LA10 Tibshelf to Shuttlewood; LA11 Staveley to Aston; LA12 Ulley to Bramley; LA13 Ravenfield to Clayton; LA14 South Kirkby to Charlston Common; LA15 Warmfield to Swillington and Woodlesford; LA16 Garforth and Church Fenton; LA17 Stourton to Hunslet; and LA18 Leeds Station.

The reports provide the following information for each area, as identified at a stage in the ongoing design and environmental assessment:

- an overview of the area;
- a description of the construction and operation of the Proposed Scheme within the area;
- a summary of the local alternatives considered since the Government's announcement of the preferred route in July 2017;
- a description of the environmental baseline;
- a description of the likely significant beneficial and adverse effects of the Proposed Scheme;
- the proposed means of avoiding, reducing or managing the likely significant adverse effects; and
- where possible, the proposals for monitoring, including measures during and post construction, and during the operational phase.

The maps relevant to each community area are provided in separate Volume 2: Community area map book. These maps include the location of the key environmental features (Map Series CT-10), key construction features (Map Series CT-05) and operation features (Map Series CT-06) of the Proposed Scheme. There are also specific maps showing proposed viewpoint and photomontage locations (Map Series LV-00, LV-02, LV-03, and LV-04, to be read in conjunction with Section 11, Landscape and visual of the Volume 2: Community area reports), operational sound contour maps (Map Series SV-01, to be read in conjunction with Section 13, Sound, noise and vibration of the Volume 2: Community area reports) and maps showing key surface water and groundwater features (Map Series WR-01 and WR-02, to be read in conjunction with Section 15, Water resources and flood risk of the Volume 2: Community area reports).

In addition to the community areas detailed above, reports are provided for community areas within which electrification of a section of the MML is proposed: MMLo1 Danesmoor to Brierley Bridge and MMLo2 Unstone Green to Sheffield Station. These reports are provided at an earlier stage of the design and environmental assessment process, following the amendment of the route of the Proposed Scheme to include the electrification of a section of the MML between Clay Cross and Sheffield Midland Station. This would enable high speed trains to connect to Chesterfield and Sheffield as part of the Proposed Scheme. They include for each area:

- an overview of the area;
- a description of the proposed works within the area, based on a stage in the ongoing design;
- an outline of potential effects; and
- an overview of stakeholder engagement and consultation to be carried out as part of the EIA process.

Mitigation measures have not been identified at this stage of the design and environmental assessment process in relation to the likely effects arising from construction and operation of the Proposed Scheme for the MMLo1 Danesmoor to Brierley Bridge and MMLo2 Unstone Green to Sheffield Station areas. Any required mitigation measures will be reported in the formal ES. In addition, any required environmental monitoring during operation of the Proposed Scheme will be reported in the formal ES.

Volume 3: Route-wide effects

This describes the effects that are likely to occur at a geographical scale greater than the community areas described in the Volume 2: Community area reports, based on a stage in the ongoing design and environmental assessment.

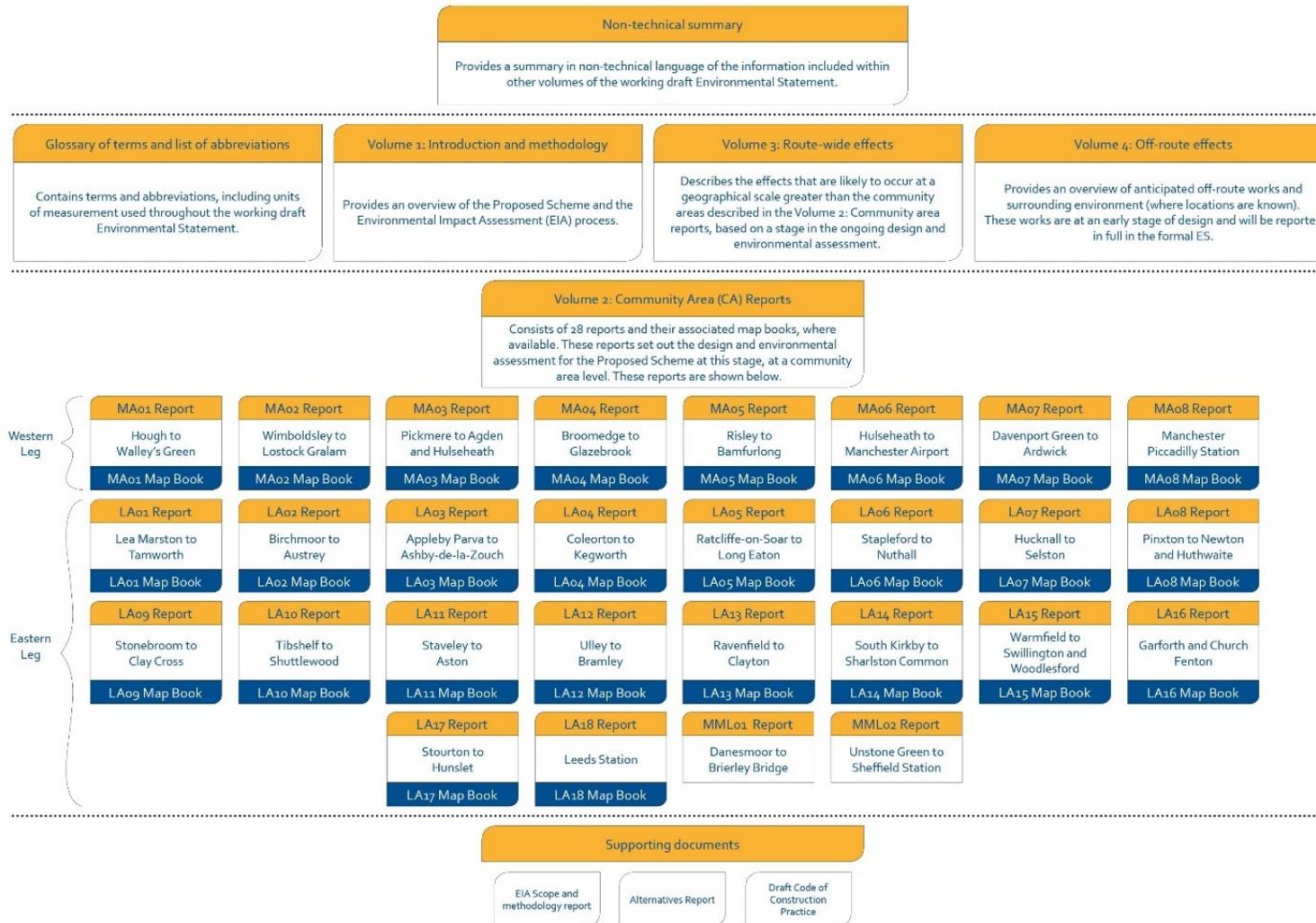
Volume 4: Off-route effects

This provides an overview of anticipated off-route works and surrounding environment (where locations are known) together with indicative lists of environmental topics expected to be included in the formal ES in due course. These works are at an early stage of the design and will be reported in full in the formal ES.

Supporting documents

- EIA Scope and Methodology Report: this outlines the scope and methodology adopted for the EIA. HS2 Ltd consulted on a draft of the EIA Scope and Methodology Report (SMR) between July and September 2017. This updated version takes into consideration comments received, where appropriate, in addition to changes required as a result of updates to legislation or industry best practice guidance.
- Alternatives report: this describes the evolution of the Proposed Scheme and the reasonable alternatives considered at this stage of the design, at the strategic, route-wide, route corridor and local levels.
- Draft Code of Construction Practice (CoCP): this sets out measures and standards to provide effective planning, management and control of potential impacts on individuals, communities and the environment during construction.

Figure 1: Structure of the working draft Environmental Statement



1 Introduction

1.1 Overview of High Speed Two

- 1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. New stations in London, Birmingham, Leeds, Manchester and East Midlands would be served by high speed trains running at speeds of up to 360 kilometres per hour (kph) (225 miles per hour (mph)). HS2 trains would also run on the existing network to serve destinations including Crewe, Preston, Liverpool, Sheffield, Newcastle, York, Glasgow, and Edinburgh.
- 1.1.2 In January 2012, following a consultation exercise, the Government announced its intention to develop a Y-shaped high speed rail network, which would be brought forward in two phases. The 2012 decision confirmed the Government's preferred route for a high speed line between London and the West Midlands, called Phase One. In November 2013, HS2 Ltd deposited a hybrid Bill in Parliament to seek powers for the construction and operation of Phase One. The High Speed Rail (London – West Midlands) Act received Royal Assent in February 2017 and pre-construction on Phase One commenced in July 2017.
- 1.1.3 In January 2013, the Government announced its initial preferred route for Phase Two between the West Midlands, Leeds and Manchester. Following some minor amendments, the proposed route was subject to a seven-month public consultation from July 2013 until January 2014.
- 1.1.4 In two reports, *HS2 Plus*¹ and *Rebalancing Britain*², Sir David Higgins recommended accelerating the section of the Phase Two route between the West Midlands and Crewe to deliver some of the benefits that HS2 would bring to the region and the North sooner. In the November 2015 Command Paper *High Speed Two: East and West: The next steps to Crewe and beyond*³, the Government announced its intention to bring forward the route between the West Midlands and Crewe, and set out the preferred line of route for what is known as Phase 2a. Phase 2a involves the construction of the first approximately 58km of the western leg of Phase Two from the end of the Phase One route to Crewe, with a connection to the West Coast Main Line (WCML) at Crewe. In July 2017, HS2 Ltd deposited a hybrid Bill to Parliament to seek powers for the construction and operation of Phase 2a. A subsequent ES deposited with an Additional Provision to that Bill followed in March 2018. The High Speed Rail (West Midlands - Crewe) Act is expected to receive Royal Assent in 2019.
- 1.1.5 On 15 November 2016, the Government set out the majority of its preferred route⁴ between Crewe and Manchester and between the West Midlands and Leeds, referred

¹ HS2 Ltd, (2014), *HS2 Plus – A report by David Higgins*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/374695/HS2_Plus_-_A_report_by_David_Higgins.pdf

² HS2 Ltd, (2014), *Rebalancing Britain – From HS2 towards a national transport strategy*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/374709/Rebalancing_Britain_-_From_HS2_towards_a_national_transport_strategy.pdf

³ Department for Transport (2015), *High Speed Two: East and West: The next steps to Crewe and beyond November 2015*. Cm 9157. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480712/hs2-east-and-west.pdf

⁴ Department for Transport (2016), *High Speed Two: From Crewe to Manchester, the West Midlands to Leeds and beyond*. Cm 9355, November 2016. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568208/high-speed-two-crewe-manchester-west-midlands-leeds-web-version.pdf

to as Phase 2b and completing what is known as the 'Y network'. Alongside the preferred route of Phase 2b, the Government also announced a consultation on seven route refinement areas.

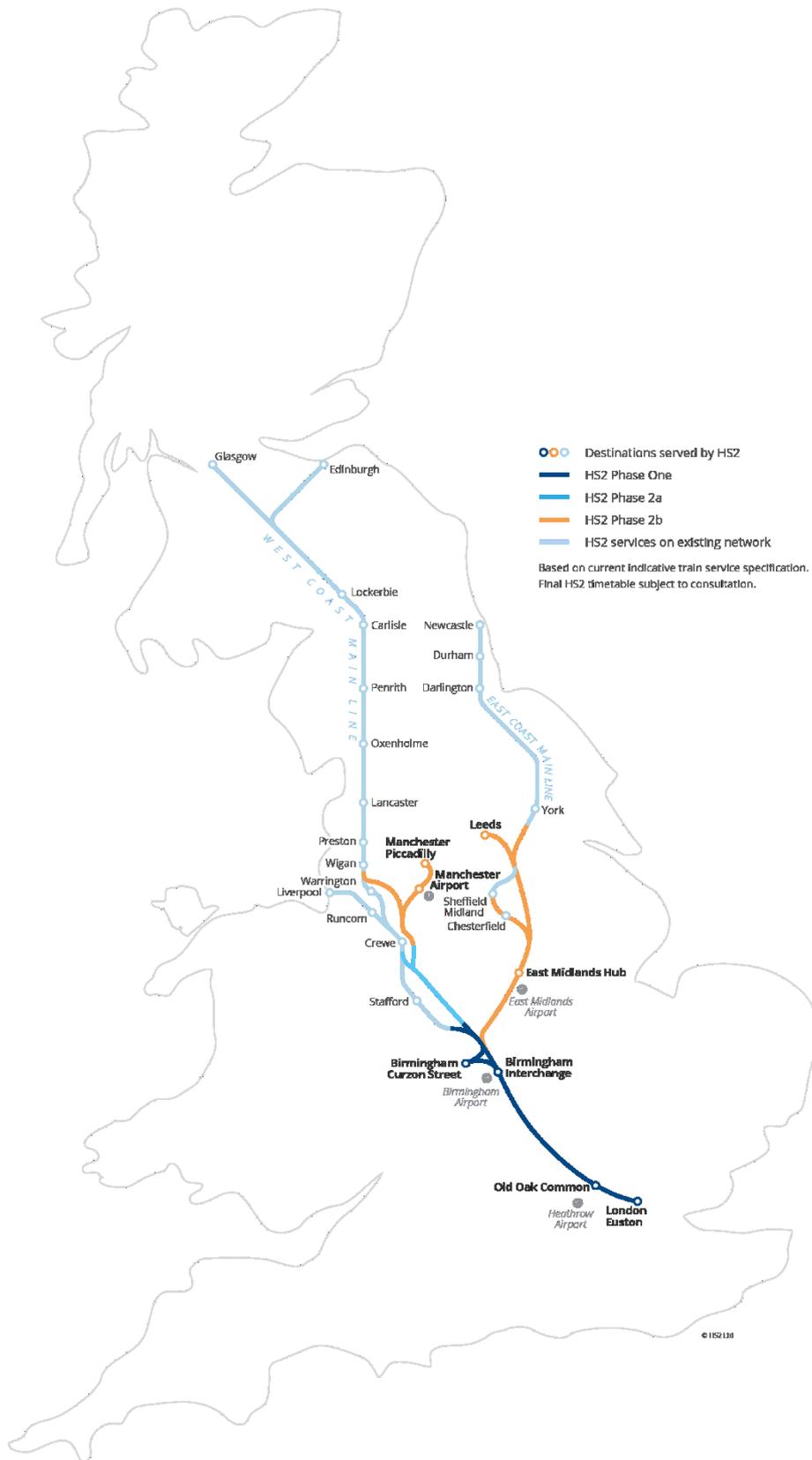
- 1.1.6 On 17 July 2017, the Government announced a decision on these refinements and confirmed the remainder of the preferred route for Phase 2b.
- 1.1.7 Phase 2b, referred to as 'the Proposed Scheme', is the subject of this working draft Environmental Statement (ES). The working draft ES is an interim report presenting preliminary environmental information for consultation. The design and assessment of the Proposed Scheme are at an early stage of development and are presented here to enable the public and stakeholders to provide comments, which will be taken into account, as appropriate. The environmental impact assessment (EIA) and design of the Proposed Scheme will continue to be refined during and following this consultation and reported in the formal ES. Therefore, nothing included at this stage is intended to limit the form of the final scheme that will be presented in the hybrid Bill and formal ES.
- 1.1.8 The Proposed Scheme comprises the route from Crewe to Manchester with a connection into the WCML (referred to as the 'western leg'), and from the West Midlands to Leeds via the East Midlands and South Yorkshire with a connection onto, and part electrification of, the Midland Main Line (MML) and a connection onto the East Coast Main Line (ECML) (referred to as 'the eastern leg'). Since the Government announced the preferred route for Phase 2b in July 2017, the Proposed Scheme was amended to include the electrification of a section of the MML between Clay Cross and Sheffield Midland Station⁵. This would enable high speed trains to connect to Chesterfield and Sheffield as part of the Proposed Scheme. The design of the proposed electrification of this section of the MML is at an early stage of development (as reported in the MMLo1 and MMLo2 Volume 2: Community area reports) and the outcome of the environmental assessment of the likely significant effects of the electrification works will be reported in the formal ES.
- 1.1.9 The powers for Phase 2b will be sought through a hybrid Bill ('the Bill') that is expected to be presented before Parliament in 2020. Construction of Phase 2b is anticipated to commence in approximately 2023, with operation planned to start around 2033.

⁵ HS2 Ltd (2018). Press release: HS2 Ltd to undertake development works for electrification of the Midland Main Line. Available online at: <https://www.gov.uk/government/news/hs2-ltd-to-undertake-development-works-for-electrification-of-the-midland-main-line>

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Figure 2: The HS2 network



1.2 Purpose of this report

- 1.2.1 This volume of the working draft ES presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment that have been identified on a route-wide basis at this stage of design development and assessment. The report also describes the means to avoid, prevent or reduce the likely significant adverse route-wide effects of the Proposed Scheme on the environment, identified to date.
- 1.2.2 Consultation on the working draft ES is being carried out early in the development of the Phase 2b proposals. This is to assist the early engagement with those potentially affected by the Proposed Scheme and to help inform the design and assessment of the Proposed Scheme. Parliamentary Standing Orders do not require a working draft ES. However, developing a working draft ES and consulting on it in advance of the statutory formal ES means that consultees have the opportunity to comment on the Proposed Scheme earlier in the process.
- 1.2.3 As this is a working draft ES, where information is not available at this time, professional judgement and reasonable worst-case assumptions have been used to provide an indication of the likely impact to inform the consultation.
- 1.2.4 The likely significant environmental effects of the Proposed Scheme will be described in the formal ES to be deposited in accordance with the requirements of Parliamentary Standing Order 27A (SO27A)^{6,7}. It is possible that the effects and mitigation described in the formal ES may differ from those presented in this working draft ES, due to the provisional nature of the environmental and design information that is currently available and as a result of consultation on the Proposed Scheme, as appropriate.
- 1.2.5 This report should be read in conjunction with the Volume 2: Community area reports and their corresponding map books and Volume 4: Off-route effects. The community area reports present the elements of the Proposed Scheme and local alternatives studied within each area of the Phase 2b route. They also identify the likely significant environmental effects of the construction and operation of the Proposed Scheme, as well as any proposed monitoring and mitigation measures, as appropriate to the respective area of study. Volume 1: Introduction and methodology, Section 9, also sets out the general approach to environmental monitoring during construction and operation of the Proposed Scheme for each environmental topic.

⁶ Standing Order 27A of the Standing Orders of the House of Commons relating to private business (environmental assessment) – 2015, House of Commons.

⁷ Standing Orders of the House of Lords – Private Business – 2015, House of Lords.

1.3 Scope of this report

- 1.3.1 The effects reported in this volume are those considered to be appropriately assessed at a geographical scale greater than that presented within the Volume 2: Community area reports and Volume 4: Off-route effects. These include:
- overall effects on the agricultural, forestry and soil resource;
 - effects relating to climate change;
 - effects on ecological resources of greater than local importance and on protected species;
 - route-wide effects on health;
 - landscape and visual effects where there is the potential for these to occur at a geographical scale greater than the community areas;
 - effects resulting from major accidents and disasters;
 - overall socio-economic effects;
 - route-wide traffic and transport effects;
 - effects associated with the off-site disposal to landfill of solid waste during construction and operation; and
 - route-wide effects on water resources and on flood risk.
- 1.3.2 Of these topics, health and major accidents and disasters are new topics in this Volume 3: Route-wide effects of the ES (and the Phase 2a ES) relative to those included in the Phase One ES. They have been included for assessment due to the requirements of the EIA Regulations⁸, as described in Volume 1: Introduction and methodology.
- 1.3.3 Certain topics are less likely to report significant route-wide effects (i.e. air quality, community, historic environment, land quality, and sound, noise and vibration). Where this is the case the environmental topic is introduced and reasons for this conclusion are presented.
- 1.3.4 In addition to the environmental topics covered in Sections 2 to 16 of this report, electromagnetic interference is addressed in Volume 1: Introduction and methodology.
- 1.3.5 An assessment of potential environmental effects beyond the Phase 2b route corridor and its associated local environment has also been undertaken and this 'off-route' assessment is reported in Volume 4: Off-route effects.
- 1.3.6 Given that each environmental topic assesses effects in a different way appropriate to that topic, the approach to route-wide effects varies between topics. The extent and basis of the route-wide assessment presented in this report is, therefore, explained in

⁸ Town and Country Planning (Environmental Impact Assessment) Regulations 2017. SI 2017 No. 571. Her Majesty's Stationery Office, London. Available online at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf

each of the topic sections. The scope of each topic and the general approach to assessment for this ES is described in Volume 1: Introduction and methodology and the EIA Scope and Methodology Report (SMR)⁹.

- 1.3.7 HS2 Ltd published a draft EIA SMR for consultation in July 2017, outlining the proposed scope and methodology for the EIA of the Proposed Scheme. This provides the framework within which the working draft ES has been prepared. This report was issued to statutory bodies, non-government organisations, and local authorities (including parish councils), and was made available on the Government's website, allowing comment by local interest groups and the public. The consultation period ended on 29 September 2017, with the EIA SMR subsequently updated to take into account the comments received where considered appropriate. The revision to the EIA SMR is published alongside the working draft ES (available on the website www.gov.uk/hs2) and will be used to undertake the assessment reported in the formal ES.

1.4 Structure of this report

- 1.4.1 This report presents the route-wide effects for each environmental topic in the same order as reported in the Volume 2: Community area reports, while including three additional sections describing the effects relating to climate change, major accidents and disasters, and waste and material resources. Where there are not considered to be significant route-wide effects, the environmental topic is introduced and reasons for this conclusion are presented. The report concludes with a section summarising the potential combined impacts of Phase One, Phase 2a and Phase 2b.
- 1.4.2 This report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment on a route-wide basis. The report also describes the means proposed to avoid, prevent or reduce the likely significant adverse route-wide effects of the Proposed Scheme. The draft Code of Construction Practice (CoCP)¹⁰ includes commitments to monitoring significant effects during construction. Operational monitoring measures specific to route-wide topics are presented within this report, where relevant.
- 1.4.3 This report is structured as follows:
- Introduction (Section 1);
 - Agriculture, forestry and soils (Section 2);
 - Air quality (Section 3);
 - Climate change (Section 4);
 - Community (Section 5);
 - Ecology and biodiversity (Section 6);
 - Health (Section 7);

⁹ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

¹⁰ Supporting documents: Draft Code of Construction Practice

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- Historic environment (Section 8);
- Land quality (Section 9);
- Landscape and visual (Section 10);
- Major accidents and disasters (Section 11);
- Socio-economics (Section 12);
- Sound, noise and vibration (Section 13);
- Traffic and transport (Section 14);
- Waste and material resources (Section 15);
- Water resources and flood risk (Section 16);
- Phase One, Phase 2a and Phase 2b combined impacts (Section 17); and
- References (Section 18).

2 Agriculture, forestry and soils

2.1 Introduction

- 2.1.1 This section of the report provides an assessment of the route-wide impacts and likely significant effects on agriculture, forestry¹¹ and soils arising from the construction and operation of the Proposed Scheme. The impacts and likely significant effects on individual farm holdings¹² are reported in the Volume 2: Community area reports.
- 2.1.2 At a national level, paragraph 109 of the National Planning Policy Framework (NPPF)¹³ states that planning policies and decisions should contribute to and enhance the natural and local environment by protecting and enhancing soils, valued landscapes and geological conservation interests. It goes on to state that new and existing development should not contribute to unacceptable levels of soil pollution or other pollution.
- 2.1.3 Paragraph 112 of the NPPF also advises that the economic and other benefits of the best and most versatile (BMV) agricultural land (Grades 1, 2 and 3a in the Agricultural Land Classification (ALC) system), and of trees and woodland should be taken into account in development decisions, and states that where significant development of agricultural land is demonstrated to be necessary, poorer quality land should be used in preference to higher quality land.
- 2.1.4 As reported in the Phase Two Sustainability Statement 2013¹⁴ and the updated Sustainability Report 2016¹⁵, efforts have been made during the route development and Appraisal of Sustainability (AoS) process to select a route alignment that avoids the highest quality agricultural land. However, this has not always been possible given the need to satisfy or balance a number of other important environmental and engineering considerations.

2.2 Scope, assumptions and limitations

- 2.2.1 The study area for the agriculture, forestry and soils assessment covers all land required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land, forestry land and soils. Where any part of a farm or rural holding is required for the construction and operation of the Proposed Scheme, the whole land holding is part of the study area for impacts on this receptor.

¹¹ The assessment of forestry in this section relates to land being used for commercial forestry.

¹² The term 'farm holding' is used in a wide sense and is taken to include land associated with arable cropping, livestock rearing, field-scale and glasshouse horticulture (of edible and non-edible crops), farm woodland enterprises such as wood fuel production, and private and commercial equestrian enterprises. In the majority of cases, the details of land use have been obtained from face-to-face interviews.

¹³ Department for Communities and Local Government (2012), National Planning Policy Framework. Available online at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

¹⁴ High Speed Rail: Consultation on the route from the West Midlands to Manchester, Leeds and beyond, Sustainability Statement Volume 1: main report of the Appraisal of Sustainability A report by Temple-ERM for HS2 Ltd (July 2013). Available online at: <https://www.gov.uk/government/publications/hs2-phase-two-consultation-sustainability-statement>

¹⁵ Temple-RSK, (2016), Sustainability Report – Sustainability Statement including Post Consultation Update. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568547/D25_WEB_C331_Sustainability_Statement_Including_Post_Consultation_Update_Volume_1_Main_Report_WEB_VERSION.pdf

- 2.2.2 The assessments of the impacts on agricultural land quality and forestry land are made with reference to the prevalence of BMV land and forestry land in the general locality, taken as a 4km corridor centred on the route of the Proposed Scheme.
- 2.2.3 The quality of agricultural land in England and Wales is assessed according to the ALC system, which classifies agricultural land into five grades from excellent quality Grade 1 land to very poor quality Grade 5 land. Grade 3 is subdivided into Subgrades 3a and 3b. The main issue in the assessment of the impacts on agricultural land is the extent to which land of BMV agricultural quality (Grades 1, 2 and 3a) is affected by the route of the Proposed Scheme. However, the extent to which all land (BMV and lower quality ALC) is affected is also an important consideration.
- 2.2.4 Soil fulfils a number of functions and services for society, in addition to those of food and biomass production, which are central to social, economic and environmental sustainability. These are outlined in sources such as the Soil Strategy for England¹⁶ and the Government's White Paper, *The Natural Choice: securing the value of nature*¹⁷. They include:
- the storage, filtration and transformation of water, carbon and nitrogen in the biosphere;
 - the support of ecological habitats, biodiversity and gene pools;
 - support for the landscape;
 - the protection of cultural heritage;
 - the provision of raw materials; and
 - the provision of a platform for human activities, such as construction and recreation.
- 2.2.5 Commercial forestry is considered as a commercial land use feature, providing resources such as timber or fuel. The qualitative effects on forestry land and woodland are addressed principally in Section 6, Ecology and biodiversity, and Section 10, Landscape and visual of this report. The resulting function or service provided by soil attributes are assessed in other sections, notably Section 6, Ecology and biodiversity; Section 8, Historic environment; Section 10, Landscape and visual; and Section 16, Water resources and flood risk of this report.
- 2.2.6 Common assumptions that have been used in assessing the effects of the Proposed Scheme are set out in Volume 1: Introduction and methodology, Section 8. These assumptions include the restoration of agricultural land that is required temporarily for construction to agricultural use, and the handing back of land used temporarily to the original landowner. It is also assumed that buildings and other farm infrastructure on the land holding would not be replaced as this would ultimately be at the discretion of the landowner. For this reason, financial compensation is not a consideration in the assessment of effects on farm holdings.

¹⁶ Department for Environment, Food and Rural Affairs (2009), *Soil Strategy for England*.

¹⁷ HM Government (2011), *The Natural Choice: securing the value of nature*.

- 2.2.7 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis¹⁸. A complete assessment of significant effects will be included in the formal ES.

2.3 Environmental baseline

- 2.3.1 The majority of land within the study area is rural with the main exceptions being near Crewe, East Midlands hub, Manchester, and Leeds.
- 2.3.2 Within the study area for the western leg of the Proposed Scheme, farm holdings are dominated by large dairy and arable farms. Within the study area for the eastern leg of the Proposed Scheme farms, are characterised by mixed farming and large scale arable enterprises, with large scale arable dominant south of Nottingham. Across the route-wide study area the smaller, urban fringe holdings are characterised by equestrian uses.
- 2.3.3 Commercial forestry is not a prevalent land use route-wide, however, this land use does appear within the study area, the largest area being Park Forest, north-west of Nottingham between Underwood and Hucknall, which is managed by the Forestry Commission.
- 2.3.4 High level agricultural land classification maps of the route of the Proposed Scheme for the western leg show that Grade 1 agricultural land is limited to the drained peat of Chat Moss between Manchester and Liverpool. Approximately 900m of the route of the Proposed Scheme is through Grade 1 land, in the vicinity of Holcroft Moss. In addition, an estimated 19.8km of the route of the Proposed Scheme along the western leg (85km in length) is through land classified as Grade 2, notably in the Mersey Valley around Lymm and Warrington.
- 2.3.5 High level agricultural land classification maps of the route of the Proposed Scheme for the eastern leg show that a limited amount of Grade 1 agricultural land lies within the eastern leg study area. An estimated 28km of the route of the Proposed Scheme along the eastern leg (198km in total) is through land that is mapped as Grade 2 agricultural land, notably in the Tame Valley, in the low hills between the Anker and the Mease valleys, in the hills between Strelley and Greasley, and on the undulating plateau between Garforth and Church Fenton.
- 2.3.6 At a route-wide level, soils provide additional functions and services for society in addition to those of food and biomass production. The key functions for soil route-wide are as water stores for flood attenuation and the provision of ecological habitats. Peat has a higher organic matter content than other soils and represents a large reservoir of organic carbon. Peat is present within the study area to the west of Manchester.

¹⁸ In cases where information is not available at this time, the assessment is either based on a precautionary approach using reasonable worst-case assumptions and is reported in the working draft ES or is ongoing and will be reported in the formal ES.

2.4 Avoidance and mitigation measures

- 2.4.1 Soil resources from the areas required temporarily and permanently for the Proposed Scheme would be stripped and stored in line with good practice techniques. This would enable agricultural land that is required temporarily for construction to be returned to agricultural use, the design objective being to avoid any reduction in long term capability which would downgrade the quality of agricultural land. This would also enable agricultural land to be converted to other uses where required by the Proposed Scheme, such as to support landscape planting and biodiversity, and to a suitable condition whereby the land would be able to fulfil the identified function.

2.5 Assessment of effects during and following construction

- 2.5.1 At this working draft ES stage, publicly available data has been used to estimate the quality of agricultural land within the study area. The Proposed Scheme is likely to require approximately 6,214ha of agricultural land temporarily during the construction phase. Publicly available data indicates that 2,364ha (38%) is BMV land. Approximately 3,850ha (62%) is shown as poorer quality agricultural land. This is a medium magnitude of impact on BMV land temporarily.
- 2.5.2 The area of agricultural land required permanently for the Proposed Scheme would be approximately 3,536ha, of which 1,296ha (or 37%) is interpreted to be BMV land and 2,240ha (63%) poorer quality land. This is a medium magnitude of impact on BMV land permanently.
- 2.5.3 BMV land is a receptor of medium sensitivity nationally, as 42% of farmland in England is estimated to be BMV. It is currently anticipated that the likely effect of the Proposed Scheme on BMV would be moderate, which would be significant, both during and following construction.
- 2.5.4 Agricultural land quality has been interpreted from publicly available data and will be confirmed by soil survey, as will the detailed distribution of soil types and land in the various grades of the ALC within the study area. This updated assessment of effects on agricultural land quality will be reported in the formal ES.
- 2.5.5 Commercial forestry land would be required for the Proposed Scheme. The total area of forestry land required by the Proposed Scheme and the associated effects will be reported in the formal ES.
- 2.5.6 Effects on soils to be disturbed will be assessed and reported in the formal ES.

2.6 Assessment of effects during operation

- 2.6.1 The potential for significant effects on sensitive livestock receptors from noise will be assessed and reported in the formal ES.
- 2.6.2 The presence and spread of noxious weeds (particularly ragwort) would be controlled within the operational infrastructure and land using an appropriate management regime that identifies and remedies areas of weed growth that might threaten adjoining agricultural interests.

3 Air quality

3.1 Introduction

3.1.1 This section of the report considers the route-wide impacts and likely significant effects on air quality identified to date arising from the construction and operation of the Proposed Scheme.

3.2 Scope, assumptions and limitations

3.2.1 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant route-wide effects will be included in the formal ES, if required.

3.2.2 This section explains that there is not considered to be potential for likely significant effects on air quality at a route-wide level arising from the construction and operation of the Proposed Scheme.

3.3 Assessment of effects during construction

3.3.1 Air quality impacts from construction activities could arise from two sources: directly from the construction sites; and indirectly from changes in the volume, composition and location of traffic on the highway network.

3.3.2 The main air pollutant emitted from construction sites is dust, which can potentially be carried a few hundred metres from construction sites. Dust generation from the Proposed Scheme would be strictly controlled by the application of best practice measures set out in the draft Code of Construction Practice (CoCP)¹⁹. The emissions of other pollutants from activities within the construction sites would be relatively small, and would be controlled by measures set out in the draft CoCP and are unlikely to cause a significant air quality effect.

3.3.3 The geographic extent of these effects will be assessed within the Volume 2: Community area reports and, where necessary, the Volume 4: Off-route effects report. It is not predicted that there would be significant air quality effects on a route-wide basis associated with construction of the Proposed Scheme at this stage of the design and assessment.

3.4 Assessment of effects during operation

3.4.1 As described in the EIA Scope and Methodology Report (SMR)²⁰ there would be no direct atmospheric emissions from the operation of trains that would cause an impact on air quality. Indirect emissions from sources such as rail and brake wear have been assumed to be negligible.

3.4.2 The operation of the Proposed Scheme would result in local changes to road traffic location and volume due to realignments, diversions and changes in traffic flows,

¹⁹ Supporting documents: Draft Code of Construction Practice

²⁰ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

which may have an impact on air quality in some locations along the route of the Proposed Scheme, as recorded within the relevant Volume 2: Community area reports. It is not predicted that there would be any significant air quality effects on a route-wide basis arising from these changes during the operation of the Proposed Scheme at this stage of the design and assessment.

4 Climate change

4.1 Introduction

4.1.1 This section of the report presents the three route-wide assessments undertaken within the climate change topic:

- the greenhouse gases (GHG) assessment;
- the in-combination climate change impacts assessment; and
- the climate change resilience assessment.

4.1.2 It should be noted that at this stage the above assessments continue to be developed. Results and conclusions will be reported in the formal ES.

4.1.3 The GHG assessment will quantify and report the GHG emissions associated with construction and operation of the Proposed Scheme in the form of the 'carbon footprint'. A carbon footprint is the total GHG emissions associated with a particular scheme, policy or development. The GHG emissions are converted into tonnes of carbon dioxide equivalent (tCO₂e), which standardises the global warming potential of the main GHG²¹ into one index based on the global warming potential of carbon dioxide (CO₂). Hereafter in this report, the term carbon is used to refer to the combined GHG emissions.

4.1.4 The in-combination climate change impacts assessment will consider the combined effect of the Proposed Scheme and potential climate change impacts on the receiving environment during construction and operation²².

4.1.5 The climate change resilience assessment will consider potential climate change impacts on the design, construction and operation of the Proposed Scheme's infrastructure and assets over their lifetime.

4.1.6 As stated in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Synthesis Report²³, mitigation (i.e. reducing carbon emissions) and adaptation (i.e. responding to climate change impacts) are complementary approaches to reducing risks of climate change impacts. Mitigation, in the short-term and medium-term, can substantially reduce climate change impacts in the latter decades of the 21st century. Benefits from adaptation can be realised now to address current risks, and can be realised in the future to address emerging risks. Innovation and investments in environmentally sound infrastructure and technologies can both reduce carbon emissions and enhance resilience to climate change.

²¹ The seven main GHGs are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). Source: National Atmospheric Emissions Inventory (2017), Overview of greenhouse gases. Available online at: <http://naei.defra.gov.uk/overview/ghg-overview>

²² The term in-combination climate change impacts refers to the combined effect of the impacts of the Proposed Scheme and potential climate change impacts on the receiving environment. It is not to be confused with the EIA terms 'combined effects' or 'cumulative effects'. The term 'potential climate change impacts' is not to be confused with the EIA term 'future predicted baseline'.

²³ Intergovernmental Panel on Climate Change (2014), *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Available online at: http://ar5-syr.ipcc.ch/topic_summary.php

4.2 Greenhouse gases assessment

Legal and policy framework

International level

- 4.2.1 In AR5²⁴, published in September 2013, the IPCC strengthened its statement on human influence being the dominant cause of the observed global average temperature increases from very likely (>90% certain) in the previous assessment report (Fourth Assessment Report (AR4)²⁵) to extremely likely (95–100% certain).
- 4.2.2 The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)²⁶, adopted in 1997, provided legally binding limits on carbon emissions for 37 Annex 1 countries (of which the UK is one). The Protocol's first commitment period started in 2008 and ended in 2012; the 37 Annex 1 countries committed to reduce carbon emissions to an average of 5% below 1990 levels within this period. The second commitment period began in 2013 and will end in 2020; the 37 Annex 1 countries have committed to reduce carbon emissions by at least 18% below 1990 levels²⁷.
- 4.2.3 In December 2015, a global climate agreement - the Paris Agreement²⁸ - was adopted at the 21st Conference of the Parties (COP21). A central aim of the Paris Agreement is to strengthen the global response to climate change by limiting the global temperature increase this century to below 2 degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. To achieve this aim, the Paris Agreement additionally sets a target for net zero²⁹ global carbon emissions in the second half of this century. The Paris Agreement was ratified by the UK and entered into force in November 2016.

European level

- 4.2.4 Under the Kyoto Protocol's second commitment period of 2013–2020, the collective European Union (EU) target is to reduce carbon emissions by 20% relative to 1990 levels³⁰.

²⁴ Intergovernmental Panel on Climate Change (2013), *Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Available online at: <https://www.ipcc.ch/report/ar5/wg1/>

²⁵ Intergovernmental Panel on Climate Change (2007), *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Available online at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

²⁶ United Nations (1998), *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Available online at: <http://unfccc.int/resource/docs/convkp/kpeng.pdf>

²⁷ Intergovernmental Panel on Climate Change (2007), *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Available online at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

²⁸ United Nations (2015), *Paris Agreement*. Available online at:

https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

²⁹ Net-zero means 'a balance between anthropogenic emissions by sources and removals by sinks of carbon emissions in the second half of this century'. As sourced from Article 4 Paragraph 1 of United Nations (2015). Available online at:

https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

³⁰ European Commission (2013), *Ratification of the second commitment period of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder*. Available online at:

http://ec.europa.eu/clima/policies/international/negotiations/docs/com_2013_768_en.pdf

- 4.2.5 In 2014 the EU agreed to collectively reduce carbon emissions by at least 40% by 2030 compared to 1990 levels³¹, this commitment was reaffirmed in the EU's Intended Nationally Determined Contribution (INDC)³² submitted as part of the Paris Agreement.
- 4.2.6 The EU emissions trading system (EU ETS)³³ is a cornerstone of the EU's policy to meet its carbon emissions reduction targets and is a key tool for reducing carbon emissions cost-effectively. The EU ETS is a cap-and-trade mechanism whereby a total amount of allowable annual carbon emissions for electricity generation, large energy-intensive industries (such as cement and steel production) and commercial flights within the EU, Norway, Lichtenstein and Iceland has been agreed at the EU level. Those installations covered by the cap are allowed to trade emission allowances with one another.
- 4.2.7 The emissions cap for 2013 from all fixed installations (e.g. power stations and cement plants) was set at 2,084,301,856 allowances (tCO₂e). During the third phase of EU ETS (2013–2020) the total number of allowances issued decreases by 38,264,246 tCO₂e per annum³⁴ (equivalent to 1.74% of the average annual allowance issued between 2008 and 2012). This will result in the fixed installation emissions being 21% lower in 2020 than 2005. In February 2018 the European Commission (EC) approved the reform of the EU ETS for the period after 2020³⁵. From 2021 the total number of allowances issued will decrease by an annual rate of 2.2%. This will reduce the cap for fixed installations to around 43% below 2005 levels by 2030³¹.
- 4.2.8 There has been a surplus in emission allowances since 2009, partially due to slow economic growth in the EU, resulting in low carbon prices and a weaker incentive to reduce emissions. The EC has tried to address this by postponing (or 'back-loading') the auction of 900 million allowances. As a long term solution, a market stability reserve will start operating in January 2019³⁶. The 900 million allowances that were back-loaded in 2014–2016 will be transferred to the reserve rather than be auctioned in 2019–2020. Unallocated allowances will also be transferred to the reserve.
- 4.2.9 Each EU Member State has binding annual greenhouse gas emission targets for 2021–2030 for sectors outside the scope of the EU ETS. This includes transport, buildings, agriculture, non-ETS industry and waste; which account for almost 60% of total domestic EU emissions. The sectors are required to reduce carbon emissions by 30% by 2030 compared to 2005³⁷. The Effort Sharing Regulation – adopted in May 2018 –

³¹ European Commission (2014), *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A policy framework for climate and energy in the period from 2020 to 2030*. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN>

³² Latvian Presidency of the Council of the European Union (2015), *Intended Nationally Determined Contribution of the EU and its member states*. Available online at: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Latvia/1/LV-03-06-EU%20INDC.pdf>

³³ European Commission (2017), *EU Emissions Trading System*. Available online at: https://ec.europa.eu/clima/policies/ets_en

³⁴ European Commission (2013), *Ratification of the second commitment period of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder*. Available online at: https://web.archive.org/web/20150921110748/https://ec/clima/policies/international/negotiations/docs/com_2013_768_en.pdf

³⁵ European Council (2018), "EU Emissions Trading System reform: Council approves new rules for the period 2021 to 2030". Available online at: <http://www.consilium.europa.eu/en/press/press-releases/2018/02/27/eu-emissions-trading-system-reform-council-approves-new-rules-for-the-period-2021-to-2030/>

³⁶ European Commission (2017), *Structural reform of the EU ETS*. Available online at: http://ec.europa.eu/clima/policies/ets/reform/index_en.htm

³⁷ European Commission (2018), *Effort sharing 2021–2030: targets and flexibilities*. Available online at: https://ec.europa.eu/clima/policies/effort/proposal_en

translates this commitment into binding annual greenhouse gas emission targets for each Member State for the period 2021–2030, based on the principles of fairness, cost effectiveness and environmental integrity³⁷.

- 4.2.10 The 2011 EC White Paper Roadmap to a Single European Transport Area³⁸ sets out a number of initiatives to build a transport sector that contributes to EU carbon emissions reduction targets. It states that transport policy must be resource and energy efficient. Its goal is *'to help establish a system that underpins European economic progress, enhances competitiveness and offers high quality mobility services while using resources more efficiently'*. It also states that curbing mobility is not an option. For high speed rail, the objective by 2050 is to *'complete a European high-speed rail network, triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail'*.

National level

- 4.2.11 The Climate Change Act 2008³⁹ established a framework for the UK to achieve its long-term goals of reducing carbon emissions by at least 80% from 1990 levels by 2050. The Climate Change Act 2008 includes an interim target of at least a 34% reduction from 1990 levels by 2020. To ensure that regular progress is made towards the target, the Climate Change Act 2008 also established a system of carbon budgets. The first five carbon budgets, leading to 2032, have been set in law. Meeting the fourth (2023–27) and fifth (2028–2032) carbon budgets will require that carbon emissions are reduced by 50% (by 2025) and 57% (by 2030) respectively, relative to 1990 levels. In April 2018, the UK Government announced that it would instruct the Committee on Climate Change (CCC) to provide new advice regarding how the 2015 Paris Agreement is expected to impact the UK's long-term greenhouse gas reduction targets⁴⁰. The instruction is likely to be made after the UN IPCC publishes Special Report Global Warming 1.5°C (SR15)⁴¹ assessing 'the impacts of 1.5°C of global warming above pre-industrial levels and related emissions pathways'⁴².
- 4.2.12 In October 2017, the UK Government published its Clean Growth Strategy⁴³ setting out a detailed set of policies and proposals that aim to accelerate economic growth and decrease carbon emissions in line with the fourth and fifth carbon budgets. The strategy identifies eight key areas where progress needs to be made in order for the UK to meet its fourth and fifth carbon budget targets. One of these areas is the need to accelerate the shift to low carbon transport, such as transitioning from road to rail for both personal and freight transport.

³⁸ European Commission (2011), *White Paper Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system*. Available online at: [http://ec.europa.eu/transport/themes/strategies/doc/2011_white_paper/white_paper_com\(2011\)_144_en.pdf](http://ec.europa.eu/transport/themes/strategies/doc/2011_white_paper/white_paper_com(2011)_144_en.pdf)

³⁹ *Climate Change Act 2008*. Her Majesty's Stationary Office, London. Available online at: <http://www.legislation.gov.uk/ukpga/2008/27/contents>

⁴⁰ Committee on Climate Change (2018), Lord Deben welcomes news that Government will seek CCC advice on UK's long-term emission targets <https://www.theccc.org.uk/2018/04/18/lord-deben-welcomes-news-that-government-will-seek-ccc-advice-on-uks-long-term-emissions-targets/>

⁴¹ UN Intergovernmental Panel on Climate Change, Special Report. Available online at: <http://www.ipcc.ch/report/sr15/>

⁴² Committee on Climate Change (2018), Lord Deben welcomes news that Government will seek CCC advice on UK's long-term emission targets. Available online at: <https://www.theccc.org.uk/2018/04/18/lord-deben-welcomes-news-that-government-will-seek-ccc-advice-on-uks-long-term-emissions-targets/>

⁴³ The Clean Growth Strategy: Leading the way to a low carbon future. Her Majesty's Stationary Office, London. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/651916/BEIS_The_Clean_Growth_online_12.10.17.pdf

- 4.2.13 The Construction 2025 Industrial Strategy⁴⁴ sets out a partnership approach between Government and the construction industry to 'become dramatically more sustainable through its efficient approach to delivering low carbon assets more quickly and at a lower cost, underpinned by strong, integrated supply chains'. By 2025, the construction industry and Government aspire to achieve a 50% reduction in carbon emissions in the built environment⁴⁵. This will be achieved through resource efficiency and adapting the built environment to deal with the effects of climate change, in particular by developing plans to drive carbon out of the built environment, led by the Green Construction Board.
- 4.2.14 The UK's Industrial Strategy, published by HM Government in November 2017, sets out a vision for transforming and ensuring the future productivity of the UK. The strategy identifies infrastructure as one of the five foundations where investment is needed in order to ensure the UK remains a competitive and attractive business destination. For the UK economy to be future proofed, the Industrial Strategy also identified four Grand Challenges: artificial intelligence and big data; clean growth; the future of mobility; and meeting the needs of an ageing society. HS2 is identified as a 'transformational' infrastructure project enabling new investment and economic activity by connecting cities and communities across Britain, as well as meeting the country's low carbon transport aspirations.

Scope, assumptions and limitations

- 4.2.15 As detailed in the EIA Scope and Methodology Report (SMR)⁴⁶ the GHG assessment will quantify the carbon emission implications associated with the construction and operation of the Proposed Scheme.
- 4.2.16 Further detail on the scope of the GHG assessment will be presented in the formal ES alongside associated assumptions and limitations.

Environmental baseline

- 4.2.17 The environmental baseline for the construction and operation of the Proposed Scheme is based on a 'without the Proposed Scheme' scenario (i.e. the Proposed Scheme is not built).

Results and conclusions

- 4.2.18 The results and conclusions of the GHG assessment will be reported in the formal ES.

⁴⁴ HM Government (2013), *Construction 2025 Industrial Strategy: government and industry in partnership*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/210099/bis-13-955-construction-2025-industrial-strategy.pdf

⁴⁵ Green Construction Board (2013), *Low Carbon Route map for the Built Environment*. Available online at: <http://www.greenconstructionboard.org/otherdocs/Routemap%20ofinal%20report%2005032013.pdf>

⁴⁶ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

4.3 In-combination climate change impacts assessment

Legal and policy framework

International level

- 4.3.1 There is no relevant overarching international legislation or policies affecting in-combination climate change impacts assessment within the EIA process.

European level

- 4.3.2 The relevant European Directive for the in-combination climate change impacts assessment is EIA Directive 2014/52/EU⁴⁷ and the related EC Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment⁴⁸. The regulations implementing this Directive were transposed into UK legislation in May 2017⁴⁹.

National level

- 4.3.3 The relevant legislation and policies for the in-combination climate change impacts assessment at the national level are:

- the Climate Change Act 2008⁵⁰ and within that the National Adaptation Programme (NAP)⁵¹, Adaptation Reporting Power (ARP)⁵² and the national Climate Change Risk Assessment 2017⁵³;
- the Environment Agency guidance on climate change allowances to be used in flood risk assessments as set out in the National Planning Policy Framework (NPPF)⁵⁴; and
- NPPF Planning Practice Guidance (PPG) on climate change⁵⁵, which prioritises addressing climate change impacts in the planning and decision making process, including for major transport infrastructure projects.

Scope, assumptions and limitations

- 4.3.4 As detailed in the EIA SMR, the in-combination climate change impacts assessment covers all environmental topics assessed as part of the EIA.

⁴⁷ Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Available online at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052>

⁴⁸ European Commission (2013), Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment. Available online at: <http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf>

⁴⁹ The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Available online at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf

⁵⁰ *Climate Change Act 2008*. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/ukpga/2008/27/pdfs/ukpga_20080027_en.pdf

⁵¹ Department for Environment, Food and Rural Affairs, (2013), *National Adaptation Programme – Making the Country Resilient to a Changing Climate*. Available online at <https://www.gov.uk/government/publications/adapting-to-climate-change-national-adaptation-programme>

⁵² Committee on Climate Change (undated), *UK Adaptation Policy*. Available online at: <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-adaptation-policy/>

⁵³ Committee on Climate Change (2017), *Progress in preparing for climate change*. Available online at: <https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

⁵⁴ Environment Agency (2016), *Guidance. Flood risk assessments: climate change allowances*. Available online at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

⁵⁵ Department for Communities and Local Government (2014), *Planning Practice Guidance. Climate change*. Available online at: <http://planningguidance.communities.gov.uk/blog/guidance/climate-change/why-is-it-important-for-planning-to-consider-climate-change/>

- 4.3.5 Further detail on the scope of the in-combination climate change impacts assessment will be presented in the formal ES alongside assumptions and limitations.

Environmental baseline

- 4.3.6 The baseline climate and projected future climate conditions will be presented in the formal ES.

Results and conclusions

- 4.3.7 The results and conclusions of the in-combination climate change impacts assessment will be reported in the formal ES.

4.4 Climate change resilience assessment

Legal and policy framework

International level

- 4.4.1 There is no relevant overarching international legislation or policies affecting climate change resilience assessment within the EIA process.

European level

- 4.4.2 The relevant European Directive for the climate change resilience assessment is EIA Directive 2014/52/EU⁴⁷ and the related EC Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment^{48,49}. The regulations implementing this Directive were transposed into UK legislation in May 2017.

National level

- 4.4.3 The relevant legislation and policies for the climate change resilience assessment at the national level are:

- the Climate Change Act 2008⁵⁶ and within that the National Adaptation Programme (NAP)⁵⁷, Adaptation Reporting Power (ARP)⁵⁸ and the national Climate Change Risk Assessment 2017⁵⁹;
- the Environment Agency guidance on climate change allowances to be used in flood risk assessments as set out in the NPPF⁶⁰ and planning practice guidance⁶¹; and
- NPPF PPG on climate change, which prioritises addressing climate change impacts in the planning and decision making process for major transport infrastructure projects.

⁵⁶ *Climate Change Act 2008*. Her Majesty's Stationary Office, London. Available online at:

http://www.legislation.gov.uk/ukpga/2008/27/pdfs/ukpga_20080027_en.pdf

⁵⁷ Department for Environment, Food and Rural Affairs, (2013), *National Adaptation Programme – Making the Country Resilient to a Changing Climate*. Available online at <https://www.gov.uk/government/publications/adapting-to-climate-change-national-adaptation-programme>

⁵⁸ Committee on Climate Change (undated), *UK Adaptation Policy*. Available online at: <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-adaptation-policy/>

⁵⁹ Committee on Climate Change (2017), *Progress in preparing for climate change*. Available online at: <https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/>

⁶⁰ Environment Agency (2016), *Guidance. Flood risk assessments: climate change allowances*. Available online at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

⁶¹ Department for Communities & Local Government (2014), *Planning Practice Guidance – Guidance climate change*. Available online at: <http://planningguidance.communities.gov.uk/blog/guidance/climate-change/why-is-it-important-for-planning-to-consider-climate-change/>

Scope, assumptions and limitations

- 4.4.4 As detailed in the EIA SMR, the climate change resilience assessment incorporates a semi-quantitative risk based assessment of potential climate change impacts on HS2 infrastructure, assets and operations.
- 4.4.5 Further detail on the scope of the climate change resilience assessment will be presented in the formal ES alongside assumptions and limitations.

Environmental baseline

- 4.4.6 The baseline climate and projected future climate conditions will be presented in the formal ES.

Results and conclusions

- 4.4.7 The results and conclusions of the climate change resilience assessment will be reported in the formal ES.

5 Community

5.1 Introduction

- 5.1.1 Community impacts arising from the construction and operation of the Proposed Scheme are considered to be of predominantly local significance and have accordingly been reported in the Volume 2: Community area reports. Impacts on the promoted⁶² recreational routes that run through multiple community areas are considered to be localised and, therefore, will be assessed and reported in the individual Volume 2: Community area reports in the formal ES.
- 5.1.2 Localised in-combination effects will be reported in the formal ES at a community area level for both construction and operation in the individual Volume 2: Community area reports.
- 5.1.3 Construction worker impacts on community resources are considered at a route-wide level and will be reported in the formal ES. The assessment will take into account the proposed numbers of workers, the type and location of accommodation, expected working hours, and the facilities that would be provided on construction compounds. It will take into account the measures contained in the draft Code of Construction Practice⁶³, which have been informed by experience from the construction of other similar large projects (such as High Speed One and the Elizabeth line (formerly Crossrail)) to manage any identified impacts.
- 5.1.4 The construction information required to undertake this assessment (referred to in this section) is not available at this stage of the design process. An assessment of route-wide impacts and likely significant effects will be reported in the formal ES.

⁶² There are many types of routes which are a 'promoted' destination in their own right as a recreational resource. These may comprise Public Rights of Way (PRoW), or other types of non-vehicular routes such as permissive paths. Examples include European Long Distance Footpaths, National Trails, National Cycle Network, National Equestrian Route Network and recreational routes (often developed by local authorities in partnership with user groups).

⁶³ Supporting documents: Draft Code of Construction Practice

6 Ecology and biodiversity

6.1 Introduction

- 6.1.1 This section of the report describes route-wide impacts and the likely significant effects identified to date on ecological resources arising from the construction and operation of the Proposed Scheme.
- 6.1.2 Significant effects arising from the construction and operation of the Proposed Scheme on individual ecological receptors that are of at least district/borough value are reported within Volume 2: Community area reports, Section 7, Ecology and biodiversity.
- 6.1.3 This section of the report considers significant effects at both the regional and national levels, and in combination effects that are not discussed within the Volume 2: Community area reports.

6.2 Scope, assumptions and limitations

- 6.2.1 Ecology survey and assessment work is ongoing, and the findings from these surveys will be reported in the formal ES. Prior to the completion of field surveys and fully developed mitigation, it is not currently possible to identify fully the effects that are likely to be significant at regional or route-wide levels.
- 6.2.2 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES.

6.3 Designated sites

- 6.3.1 There are nine sites of international importance for nature conservation that are relevant to the assessment and one site that is being considered for designation. These sites are described briefly in this section. For each site, HS2 Ltd will continue to consult with Natural England as the design evolves to ensure compliance with the Habitats Regulations 2017. Where required, further assessment will be undertaken as the design develops and through an iterative process an appropriate design will be developed. Any studies to inform the required assessments will be completed and the outcomes agreed with Natural England prior to the submission of the hybrid Bill. The sites are as follows:
- The Midland Meres and Mosses Phase 1 Ramsar Site, located north-east of Sandbach and west of Congleton, near the village of Brereton Heath. Studies to inform a Habitats Regulations Screening Assessment (HRA) were undertaken for Midland Meres and Mosses Phase 1 Ramsar site⁶⁴. It concluded that, with the appropriate avoidance measures in place, there would be no likely significant effect;

⁶⁴ HS2 (2012). *HRA Screening Report for Midland Meres and Mosses Phase 1 Ramsar Site*.

- The Midland Meres and Mosses Phase 2 Ramsar Site is located to the south of Crewe, and adjacent to the village of Gorstyhill. The Midland Meres and Mosses Phase 2 Ramsar Site was scoped out from the HRA screening process in the Phase Two Sustainability Statement. This was on the basis that Black Firs and Cranberry Bog Site of Special Scientific Interest (SSSI), which is the nearest component of the Ramsar Site, was sufficiently distant from the Proposed Scheme that there would be no significant effects. On this basis no further studies to inform HRA have been undertaken for this site;
- The West Midlands Mosses Special Area of Conservation (SAC) is located to the south of Crewe, and adjacent to the village of Wybunbury. None of the component SSSI elements of the SAC are close enough to the Proposed Scheme for significant effects to occur, and it has been scoped out from the HRA;
- Rostherne Mere Ramsar Site is located south-west of Altrincham, and adjacent to the village of Rostherne. A study to inform a HRA undertaken in consultation with Natural England and the Environment Agency concluded that there were no likely significant effects⁶⁵. Further investigations are ongoing to assess hydrological risk pathways and potential interactions with groundwater flow during construction;
- Rixton Clay Pits SAC is located to the east of Warrington, near the village of Hollins Green. It is immediately adjacent to a proposed construction traffic route on the A57 Manchester Road. However, due to the distance from the land required for the construction of the Proposed Scheme it has been agreed with Natural England that there would be no likely significant effect on the qualifying features of Rixton Clay Pits SAC;
- Manchester Mosses SAC comprises three separate areas; one located on the east edge of Warrington in the civil parish of Birchwood; the second to the north-east of Warrington, adjacent to the M62 at Holcroft Moss; and the third, the largest, to the south-east of Leigh, east of the village of Glazebury. A study to inform a HRA undertaken in 2012 concluded that the route alignment that has now been adopted for the Proposed Scheme had the potential to cause significant effects to the Holcroft Moss element of this SAC due to its proximity and the sensitivity of the site to hydrological changes. Further assessment will be undertaken prior to submission of the hybrid Bill, and an appropriate design will be developed;
- Rochdale Canal SAC, designated as the section of the canal from the parish of Failsworth, Oldham in Greater Manchester, to the town of Littleborough, north-east of Rochdale. Rochdale Canal SAC is on the other side of a large conurbation, and as there is no hydrological connectivity it has been agreed with Natural England that there are no likely significant effects;

⁶⁵ HS2 (2012), *HRA Screening Report for Rostherne Mere Ramsar Site*.

- The River Mease SAC stretches from the village of Packington, south of Ashby-de-la-Zouch, to just north of Croxall, a village north-east of Lichfield. Studies to inform HRAs have been completed for two different crossing points, one of which is only 80m from the route of the Proposed Scheme. In both cases it was determined that an Appropriate Assessment was required to assess the effects of shading on aquatic vegetation that is a reason for the designation. In both cases the detailed shading studies concluded that there would be no adverse effect. Emerging design details will be subject to further assessment, which will be undertaken prior to completion of the formal ES;
- Sherwood Forest possible Special Protection Area (SPA). The Sherwood Forest area supports nationally important populations of nightjar and woodlark, and on this basis it is being considered for designation as an SPA. The Proposed Scheme would pass through Park Forest, north-west of Nottingham between Underwood and Hucknall, an area of commercial forest that may be included in the SPA if it is designated. Although the area is not designated, studies to inform a shadow HRA⁶⁶ have been undertaken. This concluded that the works were not likely to result in any significant effect on the populations of nightjar and woodlark. However, Natural England advised that, as future forestry operations would result in the creation of suitable breeding habitat for nightjar and woodlark, there was the potential for significant effects due to the loss of the area of forestry. Further assessment will be undertaken prior to completion of the formal ES and appropriate design measures will be developed where necessary to ensure compliance with the Habitat Regulations 2017; and
- The Proposed Scheme would cross the River Aire, which is a tributary of the River Humber. There is a potential pathway for water quality effects to occur on the Humber Estuary SAC/SPA/Ramsar site. However, due to the distance involved and the nature of the Proposed Scheme, the site has been scoped out of HRA.

- 6.3.2 The Proposed Scheme has the potential to have an impact on 47 SSSI, which are of national importance. At 12 of these sites the impacts are predicted to result in a significant adverse effect. These are: Alvecote Pools, Bulwell Wood, Annesley Woodhouse Quarries, Bogs Farm Quarry, Kirkby Wharfe, Sandbach Flashes, Wimboldsley Wood, Plumley Lime Beds, Tabley Mere, Abram Flashes, Bryn Marsh and Ince Moss (one site), and Cotteril Clough. Opportunities to avoid or reduce effects to these sites, as well as on the sites identified in paragraphs 6.3.3 to 6.3.6, will be considered as the design develops.
- 6.3.3 There are nine local nature reserves (LNR) where the impacts would result in a significant adverse effect at up to the county/metropolitan level.
- 6.3.4 There are 111 non-statutory local wildlife sites (LWS), sites of biological importance (SBI) and other local sites where the impacts would result in a significant adverse effect. These sites are of county/metropolitan value.

⁶⁶ Where assessment of the effects on an SPA or SAC that is not yet formally designated is undertaken, this is referred to as a shadow HRA.

- 6.3.5 There are 19 woodlands on the Ancient Woodland Inventory (AWI) (Bull's Wood, Winnington Wood, Leonard's Wood and Smoker Wood (one site), Coroner's Wood, Hancock's Bank South, Brickhill Wood, Davenport Green Wood, New Farm Wood, Watnall Copice, Padley Wood, Owlcotes Wood, Hooton Cliff, Unnamed Wood west of Barnburgh Cliff, Watchley Crag Wood, Howel Wood, Robinson's Lumb, High Wood, Nor Wood and Nicker Wood) where there would be significant adverse effects at up to county/ metropolitan level in each case.
- 6.3.6 The overall effect of the Proposed Scheme on ancient woodland is considered to be significant at up to the regional level. Ancient woodland is irreplaceable. A heritage review of woodlands not listed on the AWI is being undertaken to identify potential additional ancient woodlands. The results will be assessed in the formal ES and further woodland creation and enhancement measures will be developed if required. On a precautionary basis, it is assumed that additional ancient woodlands are likely to be present.

6.4 Habitats

- 6.4.1 The Proposed Scheme would result in the loss of areas of a range of habitats, including habitats of principal importance (as identified under Section 41 of the Natural Environment and Rural Communities Act, 2006)⁶⁷.
- 6.4.2 On the basis of existing information it is anticipated that 16.7ha of ancient woodland would be lost to the Proposed Scheme. Pending the results of the ongoing heritage review, it is anticipated that there would be further ancient woodland, and the total area of ancient woodland that would be lost is likely to be higher.
- 6.4.3 Ancient woodland is an irreplaceable resource and this loss is considered to be a permanent adverse residual effect, which is significant at a national level. The loss of woodland would be partly compensated through a range of measures. Ancient woodland soil with its associated seed bank would be salvaged and translocated to receptor sites that have, wherever possible, been chosen because they link to and/or are adjacent to ancient woodland fragments. This would seek to increase the connectivity of fragmented ancient woodland parcels. Other measures such as planting native tree and shrub species of local provenance, and translocation of coppice stools and dead wood, would be undertaken as appropriate.
- 6.4.4 It is anticipated that ongoing surveys will identify ancient and veteran trees⁶⁸ that would be lost due to construction of the Proposed Scheme. In each case the loss would be significant at up to the district/borough level and the cumulative loss is likely to be significant at up to the regional level.

⁶⁷ *Natural Environment and Rural Communities Act (2006)*, Her Majesty's Stationery Office, London.

⁶⁸ A tree which, because of its age, size and condition, is of exceptional biodiversity, cultural or heritage value. All ancient trees are veteran trees. Not all veteran trees are old enough to be ancient, but are old relative to other trees of the same species. Very few trees of any species reach the ancient life-stage.

6.4.5 On the basis of existing information, in addition to the loss of ancient woodland, other notable habitat losses that would occur as a consequence of the construction of the Proposed Scheme include:

- semi-natural broadleaved woodland: loss of approximately 343ha as a result of Proposed Scheme as a whole. The loss represents less than 0.1% of the resource in England⁶⁹;
- grassland: loss of approximately 18ha of unimproved and semi-improved neutral grassland as a result of the Proposed Scheme as a whole. This loss represents less than 0.1% of the total neutral grassland resource in England⁶⁹;
- ponds: loss of 416 ponds across the Proposed Scheme. This loss is likely to represent approximately 0.2% of the lowland ponds in Britain⁷⁰;
- hedgerows (some of which may be important hedgerows⁷¹): the total length of hedgerows that would be lost will be reported in the formal ES; and
- fen, marsh and swamp habitats: loss of up to 40.8ha across the Proposed Scheme. This loss represents 0.2% of the national resource⁶⁹.

6.4.6 The design of the Proposed Scheme includes viaducts across the main watercourses, which would reduce effects both by reducing habitat loss during construction and by maintaining links across the scheme for relevant species. Habitat creation included in the design at this stage would help to reduce the effects on other habitats (excluding ancient woodland).

6.4.7 As well as direct losses to habitats, the formal ES will identify any significant indirect effects to habitats (for example from dust, or air emissions from construction traffic), and effects on connectivity of habitats.

6.4.8 The Volume 2: Community area reports identify provisional mitigation areas. The formal ES will include further mitigation as required.

6.5 Species

6.5.1 Adverse effects on protected and notable species could occur across the length of the Proposed Scheme. Based on existing records and the potential for suitable habitat, the impacts during construction that could result in significant route-wide effects may include:

- loss of bat roosts and foraging habitat severance of commuting routes used by bats;
- loss of nesting and foraging habitat for barn owl and other Schedule 1⁷² bird species;

⁶⁹ Natural England 2008. State of the Natural Environment (NE85)

⁷⁰ Wood, P.J., Greenwood, M.T., and Agnew, M.D. 2013. Pond diversity and habitat loss in the UK. Loughborough University

⁷¹ As identified under the Hedgerows Regulations, 1997.

⁷² The Wildlife and Countryside Act 1981 (1981 Chapter 69) – Schedule 1 – Birds which are Protected by Special Penalties, HMSO London. Available online at: <http://www.legislation.gov.uk/ukpga/1981/69>

- loss of ponds and surrounding terrestrial habitat used by populations of great crested newt;
- loss and/or fragmentation of habitats used by other species such as badger, breeding/wintering bird assemblages, otter, water vole, white-clawed crayfish and reptiles; and
- disturbance to sensitive species resulting from noise and lighting.

6.5.2 During operation there is the potential for significant route-wide effects on some bat species and birds, such as barn owl, due to the risk of mortality caused by passing trains during operation. This will be considered further and the findings reported in the formal ES.

6.5.3 The formal ES will include assessments on habitats and species at a route-wide level, together with proposals for further measures to mitigate significant effects.

6.6 Climate change

6.6.1 In developing the ecological compensation and landscaping design of the Proposed Scheme, climate change adaptation will be considered. In particular, the design of mitigation and compensation would seek to ensure that the Proposed Scheme would not hamper the ability of biodiversity to adapt to climate change. It is recognised that, in the future, species and habitats will seek to adapt to climate change, but this is likely to be constrained due to fragmented landscapes and insufficient and poorly distributed semi-natural habitat. The Proposed Scheme would cause further fragmentation during construction, but it would also provide an opportunity to assist dispersal of habitats and species by creating a green corridor of habitat that will help to link areas of isolated habitat.

6.6.2 In seeking to control and reduce potential future adverse effects of climate change on biodiversity, the need to create a permeable landscape through which species (and habitats) can move in response to changes in climatic and ecological conditions, thereby enabling them to respond to the potential impacts of climate change, is crucial. The development of the landscape mitigation and habitat creation within the Proposed Scheme would be heavily influenced by this requirement (as discussed in Volume 1: Introduction and methodology, Section 5). The aims of maintaining and enhancing habitat connectivity within the landscape and of increasing the size of core habitat areas have clear advantages for the future resilience of biodiversity in response to climate change⁷³.

⁷³ Refer, for example, to: Tyldesley, D. (2009), Climate change and biodiversity adaptation: the role of the spatial planning system. Natural England Commissioned Report, Number 004; Defra – UK Biodiversity Partnership (2007), Conserving Biodiversity in a Changing Climate: guidance on building capacity to adapt; MONARCH Partnership (2007), Modelling Natural Resource Responses to Climate Change; Natural England and BRANCH Partnership (2007), Planning for biodiversity as climate changes.

6.6.3 Thus the avoidance, mitigation, compensation and enhancement measures to be incorporated within the Proposed Scheme would seek to align with the future resilience of biodiversity to climate change, as follows:

- existing areas of biodiversity value would be preserved where reasonably practicable;
- habitat creation areas would be located in areas that are adjacent to protected areas and areas managed for biodiversity with a view to increasing their size/resilience to climate change where practicable;
- seeking to create strong linkages between habitat fragments and islands to ensure that the landscape is permeable to species that move in response to climate change;
- varied landscapes would be created with a diversity of features and structure where possible; and
- measures to avoid the spread of invasive alien species from land to be used during operation (which may be competitively favoured by climate change) would be implemented, mainly through the implementation of measures within the draft Code of Construction Practice (CoCP)⁷⁴ and associated documents.

⁷⁴ Supporting documents: Draft Code of Construction Practice

7 Health

7.1 Introduction

7.1.1 The health effects of the Proposed Scheme are reported at both route-wide and community area levels. This section of the report identifies the impacts of the Proposed Scheme identified to date that may affect the population across the route as a whole, and also at the wider regional level. It reports changes that are considered to be potentially important for the health and wellbeing of people within this population. Potential health effects arising from localised impacts, which would affect specific communities along the route of the Proposed Scheme, are reported in the Volume 2: Community area reports, Section 8, Health. A list of the anticipated impacts of the Proposed Scheme that would affect health, and where these are reported, is provided in Volume 1: Introduction and methodology, Section 8.

7.2 Scope, assumptions and limitations

7.2.1 The scope, assumptions and limitations for the health assessment are set out in Volume 1: Introduction and methodology, Section 8, and in the EIA Scope and Methodology Report (SMR)⁷⁵.

7.2.2 As set out in the EIA SMR, the health assessment is based on a broad understanding of health, consistent with the World Health Organization (WHO) definition of health as 'a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity'⁷⁶. An individual's health is mostly determined by genetics and lifestyle factors, but for a large enough population many other factors, or 'health determinants', are known to be important, and these factors may be affected by the Proposed Scheme.

7.2.3 The health assessment has considered the impacts of the Proposed Scheme on a range of environmental and socio-economic factors, termed 'health determinants', which are known to affect health and wellbeing. Based on this, a professional judgement has been made to identify those effects on population health and wellbeing that are sufficiently important to report within the ES, based on the assessment criteria set out in the EIA SMR. Some of these effects lend themselves to assessment at a local level, and are reported in the health assessment sections within Volume 2: Community area reports. Those effects that would occur along the route of the Proposed Scheme as a whole, and are not specific to a particular location, are assessed within this section of the working draft ES.

7.2.4 The health determinants considered to affect the health of the population route-wide:

- impacts during construction:
 - employment and income;

⁷⁵ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

⁷⁶ World Health Organisation (1948), Constitution of the World Health Organisation Basic Documents, 45th edition supplement. Available online at: www.who.int/governance/eb/who_constituution_en.pdf

- housing;
 - transport (traveller stress and road safety); and
 - planning blight and uncertainty.
- impacts during operation:
 - airborne noise (railway noise).

- 7.2.5 The health assessment identifies those areas where impacts on health determinants are predicted to occur. In some cases, such as for airborne noise, this comprises a fixed study area (generally⁷⁷ 1km either side of the route of the Proposed Scheme in rural areas, 500m in urban areas). In other cases, such as employment impacts, there is no defined study area. Direct impacts such as demolition of commercial and residential properties occur within the boundaries of the Proposed Scheme, although the health effects may be felt by people further afield (such as employees of affected businesses). As regards traffic and transport, the health assessment focuses on those settlements close to the Proposed Scheme where the majority of transport impacts would occur.
- 7.2.6 The health assessment methodology is based, in part, on a review of published evidence showing how impacts on health determinants are linked to health 'outcomes' (i.e. effects) in a large population. The evidence linking sound, noise and vibration from railways to health outcomes varies in its strength. There is strong evidence linking operational railway sound, noise and vibration with health outcomes, but the evidence linking the construction or operation of high speed rail with health outcomes is weak. The strength of evidence does not necessarily determine the importance of a health effect, but is an indication of the level of certainty in the assessment. Additionally, there is greater certainty in the prediction of an impact on a 'health determinant' than the consequent effect on health.
- 7.2.7 There is no established or widely accepted framework for assessing the 'significant' health effects of a development proposal. The EIA SMR sets out a methodology for describing the impacts on 'health determinants' in terms of the magnitude and duration of the change to health determinants and the extent of the population exposed to this change. It also draws attention to the strength of evidence that links a change in health determinant with health effects. This framework permits the assessment to describe the impacts on determinants in a largely qualitative manner, with some structure to the relative scale of these impacts to give a sense of the 'importance' of the potential health effects. This does not, however, provide a clear basis for drawing conclusions as to whether a health effect is likely to be 'significant' as can be done for the other environmental topics.
- 7.2.8 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. Likely significant effects will be assessed and reported in full in the formal ES.

⁷⁷ The SMR allows the study area to be extended, if necessary, to cover all areas forecast to be exposed to noise in excess of the relevant Lowest Observed Adverse Effect Level defined in accordance with Government noise policy.

7.3 Environmental baseline

- 7.3.1 The Proposed Scheme would cross a range of rural and urban areas, and the characteristics of the communities in these areas vary in terms of population density, age and demographic profile, socio-economic status and health.
- 7.3.2 The health assessments in Volume 2: Community area reports, Section 8, provide a description of the populations along the route of the Proposed Scheme and an overview of the key demographic, social and health characteristics within each area.
- 7.3.3 Baseline economic and employment data is provided in Volume 2: Community area reports, Section 12, Socio-economics, and within the socio-economic section of this report. Baseline traffic and transport information is provided in the transport assessment in Volume 2: Community area reports, Section 14, and within the traffic and transport section of this report. Residential properties in the areas directly affected by the Proposed Scheme are described in the community assessment in Section 6 of the Volume 2: Community area reports.

7.4 Avoidance and mitigation measures

- 7.4.1 Consideration of potential health issues is an integral part of the planning and design of the Proposed Scheme, alongside consideration of other environmental, community and economic issues. Adverse impacts on health determinants have been reduced insofar as reasonably practicable through mitigation measures incorporated into the design of the Proposed Scheme to reduce adverse effects on people. Examples of the mitigation measures incorporated into the design of the Proposed Scheme include the following:
- reducing the loss of property and community assets, insofar as reasonably practicable;
 - reducing visual intrusion and noise, insofar as reasonably practicable; and
 - incorporating landscape design and screening into the overall design.
- 7.4.2 The locations of construction compounds and site haul routes have been selected to reduce exposure to construction impacts insofar as reasonably practicable.
- 7.4.3 HS2 Ltd would require the nominated undertaker and its contractors to comply with an environmental management regime for the Proposed Scheme, which would include the measures set out in the draft Code of Construction Practice (CoCP)⁷⁸. This document provides a general basis for route-wide construction environmental management. Contractors would also be required to comply with measures set out in Local Environmental Management Plans (LEMP), which would apply the route-wide environmental management strategies at a local level.
- 7.4.4 The nominated undertaker would be required to take reasonable steps to engage with the community, focusing on those who may be affected by construction impacts,

⁷⁸ Supporting documents: Draft Code of Construction Practice

including local residents, businesses, landowners and community resources, and the specific needs of protected groups (as defined in the Equality Act 2010). This would include producing a Community Engagement Framework⁷⁹ and providing appropriately experienced community relations personnel to implement the framework, provide appropriate information to local communities and be the first point of contact to resolve community issues.

7.5 Assessment of effects during construction

Education, employment and income

Construction employment and training

- 7.5.1 The construction of the Proposed Scheme has the potential to increase opportunities for employment and training for communities along the route, across a range of occupations and skillsets. The socio-economic assessment, Section 12 of this report, estimates that the construction phase would generate 88,700 person years of direct construction jobs (the equivalent of 8,870 permanent full-time construction jobs), ranging from unskilled and low skilled jobs to technical and managerial roles. A further estimated 44,400 person years of employment (the equivalent of 4,440 full-time jobs) could be created as a result of demand for goods and services through the business supply chain and expenditure effects of workers. Depending on skill levels required, and the skills of local people, these jobs would be accessible to local residents and to others living within the travel to work area, as well as workers who relocate to the area in order to access these jobs.
- 7.5.2 There is strong evidence of links between employment and income and physical and mental health. The benefits of work are linked to increased access to healthier lifestyle choices and increased opportunities for participation in society, which are associated with improved mental and physical health. Employment is also an important aspect of individual identity and social status, with direct health benefits such as social and psychological wellbeing.
- 7.5.3 Uptake of direct construction jobs from within local communities would be predominantly in lower skilled roles, as contractors generally appoint the majority of skilled and managerial staff from their existing workforce or recruit nationally. The jobs created would be located within the study area for the duration of the works, after which the training, skills and experience gained may improve future employment prospects in the construction sector.
- 7.5.4 The extent of beneficial health effects within the local communities along the route of the Proposed Scheme from direct construction employment would depend on the number of people who are able to, and choose to, take up opportunities for construction employment and training. For those who do, this has the potential to result in improved income, employment status and self-esteem, and associated health

⁷⁹ HS2 Ltd has produced a Community Engagement Framework which sets out how HS2 Ltd and its contractors, as well as their sub-contractors, would undertake community engagement during the construction of the HS2 project. The framework is being implemented on Phase One of HS2 and is applicable to all phases of HS2. This framework is available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/625971/hs2_community_engagement_framework.pdf

benefits. Employment benefits are likely to be greatest in the more urban areas along the route of the Proposed Scheme, as these areas contain a higher proportion of people of working age and more people with existing skills in the construction sector. Urban areas with higher levels of existing unemployment and deprivation would have the most to gain in health terms from employment generated during construction. HS2 Ltd is developing its Skills, Employment and Training Strategy, to be launched in Autumn 2018, which will include measures aimed at ensuring local communities are able to access employment opportunities during the construction phase.

Direct and indirect business impacts and associated income and employment impacts

- 7.5.5 As well as generating construction employment opportunities, the Proposed Scheme would result in the displacement of some existing businesses through land required for its construction. The socio-economic assessment, Section 12 of this report, estimates that this would result in the relocation of 11,600 jobs. The majority of businesses affected in this way are assumed to be able to relocate, given the availability of alternative premises and the payment of compensation, and thereby continue to operate. However, some businesses may not relocate and taking this into account the socio-economic assessment estimates that 1,600 jobs might be lost across the route as a whole.
- 7.5.6 In addition, the direct loss of businesses and employment would have knock-on effects through the business supply chain and expenditure effects alongside other economic adjustment factors. The socio-economic assessment estimates that in total, approximately 2,380 jobs could be lost route-wide from businesses directly and indirectly affected during the construction phase. As outlined in the Economic Case⁸⁰ for HS2 in the longer term, the Proposed Scheme would enhance employment opportunities through increased investment and economic activity above the baseline. In the context of the economies of the North West, Yorkshire and the Humber, West Midlands and East Midlands, which provide over 10.5 million jobs, the potential level of job loss is a relatively small proportion of total employment.
- 7.5.7 This level of job losses is not considered to affect overall employment levels and associated levels of health and wellbeing across the population as a whole. However, some individuals may be adversely affected, particularly among the more vulnerable members of a community. It is likely that some directly impacted businesses would be unable to find suitable alternative premises close to their existing site and would have to relocate further afield. In these instances, although the total number of jobs might remain the same, local workers might find themselves unable to commute to the new location, resulting in the loss of their job. This would be more likely to affect workers in lower paid positions for whom a longer commute might be not financially worthwhile or practical. Some directly impacted businesses may no longer be able to operate if they cannot be relocated. Such impacts could result in long-term effects on employment status, leading to potential adverse health and wellbeing effects.

⁸⁰ Department for Transport (2017), High Speed Two Phase Two Economic Case Moving Britain Ahead. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/634196/high-speed-two-phase-two-economic-case.pdf

Transport effects

Traveller stress

- 7.5.8 Temporary and permanent closure or diversions of roads or public rights of way, changes to traffic flows and congestion around junctions during construction may affect journey times along the affected routes. The health effects associated with the impact of increased journey times on access to social networks, services, health and social care are assessed at a local level in Volume 2: Community area reports. Journey time changes may also contribute to traveller stress, which is assessed at route-wide level in this section. Government guidance has identified traveller stress as comprising feelings of discomfort, annoyance, frustration or fear, culminating in physical and emotional tension that detracts from the quality and safety of a journey.
- 7.5.9 The extent to which the construction of the Proposed Scheme might lead to traveller stress depends on the duration and extent of increases in journey times. The transport assessment, in the Volume 2: Community area reports, Section 14, has identified routes that could be subject to increases in traffic flows, diversions or realignments. There is potential for some of these impacts to cause disruption and increased journey times that could lead to traveller stress. This will be reported in the formal ES, when data from the transport model is available.

Road safety

- 7.5.10 The construction of the Proposed Scheme would increase the amount of heavy goods vehicle (HGV) traffic on local roads, which if not properly managed, has the potential to adversely affect road safety. The HGV content of traffic can affect road safety, particularly for pedestrians, cyclists and equestrians. The rate of fatal or serious accidents involving HGV is reducing significantly due to improved awareness and safety measures, with fatal or serious accidents involving HGV falling by 44% between 2006 and 2016⁸¹. HS2 Ltd would discuss with local authorities measures to ensure road safety during construction works. The nominated undertaker, in line with the draft CoCP, would produce traffic management plans including measures to address road safety and reduce the risks to non-motorised users from construction vehicles on the roads.
- 7.5.11 It is considered that with appropriate management, including restrictions on the timing of HGV movements, the construction of the Proposed Scheme would not result in direct adverse health effects associated with road safety. However, road safety is likely to be a key issue of concern to local communities, and this could contribute to adverse effects on wellbeing through increased levels of anxiety, as well as potential behavioural changes such as reduced uptake of walking and cycling on construction traffic routes.

⁸¹ Department for Transport (2017), Reported road casualties in Great Britain: Summary. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/648082/rrcgb2016-02.pdf

Air emissions

- 7.5.12 Exposure to air pollutants, including NO₂, NO_x and small particulate matter (PM₁₀ and PM_{2.5}), is known to have adverse effects on respiratory health. When a large population is exposed to a net change in air quality, it may be possible to quantify the resulting health effects. Section 3 of this report states that changes in air quality are not expected to be significant at a route-wide level. Based on this, and knowledge from previous phases of the Proposed Scheme, it is anticipated that any increase in overall population exposure to air pollutants would be very small, and would not give rise to any measurable health effects. Therefore, a route-wide, quantitative assessment of health effects resulting from changes in air quality is not currently proposed. This will be reviewed based on the findings of the air quality assessment in the formal ES.
- 7.5.13 Local air quality effects will be assessed in Volume 2: Community area reports, Section 5, Air quality, and as part of the assessment of neighbourhood quality impacts in Volume 2: Community area reports, Section 8, Health.

Housing

Residential relocations

- 7.5.14 The Proposed Scheme would result in the demolition of a total of 536 properties across the route as a whole. Demolitions are reported in Volume 2: Community area reports, Section 2.
- 7.5.15 People whose properties have to be acquired for the construction of the Proposed Scheme would be eligible for compensation through the Compensation Code⁸². This includes an Express Purchase Scheme⁸³, which enables homeowners within the 'safeguarding area' to sell their properties to the Government in advance of the construction phase.
- 7.5.16 There is moderate to strong evidence on the links between housing and health, relating to the quality and security of housing, and also to the effects of involuntary relocation. Relocation of people from their homes has been shown to influence health outcomes, as disturbance to people's living environments, social networks and regular routines may precipitate stress and related symptoms.
- 7.5.17 The effects of involuntary relocation would vary according to the type and location of property. For rural residents, in isolated rural properties or within rural villages, there is a reduced likelihood of finding a suitable alternative property on the market, and therefore, a greater chance that residents would be compelled to move outside their local community. Social housing occupants would have less control over the type and location of alternative property compared with homeowners.

⁸² HS2 Ltd (2018), High Speed Two Phase 2a Information Paper C8: Compensation Code for Compulsory Purchase. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/701203/C8_Compensation_code_for_compulsory_purchase_v2.0_.pdf

⁸³ HS2 Ltd (2018), HS2 Express Purchase Scheme. Available online at: <https://www.gov.uk/claim-compensation-if-affected-by-hs2/express-purchase-scheme>

- 7.5.18 In areas where a large number of homes are required to be demolished, the ability to secure a comparable home in the local area would depend on availability and affordability within the local property market.
- 7.5.19 Those affected by involuntary relocation would be likely to experience adverse effects, which may include: stress associated with the move itself; negative feelings associated with attachment to existing homes; feelings of frustration or anxiety related to uncertainty and lack of control; practical issues such as specific adaptation requirements; and reduced access to family, social networks, employment or education. These effects may occur prior to, during and after the relocation process.
- 7.5.20 The health effects of involuntary relocation would vary between individuals, with some groups being more vulnerable to adverse effects. Age is a factor in determining the ability of people to adapt to the effects of relocation, with older people more likely to experience difficulties. People with disabilities, and those with physical or mental health conditions, may also experience difficulty in adapting, and may require specific modifications to their homes. Parents and carers may face longer journeys to schools, particularly in rural areas, and some children may change school as a result of relocation. Vulnerable people are also more likely to depend on support from within their local communities, which may be disrupted by relocation.

Housing market

- 7.5.21 The prospect of construction of the Proposed Scheme may affect local property values prior to and during construction. Homeowners whose properties are within the 'rural support zone' (outside the safeguarding zone and up to 120m from the centre line of the Proposed Scheme in rural areas) may sell their property at its un-blighted open market value to the Secretary of State for Transport through the Voluntary Purchase Scheme⁸⁴, or alternatively apply for a cash offer of 10% of this value. Homeowners outside of this area may be entitled to sell their property at its un-blighted open market value to the Secretary of State for Transport through the Need to Sell Scheme⁸⁵, if they have a 'compelling reason' to sell, such as relocation for a job or ill health, and are unable to sell other than at a substantially reduced value because of the location of the property and the impact of the Proposed Scheme.
- 7.5.22 HS2 Ltd recognises that home-owners close to the route have been, and will continue to be, affected by the Proposed Scheme. There is potential for homeowners to be impacted by property blight, particularly in the period leading up to construction. Past experience of infrastructure projects and other kinds of development suggests that blight tends to be at its worst before building starts, when there is most uncertainty and least definite information about the impacts of the development. HS2 Ltd will work to reduce uncertainty by engaging with local authorities and communities throughout the planning stages.

⁸⁴ HS2 Ltd (2018), HS2 Cash Offer or Voluntary Purchase Scheme. Available online at: <https://www.gov.uk/claim-compensation-if-affected-by-hs2/cash-offer-or-voluntary-purchase-scheme>

⁸⁵ HS2 Ltd (2018), HS2 Need to Sell Scheme. Available online at: <https://www.gov.uk/claim-compensation-if-affected-by-hs2/need-to-sell-scheme>

Planning blight and uncertainty

- 7.5.23 As with any major infrastructure project, the impacts of the construction and operation of the Proposed Scheme would result in changes to the quality and character of neighbourhoods along the route. Responses to community consultation undertaken since July 2017 have highlighted concerns about issues such as noise, tranquillity, visual impacts and construction traffic.
- 7.5.24 During the planning stages of the Proposed Scheme, concerns about construction and operational impacts have the potential to lead to increased stress, potentially affecting wellbeing through reduced levels of life satisfaction or increased levels of anxiety or depression. Stress may be caused by knowledge of the predicted impacts of the Proposed Scheme, or uncertainty about what the impacts might be. As described above, these factors may also impact on property values, which in turn could add to levels of stress in the population.
- 7.5.25 Stress associated with uncertainty, frustration and lack of control can be reduced by providing clear and transparent information to communities. The working draft ES provides information on the likely impacts of the Proposed Scheme, and more details will be included in the formal ES. This will serve to provide more clarity and certainty about how neighbourhoods along the route of the Proposed Scheme will be impacted, reducing the stress associated with uncertainty. However, due to the nature of the Proposed Scheme, stress and anxiety associated with impacts is likely to remain.
- 7.5.26 The draft CoCP would require the nominated undertaker and its contractors to produce a Community Engagement Framework and provide appropriately experienced community relations personnel to: implement the framework; provide appropriate information to local communities; and be the first point of contact to resolve community issues. This would help alleviate the effects of planning blight and uncertainty, and the associated health and wellbeing effects, during the construction phase.

7.6 Assessment of effects during operation

Airborne noise

- 7.6.1 The operation of the Proposed Scheme has the potential to result in increased exposure to airborne noise from passing trains. There is a strong link between operational transport noise and health, with long-term exposure to higher levels of transport noise being associated with adverse health outcomes. At the population level, it is possible to quantify the effects on health resulting from long term exposure to operational transport noise, using established exposure-response relationships for specific health outcomes. A Defra-led group of Government analysts⁸⁶ published three reports between 2008 and 2010 detailing current understanding of the links between transport noise and various effects including sleep disturbance, annoyance, hypertension and ischemic heart disease. These effects, where they are in addition to those reported in Section 13, Sound, noise and vibration of the Volume 2: Community

⁸⁶ The Interdepartmental Group on Costs and Benefits - Noise Subject Group.

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area reports, will be assessed using a Defra appraisal tool for the valuation of the health effects of transport noise⁸⁷, and with the effects expressed in terms of 'disability adjusted life years' (DALYs)⁸⁸. This will be reported in the formal ES, at route-wide level.

- 7.6.2 Local construction and operational noise effects (including vibration during construction) are reported in Volume 2: Community area reports, Section 13, Sound, noise and vibration, and as part of the assessment of neighbourhood quality impacts in Volume 2: Community area reports, Section 8, Health.

⁸⁷ Department for Environment, Food and Rural Affairs (2014), Environmental Noise: Valuing impacts on: sleep disturbance, annoyance, hypertension, productivity and quiet.

⁸⁸ DALYs indicate the estimated number of healthy life years lost in a population from premature mortality or morbidity, i.e. the health burden.

8 Historic environment

8.1 Introduction

- 8.1.1 This section of the report describes the direct physical effect identified to date of the Proposed Scheme at a route-wide level on designated heritage assets, including World Heritage Sites, scheduled monuments, registered parks and gardens, registered battlefields and listed buildings.
- 8.1.2 Heritage assets can be affected through physical removal or through changes to their setting due to development. The loss of individual heritage assets and changes to their setting are not considered to be of route-wide importance and are, therefore, most appropriately assessed on an individual basis within the relevant Volume 2: Community area reports, Section 9, Historic environment.

8.2 Scope, assumptions and limitations

- 8.2.1 For the purpose of the working draft ES, it is assumed that all heritage assets within the land required for the construction and operation of the Proposed Scheme would be removed or demolished unless expressly excluded as a result of the mitigation process.
- 8.2.2 As a result of ongoing design development, and historic environment survey and assessment it is not possible to fully identify the potential for significant route-wide effects for the working draft ES. Predicted route-wide effects will be reported in the formal ES.

8.3 Assessment of effects during construction

- 8.3.1 The Proposed Scheme would not have any direct physical effect on any World Heritage Site, registered battlefield, Grade I or Grade II* listed building. Effects on ancient woodland are assessed in Section 6, Ecology and biodiversity of this report.
- 8.3.2 Across the entire route of the Proposed Scheme, a number of designated heritage assets would be significantly affected through direct physical impact. These include:
- one scheduled monument;
 - twelve Grade II listed buildings; and
 - twelve conservation areas.
- 8.3.3 A number of non-designated heritage assets would be affected by the Proposed Scheme in more than one community area or would be affected by more than one phase of HS2. The route-wide effect of the Proposed Scheme on these assets will be assessed and reported in the formal ES.

8.4 Assessment of effects during operation

- 8.4.1 Historic environment assessment undertaken for the working draft ES is provisional. As a result it is not possible to identify specific physical effects on heritage assets resulting from operation. An assessment of significant effects predicted as a result of operation will be reported in the formal ES.

9 Land quality

9.1 Introduction

9.1.1 This section of the report presents the route-wide assessment of the likely significant land quality effects identified to date arising from the construction and operation of the Proposed Scheme. Land quality encompasses issues relating to potential and existing land contamination, mineral or mining resources and geological conservation resources.

9.1.2 Significant effects arising from the construction and operation of the Proposed Scheme interacting with individual areas of potential land contamination, mineral or mining resources and geological conservation resources are reported within Volume 2: Community area reports, Section 10, Land quality. This section of this report considers where wider, regional scale, effects could occur as a result of the interaction of the Proposed Scheme with areas of land contamination, mineral or geological resources; when they are considered either individually or in combination with each other.

9.2 Scope, assumptions and limitations

9.2.1 The scope, assumptions and limitations for the land quality assessment are set out in Volume 1: Introduction and methodology, Volume 2: Community area reports and maps and the EIA Scope and Methodology Report (SMR)⁸⁹.

9.2.2 Existing contamination has been assessed by screening to identify relevant sites, taking into account the potential for contamination to be present, the nature of works proposed in the area and the proximity of sensitive land uses. Sites identified as of potential concern by the screening exercise have then been further assessed to identify the probability and consequence of pollution or harm occurring, in order to identify potentially significant effects during both construction and operational phases.

9.2.3 Mining, mineral and geological resources have been assessed by considering their sensitivity or value and the potential magnitude of the impact on them as a result of the Proposed Scheme in order to identify potentially significant effects.

9.2.4 Although ground gases, leachate and contaminated groundwater can migrate some distance from their source, such migration is usually over a relatively limited area unlikely to lead to regional effects, with remediation at construction stage generally giving rise to essentially local effects. Where either groundwater, leachate or ground gas migration is encountered, measures would be put in place to control contaminant mobilisation as necessary to avoid the occurrence of adverse effects at a local level. Controls to deal with the effects of encountering land contamination are set out in the draft Code of Construction Practice (CoCP)⁹⁰ and may also, where appropriate, be enhanced by further site-specific remediation measures. Route-wide effects from

⁸⁹ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

⁹⁰ Supporting documents: Draft Code of Construction Practice

existing contamination have, therefore, been assessed only for sites for which residual effects, when considered individually or in conjunction with those of other sites in the vicinity, have been identified that are considered to have the potential to present a significant effect at a regional level.

- 9.2.5 Route-wide effects in relation to mining, mineral and geological resources have been considered where the Proposed Scheme may have a significant effect on a regionally or nationally important mining or mineral resource, or on a nationally or internationally important geological resource.
- 9.2.6 As set out in the EIA SMR, the assessment considers soils, water and geological resources from a perspective of land contamination, mineral or mining resources and geological conservation. Other aspects associated with these resources are dealt with elsewhere within this report, such as the agricultural value of soils (Section 2, Agriculture, forestry and soils), waste issues associated with disposal of contaminated soils (Section 15, Waste and material resources), and groundwater and surface water (Section 16, Water resources and flood risk).
- 9.2.7 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES.

9.3 Environmental baseline

- 9.3.1 Along the route of the Proposed Scheme potentially contaminative land uses have been found in 1,991 locations. In rural areas, remediation of these sites at the construction stage would give rise to local effects. In more urban areas, where the incidence of potentially contaminative land uses is more frequent/widespread, the effects would again be essentially local in nature due to the limited area over which contamination can spread. Where appropriate, combined effects on a local scale between areas of nearby contamination are assessed in Volume 2: Community area reports, Section 10, Land quality.
- 9.3.2 The assessment has not identified potential regional effects associated with areas of existing contamination. However, large parts of the route are dominated by historic coal mining affected areas where there is potential for coal beds, abandoned works, colliery spoil and infilled open cast pits to be sources of contamination and adits, shafts and fractures that have the potential to form pathways for gas, vapour and groundwater migration. Mitigating these effects on a local scale using techniques such as grouting has the potential to negatively impact the groundwater or ground gas regime and will need to be considered at a regional scale rather than as a series of local effects.
- 9.3.3 The assessment has identified potential regional or route-wide effects associated with areas of mining and mineral resources. Approximately 123km of the route of the Proposed Scheme would pass through Mineral Safeguarding Areas (MSAs) designated for sand, gravel, brick clay, coal, salt, gypsum, limestone and building stone where there may be some potential for limited sterilisation of resource. Of particular note, the Cheshire area is dominated by salt mining activity. Approximately 182km of the route of the Proposed Scheme would be situated within prospective

Petroleum Exploration and Development Licence (PEDL) areas (within the Cheshire, Greater Manchester, Leicestershire, Nottinghamshire and Derbyshire areas) and approximately 126km would be situated within shale prospective areas. There is also at least one planned gas storage facility situated within an existing salt cavern close to the route of the Proposed Scheme in the Cheshire area.

- 9.3.4 The assessment has not identified potential regional or route-wide effects associated with sites of geological resources. Thirteen sites of geological conservation have been identified within the vicinity of the route of the Proposed Scheme, five of which are sites of special scientific interest (SSSI) of regional importance and the remaining being of local importance. However, no local significant effects on these sites have been identified and on that basis, there are unlikely to be any regional or route-wide effects.

9.4 Avoidance and mitigation measures

- 9.4.1 Avoidance and mitigation measures to address local effects, as described in Volume 1: Introduction and methodology and Volume 2: Community area reports are described in the draft CoCP. If site-specific remedial measures are required, these will also flow from the draft CoCP.
- 9.4.2 Based upon the findings of the assessment, it is considered that no further avoidance or mitigation measures are required in order to address route-wide effects.

9.5 Assessment of the effects of construction

- 9.5.1 It is intended to deal with contaminated soils by treating and reusing suitable materials wherever safe, practicable and necessary. Any material that cannot be made suitable for use would be taken off site, for further treatment or disposal. The likely incidence of such materials is considered to be low, and therefore, the route-wide disposal of contaminated soil is not considered to be a significant issue (see Section 15, Waste and material resources, of this report).
- 9.5.2 It is anticipated that, with the application of the measures set out in the draft CoCP and site-specific remediation, there would be no significant adverse route-wide effects from contamination during construction.
- 9.5.3 For route-wide effects associated with mitigation of underground voids in areas of existing contamination during construction, the design of mitigation in accordance with the draft CoCP would need to be supported by detailed ground investigation to characterise potential pathways at and near to the site, detailed hydrogeological assessment and consultation with stakeholders including the Coal Authority, Environment Agency, the local authority, land owners and HS2 Ltd to define a solution that considers the combined effects of mitigation for existing contamination. With this mitigation in place, it is considered that on a regional or route-wide basis the effects from contamination during construction would not be significant.
- 9.5.4 For mineral resources, route-wide effects will be assessed in relation to the proportion of a resource being affected by sterilisation or isolation and its relative importance in terms of local and national scale. MSAs for identified deposits of sand and gravel occur regularly along the route of the Proposed Scheme. In the Crewe to Manchester

area there are extensive areas of salt deposits that are the subject of MSAs. In several areas, there are a number of PEDL areas such as the Bowland Shale Prospective Area, in addition to widespread deposits of deep coal associated with coalfields. There is also at least one planned gas storage facility situated within an existing salt cavern. Where construction does occur within a MSA, any pre-extraction of surface minerals would assist in reducing the sterilisation impact to a local mineral supply. The pre-extraction of identified minerals would need to be discussed with the landowner, the Mineral Planning Authority and other relevant stakeholders to assist in achieving effective management of minerals. Consent from the relevant authorities may also be required. It should be noted that the hydrocarbon deposits could potentially be exploited by lateral drilling. With this mitigation available, it is considered that on a regional or route-wide basis the effects on mineral resources during construction would not be significant.

- 9.5.5 For geological conservation resources, route-wide effects will be assessed based upon the degree of local or national importance and the proportion of the resources impacted. Thirteen sites of geological conservation resources have been identified within the vicinity of the Proposed Scheme, five of which are SSSI of regional importance and the remaining being of local importance. However, these are not considered to constitute regional or route-wide effects on geological conservation areas.

9.6 Assessment of the effects of operation

- 9.6.1 At this stage in the design and assessment it is anticipated that there would be no significant route-wide effects for land quality during operation.
- 9.6.2 Route-wide permanent adverse impacts on land quality arising during operation would be avoided or mitigated through measures included in the design and these will be reported in the formal ES.

10 Landscape and visual

10.1 Introduction

10.1.1 This section of the report provides an assessment of the route-wide impacts and likely significant effects identified to date on landscape arising from the construction and operation of the Proposed Scheme. Within the Volume 2: Community area reports, Section 11, significant landscape effects are reported by landscape character areas (LCAs) and significant visual effects on receptors are reported by reference to identified viewpoints.

10.1.2 The LCAs have been determined as part of an integrated process of landscape characterisation, informed by the outcome from other topics including historic environment, and ecology and biodiversity. Use has been made of published landscape character assessments and a wide range of supporting Geographic Information System (GIS) data, aerial photography and Ordnance Survey (OS) mapping, plus desk study and fieldwork. Landscape character assessments that have been reviewed include the relevant National Landscape Character Areas and local authority landscape character assessments. More detail on the approach to the landscape characterisation is set out in the EIA Scope and Methodology Report (SMR)⁹¹.

10.2 Scope, assumptions and limitations

10.2.1 The National Forest and the Northern Forest are the only landscape receptors where effects have the potential to occur at a geographical scale greater than the community areas described in Volume 2: Community area reports.

10.2.2 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES.

10.3 Policy framework

10.3.1 National, regional and local policies provide a positive framework for environmental conservation and enhancement measures. These include delivery of the National Forest, the Northern Forest and a wide range of other landscape-scale green infrastructure projects

10.3.2 Provision of a new green infrastructure as part of the strategic mitigation for the Proposed Scheme is a key way to achieve HS2's aspiration of a multi-functional 'green corridor' along the route. This 'green corridor' would include new wildlife habitats, native woodlands and community spaces to help integrate the Proposed Scheme into its surrounding landscape and help achieve environmental resilience and new assets for community benefit and cohesion.

⁹¹ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

- 10.3.3 At a national level, paragraph 99 of the National Planning Policy Framework (NPPF)⁹² states, amongst other things, that *'New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure.'*
- 10.3.4 Paragraph 109 of the NPPF states that *'the planning system should contribute to and enhance the natural and local environment by: protecting and enhancing valued landscapes, geological conservation interests and soils.'*
- 10.3.5 Paragraph 114 of the NPPF states, amongst other things, that local planning authorities should *'set out a strategic approach in their Local Plans, planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure.'*

10.4 Environmental baseline

The National Forest

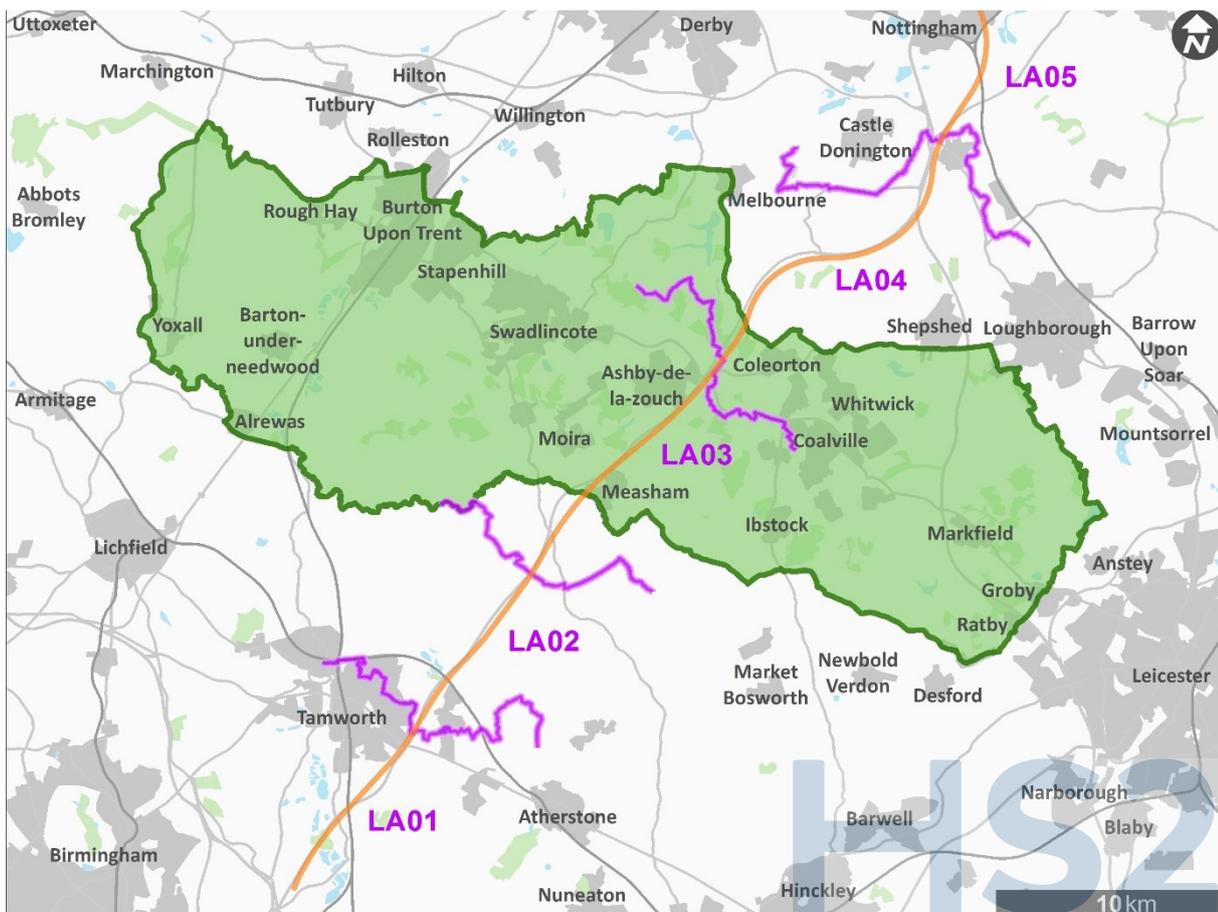
- 10.4.1 The National Forest is an environmental project set up with Government support in the 1990s and run by The National Forest Company. It extends from Burton-upon-Trent in the west to Leicester in the east.
- 10.4.2 It has transformed nearly 52,000ha (128,000 acres) of industrial land with the establishment of approximately 8.5 million trees over the past 28 years. Benefits have included not only landscape restoration but wildlife enhancement, recreational provision, bringing communities together and increased climate change resilience. The forest has also supported the visitor, woodland and recreational economies, along with inward investment and business growth⁹³.
- 10.4.3 The approximate extent of the National Forest is illustrated in Figure 3 and the following community areas are located within it:
- Appleby Parva to Ashby-de-la-Zouch (LA03); and
 - Coleorton to Kegworth (LA04).

⁹² Department for Communities and Local Government (2012), National Planning Policy Framework. Available online at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

⁹³ The National Forest Company (2014), The National Forest Strategy 2014 – 2024.

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Figure 3: The National Forest



The Northern Forest

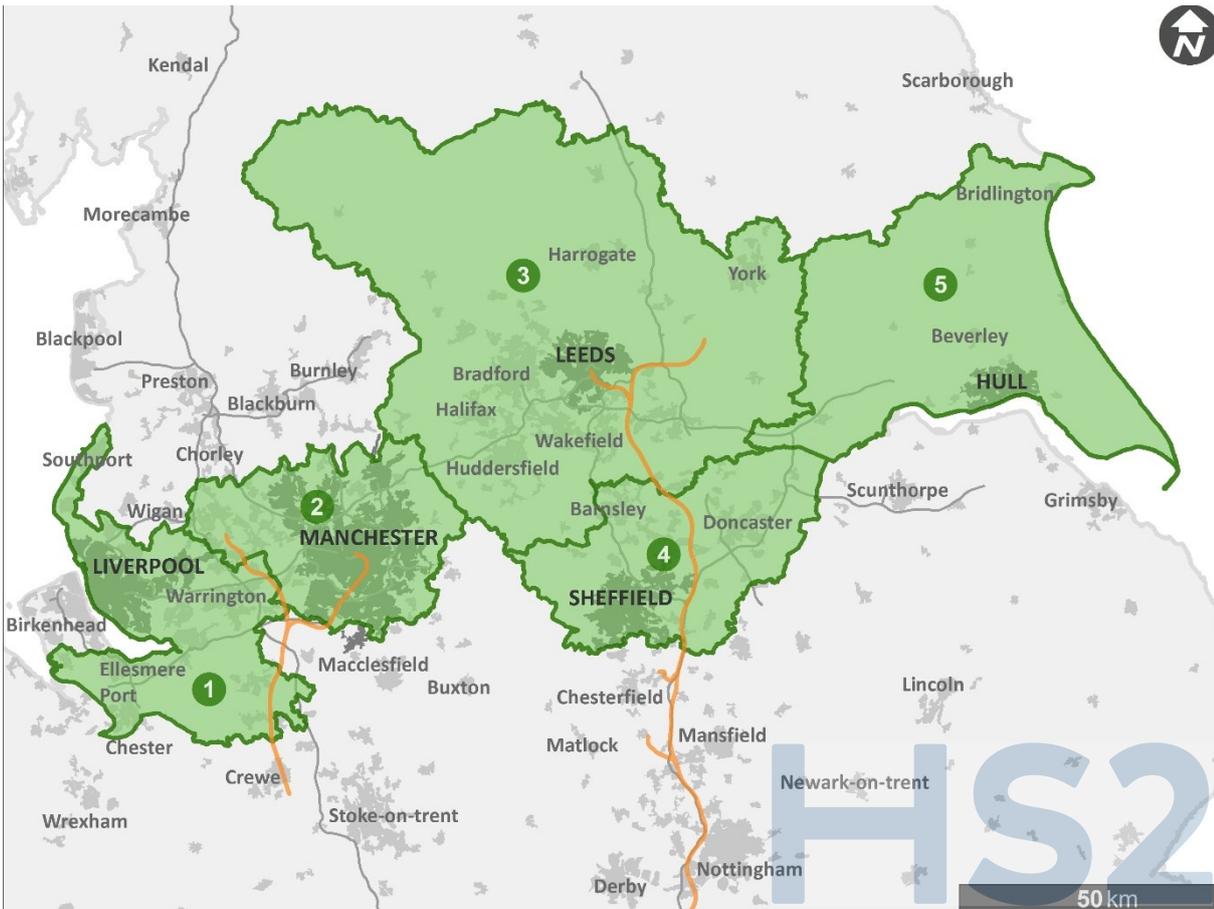
- 10.4.4 The Government announced plans for a new multi-regional Northern Forest in January 2018. The proposed forest would extend across the whole width of England and would include the cities of Manchester, Leeds, Sheffield and Hull. The approximate extent of the Northern Forest is illustrated in Figure 4. It would incorporate five community forests, as identified in Figure 4: (1) the Mersey Forest; (2) Manchester City of Trees; (3) the Leeds White Rose Forest; (4) the South Yorkshire Community Forest; and (5) the HEYwoods project⁹⁴. The project aims to plant more than 50 million trees over the next 25 years. The Woodland Trust and the five community forests estimate that, based on an average of around 500 trees per hectare, there would be an overall establishment of 100,000 hectares of woodland if this target of 50 million trees is met⁹⁵.
- 10.4.5 The proposed forest would help reverse the long-term decline in UK woodland cover and would provide a wide range of environmental, social and economic benefits. Locations for new woodland would be identified on the basis of a wide range of factors, including the benefits that would arise from reducing flood risk in river valleys, opportunities for enhancement to biodiversity and landscape character, improvements to air quality in and around cities and enhanced leisure opportunities.

⁹⁴ Department for Environment, Food & Rural Affairs (2018), New Northern Forest gets Government backing. Available online at: <https://www.gov.uk/government/news/new-northern-forest-gets-government-backing>

⁹⁵ The Northern Forest Manifesto (2018), *A new Northern Forest*.

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Figure 4: The Northern Forest



10.4.6 Proposed areas of the Northern Forest are located within the following Community areas:

- Hough to Walley's Green (MA01);
- Wimboldsley to Lostock Gralam (MA02);
- Pickmere to Agden and Hulseheath (MA03);
- Broomedge to Glazebrook (MA04);
- Risley to Bamfurlong (MA05);
- Hulseheath to Manchester Airport (MA06);
- Davenport Green to Ardwick (MA07);
- Manchester Piccadilly Station (MA08);
- Staveley to Aston (LA11);
- Ulley to Bramley (LA12);
- Ravenfield to Clayton (LA13);
- South Kirkby to Sharlston Common (LA14);
- Warmfield to Swillington and Woodlesford (LA15);
- Garforth and Church Fenton (LA16);

- Stourton to Hunslet (LA17); and
- Leeds Station (LA18).

10.5 Avoidance and mitigation measures

- 10.5.1 Avoidance and mitigation measures to address local effects on landscapes within the Forest areas at construction stage are set out in Volume 1: Introduction and methodology and the Volume 2: Community area reports for those community areas listed in 10.4. These are applied as part of the draft Code of Construction Practice (CoCP)⁹⁶ and as appropriate, site-specific remedial measures which flow from the draft CoCP.
- 10.5.2 Avoidance and mitigation measures to address local effects on landscapes within the Forest areas at the operational stage are set out in the Volume 2: Community area reports for the community areas listed in 10.4.
- 10.5.3 Based upon the findings of the assessment, it is considered that no further avoidance or mitigation measures are required in order to address route-wide effects.

10.6 Assessment of the effects of construction

- 10.6.1 Construction of the Proposed Scheme would result in significant adverse effects on landscape character and visual amenity in more than one community area within both the National Forest and the Northern Forest. These effects are assessed within the relevant Volume 2: Community area reports. The Proposed Scheme, including construction of viaducts, embankments and cuttings, removal of vegetation and changes to landform, would detract from scenic quality and adversely affect landscape character along an approximate 10km length of the National Forest and an approximate 140km length of the Northern Forest. However, the character and visual amenity of the National Forest as a whole and Northern Forest as a whole would be largely unaffected by the Proposed Scheme by virtue of the localised impacts in relation to the scale of the forests and the degree of visual containment afforded by vegetation and topography. It is not anticipated, on this basis, that there would be significant effects on a route-wide basis associated with construction of the Proposed Scheme.

10.7 Assessment of the effects of operation

- 10.7.1 The route-wide assessment for the loss of commercial woodlands will be reported in Section 2, Agriculture, forestry and soils, of the formal ES. The route-wide assessment for the loss of existing woodlands is reported in Section 6, Ecology and biodiversity, of this report.
- 10.7.2 A wide range of new woodland planting would be provided as part of the design of the Proposed Scheme, using species composition, planting types and planting density appropriate to specific areas. This new planting would mitigate the loss of woodland and would provide habitat connectivity, enhanced landscape/green infrastructure connectivity, and connectivity of historic landscape features, where reasonably

⁹⁶ Supporting documents: Draft Code of Construction Practice

practicable. Such planting would also provide visual screening and help integrate embankments and other structures into the local landscape. In some cases, this new planting would form part of new areas of publicly accessible informal semi-natural greenspace, thereby providing new recreational opportunities in the National Forest and Northern Forest.

- 10.7.3 The Proposed Scheme would result in a net gain of approximately 50ha⁹⁷ of mixed deciduous and semi-natural broadleaved woodland within the National Forest, and approximately 1,225ha⁹⁷ of mixed deciduous and semi-natural broadleaved woodland within the Northern Forest⁹⁸. This would accelerate the creation of new woodland in both forests and contribute to a reversal in the long-term decline in woodland cover in the UK. The government estimates that for every 250,000 new hectares of woodland planted, £500 million of social benefits are generated each and every year⁹⁹. The net gain of approximately 1,225ha of woodland within the Northern Forest would represent an important contribution to the target of establishing over 100,000 hectares of woodland in the next 25 years⁹⁵. It is anticipated, on the basis of the above, that the operation of the Proposed Scheme would result in a significant beneficial effect on woodland cover on a route-wide basis.

⁹⁷ A preliminary figure based on a minimum 0.5ha area of planting.

⁹⁸ The net gain in the area of woodland does not necessarily equate with a net gain in biodiversity.

⁹⁹ Natural Capital Committee (2015). The State of Natural Capital: Protecting and Improving Natural Capital for Prosperity and Wellbeing. Third report to the Economic Affairs Committee. Available online at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/516725/ncc-state-natural-capital-third-report.pdf

11 Major accidents and disasters

11.1 Introduction

- 11.1.1 This section of the report presents the route-wide assessment of the likely significant environmental effects identified to date arising directly from the Proposed Scheme if it were to be affected by a major accident and/or natural disaster.
- 11.1.2 The assessment of the vulnerability of the Proposed Scheme to major accidents and natural disasters is included in this working draft ES following changes to EU and UK legislation. The revised Environmental Impact Assessment (EIA) Directive 2014/52/EU (revised Directive) requires the assessment of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters. The Town and Country Planning (EIA) Regulations 2017¹⁰⁰ have transposed the revised Directive into UK law. In the transposition between the revised Directive and EIA Regulations the word 'natural' has been omitted to ensure that both manmade and natural disasters are considered.
- 11.1.3 The underlying objective of the assessment is to ensure that appropriate precautionary actions are taken for those projects, which *'because of their vulnerability to major accidents and/or natural disasters (such as flooding, sea level rise, or earthquakes), are likely to have significant adverse effects on the environment'* (revised EIA Directive 2014/52/EU)¹⁰¹.
- 11.1.4 Based on the requirements of the revised Directive, this section of the report deals with the following issues:
- the legal, contractual and management frameworks that are in place to ensure safety of the Proposed Scheme (as described in Sections 11.2 and 11.3);
 - the vulnerability of the Proposed Scheme to major accidents and disasters;
 - the likelihood of significant adverse environmental effect(s) arising from these major accidents and natural disasters; and
 - the measures required to prevent or mitigate the likely significant adverse effects of such events on the environment.

11.2 Legal and regulatory framework

EIA requirement

- 11.2.1 The revised Directive states that in order to ensure a higher level of protection of the environment, precautionary actions need to be taken for certain projects that have a high vulnerability to major accidents and/or natural disasters. Due to the scale of the Proposed Scheme it has been considered appropriate to undertake an assessment. The assessment will be used to confirm the Proposed Scheme has managed its

¹⁰⁰ Town and Country Planning (Environmental Impact Assessment) Regulations 2017. SI 2017 No. 571. Her Majesty's Stationery Office, London. Available online at: http://www.legislation.gov.uk/ukxi/2017/571/pdfs/ukxi_20170571_en.pdf

¹⁰¹ Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052>

vulnerability to potential major accidents and disasters during construction and operation to be as low as reasonably practicable (ALARP).

- 11.2.2 Part 1 of the Town and Country Planning (EIA) Regulations 2017 requires that the EIA shall identify, describe and assess in the appropriate manner, the direct and indirect significant effects of the Proposed Scheme on population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape and the interaction between these factors, arising from the vulnerability of the Proposed Scheme to major accidents or disasters that are relevant to the Proposed Scheme.

Other relevant legislation

- 11.2.3 The design, management, operation and maintenance of the Proposed Scheme must comply with the following UK legislation and EU regulations:
- EU Regulation 402/2013 on the Common Safety Method on Risk Evaluation and Assessment¹⁰² (CSM-RA) (as amended by EU Regulation 2015/1136). An EU Regulation that describes the methods required to be used to assess compliance with safety levels and safety requirements;
 - Health and Safety at Work etc. Act 1974¹⁰³ (HSWA). This legislation places general duties on employers, people in control of premises, manufacturers and employees. Health and safety regulations made under this Act contain more detailed provisions. The Act provides the framework for the regulation of industrial health and safety in the UK. The overriding principle is that foreseeable risks to persons shall be reduced so far as is reasonably practicable and that adequate evidence shall be produced to demonstrate that this has been done;
 - Construction (Design and Management) (CDM) 2015 Regulations¹⁰⁴. These regulations place specific duties on clients, designers and contractors, so that health and safety is taken into account throughout the life of a construction project from its inception to its subsequent final demolition and removal. Under CDM regulations, designers have to avoid foreseeable risks so far as reasonably practicable by: eliminating hazards from the construction, cleaning, maintenance, and proposed use and demolition of a structure; reducing risks from any remaining hazard; and giving collective safety measures priority over individual measures;
 - The Railways and Other Guided Transport Systems (Safety) Regulations 2006¹⁰⁵ (as amended) (ROGS). ROGS place a duty on Railway Undertakings

¹⁰² Official Journal of the European Union (2013), Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R0402>

¹⁰³ *Health and Safety at Work etc. Act 1974*. SI 1974 c.37. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/ukpga/1974/37/pdfs/ukpga_19740037_en.pdf

¹⁰⁴ *The Construction (Design and Management) Regulations 2015*. SI 2015 No. 51. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf

¹⁰⁵ *The Railways and Other Guided Transport Systems (Safety) Regulations 2006*. SI 2006 No. 599. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/uksi/2006/599/pdfs/uksi_20060599_en.pdf

(RUs) and Infrastructure Managers (IMs) to:

- develop safety management systems (SMS) that must meet certain requirements;
 - have a safety certificate (for RUs) or a safety authorisation (for IMs);
 - show that they have procedures in place to introduce new or altered vehicles or infrastructure safely;
 - carry out risk assessments and put in place the safety measures they have identified as necessary to make sure that the transport system is run safely; and
 - work together to make sure the transport system is run safely (ROGS regulation 22).
- The Railways (Interoperability) Regulations 2011¹⁰⁶ (as amended) (RIR). These regulations implement the EU Railway Interoperability Directive 2008/57/EC¹⁰⁷, which had the purpose of establishing common operational standards and practices across European railways, including adoption of the CSM-RA;
 - all activities relating to the main line network must comply with Railway Group Standards¹⁰⁸. The Railway Group Standards set out National Technical Rules and National Safety Rules for the Great Britain main line railway. Compliance with the National Technical Rules and National Safety Rules is required under the Railways (Interoperability) Regulations 2011;
 - The Management of Health and Safety at Work Regulations 1999¹⁰⁹. These regulations generally make more explicit what employers are required to do to manage health and safety under the HSWA;
 - Civil Contingencies Act 2004¹¹⁰ provides a framework for emergency preparedness and response procedures throughout the UK. Roles and responsibilities are set out for those involved in emergency preparation and response to events that threaten serious damage to human welfare or to the environment. Network Rail, and its operating companies, sit as Category 2 responders. The Act requires Category 2 responders to co-operate and share information with Category 1 responders (e.g. emergency services and local authorities) to inform multi-agency planning frameworks; and

¹⁰⁶ *The Railways (Interoperability) Regulations 2011*. SI 2011 No. 3066. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/ukksi/2011/3066/pdfs/ukxi_20113066_en.pdf

¹⁰⁷ *Directive of the European Parliament and of the Council on the Interoperability of the Rail System in the Community*, 17 June 2008, 2008/57/EC.

¹⁰⁸ Rail Safety and Standards Board (undated), Standards and the rail industry. Available online at: <https://www.rssb.co.uk/standards-and-the-rail-industry>

¹⁰⁹ *The Management of Health and Safety at Work Regulations 1999*. SI 1999 No. 3242. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/ukksi/1999/3242/pdfs/ukxi_19993242_en.pdf

¹¹⁰ Civil Contingencies Act 2004. C.36. Available online at: <https://www.legislation.gov.uk/ukpga/2004/36/contents>

- Other UK safety related regulations. A number of other safety related regulations within UK law, including for example the Electricity at Work Regulations 1989¹¹¹, which also apply to the Proposed Scheme.

- 11.2.4 In broad terms, risks associated with major accidents and disasters will be identified, assessed and mitigated during the design, construction, operation and maintenance of the Proposed Scheme. The legislation described above sets out the requirement, duties, and in some cases establishes the mechanisms for doing this.
- 11.2.5 In accordance with Paragraph 15 of the revised EIA Directive (2014/52/EU)¹¹², safety assessments undertaken for the Proposed Scheme have been used to inform the identification and assessment of major accidents and natural disasters to which the Proposed Scheme may be vulnerable.
- 11.2.6 In addition to the other regulations described in 11.2.3, the Proposed Scheme is being designed and its implementation will be guided by other industry standards and codes, many of which are mandatory. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are considered acceptable.

HS2 Ltd safety and risk management strategy

- 11.2.7 The Proposed Scheme will be designed, constructed, operated and maintained to reduce as low as is reasonably practicable, the risk of harm (including major accidents) occurring. This section briefly describes how HS2 Ltd will meet its legal and contractual obligations and deliver an exemplary project in terms of health, safety and the environment, since this provides the framework within which the risk of major accidents and/or natural disasters impacting the environment will be managed. All measures to manage and reduce risk described in this section are defined as 'embedded' measures for the purposes of this assessment.

Development agreement

- 11.2.8 The HS2 development agreement between the Government and HS2 Ltd¹¹³ sets out HS2 Ltd's role in developing, building and operating the new railway. This includes HS2 Ltd's legal obligations with respect to health and safety, risk and liability. The railway shall be designed, constructed and operated so that safety risks are ALARP. Furthermore the railway shall be designed and delivered to avoid, reduce and if possible, remedy adverse impacts on the environment, insofar as reasonably practicable.

¹¹¹ *The Electricity at Work Regulations 1989*. SI 1989 No. 635. Her Majesty's Stationary Office, London. Available online at: <http://www.legislation.gov.uk/ukxi/1989/635/contents/made>

¹¹² Recital 15 of the Directive states in its second part: 'In order to avoid duplications, it should be possible to use any relevant information available and obtained through risk assessments carried out pursuant to Union legislation, such as Directive 2012/18/EU of the European Parliament and the Council (4) and Council Directive 2009/71/Euratom (5), or through relevant assessments carried out pursuant to national legislation provided that the requirements of this Directive are met.' The specific Directives referred to in recital 15 are not applicable to the Proposed Scheme as they relate to operating sites containing large quantities of hazardous substances (for example oil refineries, oil storage depots and nuclear facilities). However, the principle of using relevant information obtained through risk assessments undertaken as part of the Proposed Scheme development is adopted here.

¹¹³ A copy of the development agreement is available on the Department for Transport's website. Available online at: <https://www.gov.uk/government/publications/hs2-development-agreement-july-2017>

- 11.2.9 Annex 4 of the development agreement identifies the key project objectives and strategies to deliver HS2 Ltd's commitments, including those in 11.2.8. This includes a commitment that: *'HS2 Ltd will design, build and operate the Railway to meet or better the performance standard of HS1, to reduce safety risks as low as reasonably practicable and in line with best current international practice.'*
- 11.2.10 HS2 Ltd's commitments in terms of both physical and cyber-security, are set out in Annex 4 of the development agreement. Key to the assessment presented in this report is that: *'...measures to prevent unauthorised access to the Railway (primarily consisting of the physical separation of the Railway from the external environment) will be developed.'*

System safety strategy

- 11.2.11 HS2 Ltd's System Safety Strategy explains HS2 Ltd's approach to demonstrating, through the whole lifecycle of the railway system, that the new HS2 High Speed Railway (HSR) system will be safe to operate and maintain through:
- compliance with the CSM-RA to support the application for HS2 Ltd to achieve authority from the rail regulator to place HS2 into service; and
 - the provision of suitable and sufficient information that allows future infrastructure managers and transport undertakings to meet the requirements of their safety management systems in respect of the Railways and Other Guided Transport System (Safety) Regulations 2006 (as amended) (ROGS)¹¹⁴ including the assessments of the operational procedures through the application of CSM-RA.
- 11.2.12 Ultimately, the HS2 Ltd System Safety Strategy and the activities it defines are required to achieve the authority to place HS2 into service. Failure to achieve this approval would mean that the Proposed Scheme could not be put into operation.
- 11.2.13 The HS2 Ltd System Safety Strategy sets out the hierarchy of documentation, governance, accountability and scope of the system safety, specifically how HS2 Ltd will apply CSM-RA.
- 11.2.14 Sections of the System Safety Strategy of particular relevance to this section include:
- safety principles;
 - legislation, standards and guidance;
 - definitions and abbreviations;
 - responsibilities (including roles and responsibilities, process and organisation for acceptance, safety aspects of organisation and contractual strategy, competency);
 - approach (including system definition, hazard identification, risk analyses and

¹¹⁴ The Railways and Other Guided Transport Systems (Safety) Regulations 2006, SI 2006 No. 599 (as amended by Regulations 2011 No. 1860, 2013 No. 950 and 2015 No. 1917). Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/uksi/2006/599/pdfs/ukxi_20060599_en.pdf

evaluation, safety requirements and demonstration of compliance); and

- the CSM-RA compliance matrix presented in Annex B of the strategy.

Health and safety management system

- 11.2.15 The HS2 Ltd Health and Safety Policy¹¹⁵ presents HS2 Ltd's high-level health and safety commitments, which will be delivered by HS2 Ltd's health and safety management system. It underlines HS2 Ltd's principles of health and safety, and sets out its areas of focus for eliminating, reducing and controlling risk.
- 11.2.16 HS2 Ltd's health and safety management system is founded on the principles of the Health and Safety Executive's guidance HSG65¹¹⁶ and is certified to Occupational Health and Safety Assessment BS 18001:2007¹¹⁷. It defines the responsibilities at each level in the business, and establishes the organisational framework, the processes and tools to continually identify, prevent and manage health and safety risks, to comply with, or exceed legislative requirements and to monitor and review health and safety performance.

HS2 Ltd approach to risk management

- 11.2.17 Risk management is embedded as a fundamental tenet for the management of all aspects of HS2 and is undertaken in order to constrain threats within acceptable limits. HS2 Ltd's approach to risk management is based on a number of guiding principles, including that:
- risk management applies to all aspects of HS2;
 - clear accountability for risk will be ensured; and
 - risk management will be based on continuous improvement.

HS2 Ltd supply chain health and safety standards

- 11.2.18 Contractors and suppliers working on behalf of HS2 Ltd are expected to comply with HS2 Ltd's supply chain health and safety standards¹¹⁸. These set out HS2 Ltd's expectations in terms of the health and safety commitments of its suppliers, HS2 Ltd's health and safety principles, and its strategic commitments. Contractors appointed by HS2 Ltd to design, assess and construct the railway (and undertake the enabling works) are required to further identify and mitigate risk during the detailed design stage and identify and mitigate construction risks. HS2 Ltd evaluates the competence of contractors to be able to do this as part of the procurement process. These strategic commitments cover:
- workforce safety;
 - public and neighbour health and safety;

¹¹⁵ High Speed Two (HS2) Limited (2016), *Health and Safety Policy*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537382/CS449_H_S_Policy_Final.pdf

¹¹⁶ Health and Safety Executive (2013), *Managing for Health and Safety (HSG65)*.

¹¹⁷ British Standards Institution (2016), *BS OHSAS 18001 Occupational Health and Safety Management*.

¹¹⁸ High Speed Two (HS2) Limited (2015), *Supply chain health and safety standard*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510415/Supply_Chain_Health_and_Safety_Standard.pdf

- occupational health and wellbeing;
- safe design;
- safe supply chain selection and management;
- safe operations; and
- assurance.

- 11.2.19 The draft Code of Construction Practice (CoCP)¹¹⁹ describes the control measures and standards to be implemented in order to protect communities and the environment during construction works. It sets out the principles that form the basis of the environmental management system (EMS), and measures to be defined within the Local Environmental Management Plans (LEMPs)¹²⁰.
- 11.2.20 Particularly relevant to this topic assessment, the draft CoCP includes the requirement for construction contractors and suppliers to have:
- a comprehensive community emergency plan, where relevant. This will ensure that in the case of a major emergency, when working in partnership with the relevant emergency service, the community can be kept fully informed and that adequate arrangements are in place for the evacuation of an affected area if necessary;
 - site specific assessments of security and trespass risk, and appropriate control measures;
 - a procedure for assessing risks and putting response measures in place related to unexploded ordnance;
 - pollution incident control, including pollution response plans and arrangements with spill response companies;
 - emergency planning and emergency response procedures;
 - appropriate plans and management controls to prevent fires; and
 - due consideration to the impacts of extreme weather events and related conditions during construction.
- 11.2.21 The draft CoCP also presents requirements for measures to reduce the impacts of construction activities on specific categories of environmental receptors along the route, including: agriculture, forestry and soils; air quality; cultural heritage; ecology and biodiversity; ground settlement; land quality; landscape and visual; sound, noise and vibration; traffic and transport; waste and materials; and water resources and flood risk.

¹¹⁹ Supporting documents: Draft Code of Construction Practice

¹²⁰ The LEMPs will set out how the Proposed Scheme will adapt and deliver the required environmental and community protection measures within each local authority area, through a series of topic-specific measures that reflect the general requirements of the CoCP.

11.3 Scope, assumptions and limitations

11.3.1 The scope of this assessment topic follows that set out in Volume 1: Introduction and methodology, Section 8, and the EIA Scope and Methodology Report (SMR)¹²¹. It addresses those unplanned events or situations, that have been determined as being relevant to the Proposed Scheme, are considered to be major in scale and have been identified as having the potential to result in a significant adverse environmental effect. Key terms used in this assessment topic are defined in Table 1. A full review of terminology and selected definitions is presented in the EIA SMR.

Table 1: Key definitions relevant to this assessment topic

Term	Definition
ALARP	As low as reasonably practicable
CSM-RA	Common Safety Method (Risk Assessment)
Environmental receptor	Features of the environment that are subject to assessment under Article 3 of the revised EIA Directive 2014/52/EU, namely population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape. These are categorised consistently with the EIA structure.
Major accident	A major accident, in the context of the Proposed Scheme, is an event or situation that threatens immediate or delayed serious damage to human health, welfare and/or the environment and requires the use of resources beyond those of HS2 Ltd or its contractors. Serious damage includes the loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor that cannot be restored through minor clean-up and restoration efforts.
Disaster	An external occurrence leading to an event or situation that meets the definition of a major accident. It may result from natural sources, such as extreme weather (storm, flood, temperature) and ground-related hazard events (subsidence, landslide, earthquake), or from man-made sources such as large scale fire, structural collapse, explosion, or transport accident.
Reasonable worst case environmental effect	A challenging manifestation of the consequence(s) of a risk event occurring, after highly implausible or less significant consequences are excluded.
Risk	The likelihood of an impact occurring, combined with effect or consequence(s) of the impact on a receptor if it does occur.
Risk event	An identified, unplanned event, which is considered relevant to the Proposed Scheme and has the potential to be a major accident or natural disaster subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
Serious damage	Serious damage includes the loss of life, permanent injury and temporary or permanent destruction of an <i>environmental receptor</i> .
Vulnerability	In the context of the revised EIA Directive 2014/52/EU, the term refers to the ' <i>exposure and resilience</i> ' of the Proposed Scheme to the risk of a major accident and/or natural disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

11.3.2 Environmental effects associated with unplanned events that do not meet the definition of major accidents and/or disaster (e.g. leaks and spills that may be contained within construction sites and the operational railway infrastructure) are

¹²¹ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

addressed in the draft CoCP and Section 15, Water resources and flood risk, of this report.

11.3.3 Receptors addressed in the assessment are those relevant to the scope of the working draft ES and include:

- members of the public and local communities;
- infrastructure and the built environment;
- the natural environment, including ecosystems, land and soil quality, air quality, surface and groundwater resources and landscape; and
- the historic environment, including archaeology and built heritage.

Exclusions

11.3.4 Effects of the Proposed Scheme on employees of HS2 Ltd and/or its contractors and suppliers (e.g. construction and maintenance staff) and HS2 passengers are managed via other health and safety legislation, as described in Section 11.2, and are not addressed in the scope of this assessment. Effects on members of the public who wilfully trespass are also considered to be outside the scope of this assessment, recognising that HS2 Ltd would take appropriate measures to provide a secure boundary to reduce the likelihood of trespass. Finally, risk events that only present risks to HS2 Ltd as an organisation (e.g. cost and programme) are outside the scope of this assessment.

11.3.5 Further details on the exclusions and the scope of this assessment are set out in the EIA SMR.

Risk event identification

11.3.6 Major accident and natural disaster 'risk events', to which the Proposed Scheme is considered vulnerable, have been identified by referring to risk assessments undertaken for the Proposed Scheme and determining whether there is potential for impact to an in-scope receptor. These risk assessments are part of other processes, many of which are required by law.

11.3.7 The identification of relevant risk events focuses on high-level major accident and/or natural disaster events that have the potential to cause significant harm. Many of the risk events to which the Proposed Scheme may be vulnerable have multiple causes; for example, a train derailment may be caused by infrastructure condition, a natural disaster event, malicious intent or human error, amongst others. Unless the risk event is identified as having the potential to result in a likely significant effect, the underlying causes of the risk event are not the subject of assessment.

11.3.8 It is important to state that no additional risk assessments have been undertaken specifically for this section of Volume 3: Route-wide effects. Accidents on the railway, including those initiated by natural events, are controlled through the rail regulatory framework summarised in Section 11.2. The requirement to satisfy that framework has led to the identification of many safety-relevant hazards, which include those that might have an environmental effect. This section presents a review of risk assessments carried out for the Proposed Scheme to determine whether significant

effects on the environment could occur, and whether such risks have been managed and mitigated to be as low as reasonably practicable.

- 11.3.9 System safety activities are required to be assessed by an independent body before being approved by HS2 Ltd's Safety Review Panel and then the Health and Safety Executive. Authorisation to place the Proposed Scheme into service must then be given by the Office of Road and Rail (the Regulator). This section does not seek to reproduce this extensive process, rather to summarise the current state of risk identification and assessment, in order to specifically assess whether any additional mitigation measures may be required to prevent any significant effects to the environment.
- 11.3.10 Safety risk assessments would remain live documents throughout the design, construction and operation of the Proposed Scheme.
- 11.3.11 The guiding principle of both the CSM-RA and the CDM risk assessment is that all foreseeable risks should be controlled to an acceptable level, which is defined as 'as low as reasonably practicable'.

Assessment methodology

- 11.3.12 The major accidents and natural disasters assessment has been undertaken in accordance with the methodology described in the EIA SMR.
- 11.3.13 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis, and in the absence of some baseline information. Likely significant effects will be assessed and reported in full in the formal ES.

11.4 Environmental baseline

11.4.1 The baseline relevant to this topic comprises:

- features external to the Proposed Scheme that contribute a potential source of hazard to the Proposed Scheme;
- sensitive environmental receptors at risk of significant effect; and
- current (without the Proposed Scheme) major accident and disaster risks.

Baseline features that contribute a potential source of hazard

- 11.4.2 As far as is reasonably practicable, the route of the Proposed Scheme avoids existing features that have the potential to present a hazard to the construction or operation of the Proposed Scheme.
- 11.4.3 Features external to the Proposed Scheme that lie within the land required to construct the Proposed Scheme and/or cross the route of the Proposed Scheme, and which present a potential source of hazard, either during construction or operation include, but are not limited to:
- oil, gas and electricity transmission;
 - potential presence of unexploded ordnance;

- former landfill sites and the potential presence of landfill gas;
- potential presence of coal-bed methane and shale gas;
- below ground hazards such as salt and coal mining;
- existing operational railway lines;
- existing operational airports;
- proximity of hazardous facilities sites; and
- adjacent highways, both local roads and motorways.

11.4.4 These features, where present, have been considered and addressed as appropriate throughout the design development.

Proximity to hazardous facilities

11.4.5 As noted above, the presence of hazardous facilities, classified as either sites registered under the Control of Major Accident Hazards (COMAH) Regulations¹²², and hazardous substance consent sites¹²³ present a potential source of hazard to the Proposed Scheme and vice versa.

11.4.6 'Consultation zones' are set by the Health and Safety Executive (HSE) around hazardous sites, determined by a detailed assessment of the risks created by the hazardous site. The zones take into account the volume of hazardous substances consented, and the hazard ranges and consequences of the hazardous substances that are present, and the type of storage. The consultation zones act as a trigger for the HSE as a statutory consultee to be consulted where any encroachment upon these may be caused by a project. They form an important part of the environmental baseline for the Proposed Scheme.

11.4.7 At the working draft ES stage, the spatial dataset that will allow any intersection of the Proposed Scheme with any existing Consultation Zones is not available. As part of the formal ES, any interactions between the Proposed Scheme and existing Consultation Zones will be identified, and the HSE and site owners will be consulted where necessary.

11.4.8 For hazardous sites (as defined in 11.4.5) that are in the vicinity of the Proposed Scheme, but whose Consultation Zones are not encroached on, a secondary assessment of the potential for any indirect impact, through for example congestion hot spots or significant changes to the road layout will be undertaken. This will be based on the traffic and transportation assessment.

Environmental receptors

11.4.9 Environmental receptors that may be at risk in the event of a major accident and/or disaster include those close enough to be impacted by a major accident in the

¹²² The Control of Major Accident Hazards Regulations 2015. SI 2015 No. 483. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/uksi/2015/483/pdfs/ukxi_20150483_en.pdf

¹²³ Sites which hold certain quantities of hazardous substances at or above defined limits must obtain hazardous substance consent, in accordance with the Planning (Hazardous Substances) Regulations 2015.

Proposed Scheme construction and operational areas. The receptors included and excluded under this definition are detailed within the EIA SMR.

Baseline accidents and disaster risks

- 11.4.10 Major accident and disaster risks relevant to the baseline in the absence of the Proposed Scheme include extreme weather events, associated flooding and road traffic collisions. Baseline 'without project' conditions are described in Volume 2: Community area reports for traffic and transport, Section 14 and water resources and flood risk, Section 15, and Section 4 of this report on climate change.

11.5 Assessment of the effects of construction

- 11.5.1 Major accidents and disasters to which the Proposed Scheme may be vulnerable during the construction phase and the outcomes of the assessment are summarised in Table 2.
- 11.5.2 Table 2 describes those risk events whose impact on an environmental receptor (including members of the public who are not employees or passengers) has the potential to be a major accident as defined in Table 1. Key management and mitigation measures will be detailed at the formal ES stage once a complete assessment has been undertaken. In all cases, compliance with the legal and regulatory requirements described in this section to manage risks to be as low as reasonably practicable ALARP must be demonstrated.
- 11.5.3 For the purposes of the working draft ES, an assessment of impacts upon emergency response plans for hazardous facilities during construction has not been able to be undertaken due to the absence of consultation zone data. For the formal ES, an assessment will be made upon this where interaction with a consultation zone is present.

Table 2: Identification of potential major accident and/or disaster events during construction

Risk event	High level reasonable worst case consequence if the event occurred
Tunnel collapse	Ground settlement reaches surface resulting in subsidence and structural damage to buildings immediately above.
Ground collapse (including ground instability/slope failure)	Construction activity causes localised collapse and subsidence of ground at surface.
Offline train derailment/collision on Network Rail line	Network Rail train derails off-track and outside the boundary with potential to cause harm to member of public, property or adjacent land/water course.
Major road traffic accident	Death and/or injury to motorists.
Physical damage or contamination of an aquifer or borehole	Release of contaminants into water supply.
Spillage or longer term seepage of pollutants into watercourse	Damage to natural habitat or sensitive water course. Contamination of water supply.

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Risk event	High level reasonable worst case consequence if the event occurred
Fire and/or explosion or release of harmful gas	Fire and/or explosion affects neighbouring property and/or members of the public.
Release of asbestos during demolition of buildings and structures	Accident during demolition results in uncontrolled release of asbestos containing material and exposure of public to asbestos containing material.
Extreme weather (flood)	Release of contaminants onto land outside construction site.
Collapse/damage to structures	Falling debris or collapse of infrastructure affecting a public right of way/public area or leads to injury or fatality of members of public. Collapsed culvert leads to flood impact.
Injury to member of public; pedestrians, equestrians	Construction related activity causes injury or fatality to members of public.
Impact upon emergency response/evacuation (including for hazardous facilities)	Dedicated emergency response routes and evacuation procedures are unusable, leading to injury or fatality to members of public and damage to sensitive environmental receptors.
Damage to environmental receptor	Construction related activity causes irreversible damage to environmental receptor (listed building, ecological site, watercourse etc.).
Airport related incident	Construction incident affecting vital airport infrastructure, or approaching flights, leading to injury or fatality to members of public.

11.6 Assessment of the effects of operation

11.6.1 Risk events to which the Proposed Scheme may be vulnerable during the operational phase and the results of the assessment are summarised in Table 3. The table describes those risk events whose impact on an environmental receptor (including members of the public who are not employees or passengers) has the potential to be a major accident as defined in Table 1. Key management and mitigation measures will be detailed at the formal ES stage once a complete assessment has been undertaken. In all cases, compliance with the legal and regulatory requirements described in this section to manage risks to be ALARP must be demonstrated, including requirement to:

- manage all train accident risks in accordance with the CSM-RA. Measures have to be accepted by the regulator as being adequate to manage risks to be ALARP in order for a licence to be granted;
- comply with design standards (including HS2 Ltd Technical Standards). This would include designing to appropriate environmental parameters (flood, wind, lightning) including climate change. Design standards apply to rolling stock, controls and systems, civil infrastructure, and electrical infrastructure;
- comply with the Technical Specifications for Interoperability and the Railway

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Group Standards; and

- co-ordinate between HS2 and the conventional rail network.

11.6.2 For the purpose of the working draft ES, an assessment of impacts upon emergency response plan for hazardous facilities during operation has not been able to be undertaken due to the absence of consultation zone data. For the formal ES, an assessment will be made upon this where interaction with a consultation zone is present.

Table 3: Identification of potential major accident and/or disaster events during operation

Risk event	High level reasonable worst case consequence if the event occurred
Train derailment or collision (HS2)	Off-track and outside boundary derailment causing severe disruption to rail transportation, major accident causing harm to staff, passengers and adjacent receptors.
Train derailment or collision (maintenance trains)	Off-track and outside boundary derailment involving maintenance train travelling at low speed, but potentially carrying flammable fuel. No passengers. Diesel spillage contamination.
Train derailment or collision (Network Rail)	Off-track and outside boundary derailment of a non-HS2 train (including freight), or a HS2 train using the conventional rail network. Severe disruption to rail transportation, major accident causing harm to staff, passengers and adjacent receptors, spillage of pollutants.
Major road traffic accident	Major road traffic accident resulting in death or permanent injury to members of public. Spillage of pollutants.
Collapse of structures leading to non-train incident	Death or injury to members of public (pedestrians, cyclists or road users etc.). Road traffic accident.
Ground instability (including collapse of embankments and slope failure)	Breach of embankment and rapid inundation of land on other side of railway.
Fire and/or explosion, either direct or indirect harm	Contamination of aquifer/drinking water supply resulting from run-off of fire water. Drift of fire from HS2 facility (e.g. depot) into public property (e.g. properties or arable land) with resulting damage to property.
Extreme weather (e.g. flood, high winds)	Impact on member of public, property or land, which adversely differs to extreme weather impact without the presence of the Proposed Scheme. Flooding of underpasses or subways with potential harm to a member of public.

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Risk event	High level reasonable worst case consequence if the event occurred
Accidental drowning	Member of public accidentally falls into attenuation pond and drowns.
Pedestrians/equestrians falling/jumping from overbridges	Injury or fatality of member of public.
Vehicle falling from overbridge or adjacent road	Injury or fatality to pedestrians/cyclists or motorists.
Traffic incident involving pedestrians/cyclists/equestrian	Injury or fatality to pedestrians/cyclists/horse riders and motorists.
Crime/risk to personal safety of member of public	Injury to member of public.
Injury to member of public; pedestrians, equestrians	Injury to pedestrians/cyclists/horse riders.
Injury to member of public using level crossing on Network Rail	Injury or fatality to member of public.
Emergency response impacts on environmental receptors	Harm to environmental receptor in the vicinity of an incident.
Exposure to live conductor/arcing etc.	Injury or fatality to member of public.
Impact upon emergency response/evacuation (including for hazardous facilities)	Dedicated emergency response routes and evacuation procedures are permanently removed, leading to injury or fatality to members of public and damage to sensitive environmental receptors.
Airport related incident	<p>Presence of HS2 reduces aircraft visibility/aircraft falls short of runway onto the Proposed Scheme causing major incidents resulting in derailment and/or injury or fatality to members of public.</p> <p>Attenuation ponds create new habitat, causing additional bird strikes to aircraft and subsequent injury or fatality to members of public.</p>

12 Socio-economics

12.1 Introduction

12.1.1 This section of the report provides an assessment of the route-wide socio-economic impacts and likely socio-economic significant effects identified to date arising from the construction and operation of the Proposed Scheme. Direct socio-economic effects of the Proposed Scheme are reported at both route-wide and community area levels. The potential overall changes to employment levels (i.e. both the wider socio-economic benefits and those that would arise from the construction and operation of the Proposed Scheme) are reported in this section of the report at a route-wide level. Significant localised effects on employment are reported at a local level in Volume 2: Community area reports, Section 12.

12.2 Scope, assumptions and limitations

- 12.2.1 The scope, assumptions and limitations for the socio-economics assessment are set out in Volume 1: Introduction and methodology, Section 8, and in the EIA Scope and Methodology Report (SMR)¹²⁴.
- 12.2.2 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES.

12.3 National policy and guidance

- 12.3.1 The key points from national policy and guidance, which have informed the planning and development context for the socio-economic assessment, are as follows:
- the UK Government's commitment to sustainable development presented in the Defra publication 'Mainstreaming sustainable development'¹²⁵. The report sets out an approach based on providing ministerial leadership and oversight, leading by example, embedding sustainable development into policy, and providing transparent and independent scrutiny;
 - the National Planning Policy Framework (NPPF), which identifies the role of the planning system in promoting sustainable development and suggests that economic, social and environmental gains should be sought jointly and simultaneously. As well as the NPPF, local planning policy helps to define the significance of impacts. This is because it is planning policy that typically identifies areas and issues of environmental sensitivity and economic opportunity;
 - the January 2012 Command Paper – 'Investing in Britain's Future', which articulates a national strategy for high speed rail placing the Proposed Scheme as part of a wider network supporting the continuing growth of rail services in

¹²⁴ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

¹²⁵ Department for Environment, Food and Rural Affairs (2011), *Mainstreaming sustainable development – The Government's vision and what this means in practice*. Defra, London.

the UK to support ongoing economic growth;

- the National Infrastructure Plan, which provides a strategic framework for the identification and prioritisation of infrastructure development within the UK and establishes a series of objectives for infrastructure investment. The original 2011 plan¹²⁶ identified HS2 as a priority project with the potential to deliver the essential capacity and connectivity, attract investment and secure long-term economic prosperity, and therefore, generate employment. An update was undertaken in 2012 in which the Government announced its decision to proceed with HS2, and a further update published in 2016¹²⁷, which set out the progress made on priority infrastructure investments; and
- The Government published in July 2017¹²⁸ its preferred route for the full 'Y network' – the eastern leg to Leeds and the western leg to Manchester and set out its revised business case.

12.4 Key themes of the assessment

12.4.1 This section presents the three types of impacts considered in the route-wide socio-economic assessment, using the methodology described in the EIA SMR. It also describes how socio-economic effects are presented.

Impacts on employment associated with construction

12.4.2 Two types of impact are defined:

- direct employment opportunities: the number of jobs that the Proposed Scheme is expected to directly generate throughout the construction phase; and
- indirect employment opportunities: the number of jobs that the Proposed Scheme is expected to generate indirectly throughout the construction phase through multiplier effects¹²⁹.

Impacts on existing businesses and organisations

12.4.3 Three types of impact are defined:

- businesses and organisations (socio-economic resources) that would be displaced due to land being acquired for the construction of the Proposed Scheme. Socio-economic resources are defined as a property used by one business or organisation, or by a group of businesses and/or organisations;
- socio-economic resources affected by a change in key environmental conditions as a result of construction and operation of the Proposed Scheme. A combination of factors such as: sound, noise and vibration; air quality; heavy

¹²⁶ Infrastructure UK (2011), *National Infrastructure Plan 2011*. HM Treasury, London.

¹²⁷ Infrastructure and Projects Authority (2016), *National Infrastructure Delivery Plan 2016–2021*. HM Treasury and Cabinet Office, London.

¹²⁸ Department for Transport, (2017) High Speed Two From Concept to Reality Moving Britain Ahead. Available online at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/629380/high-speed-two-from-concept-to-reality.pdf

¹²⁹ The additional impacts of construction employment creation on the business supply chain and their expenditure effects can be calculated using four economic adjustment factors: leakage, displacement, substitution and multiplier effects. These factors and their rates are explained in Homes and Communities Agency (2014), *Additionality Guide: A standard approach to assessing the impact of interventions* (4th Edition). Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/378177/additionality_guide_2014_full.pdf

goods vehicle (HGV) traffic flows; and visual impacts could adversely affect the ability of a business unit to attract trade; and

- socio-economic resources affected by isolation¹³⁰ from customers/users as a result of the construction and operation of the Proposed Scheme. This analysis considered the consequence of these isolation effects on business operations.

Impacts on employment associated with operation

12.4.4 Two types of impact are defined:

- direct employment opportunities: the number of jobs that the Proposed Scheme is expected to directly generate throughout the operational phase; and
- indirect employment opportunities: the number of jobs that the Proposed Scheme is expected to generate indirectly throughout the operational phase through multiplier effects.

Socio-economic effects

12.4.5 Socio-economic effects are presented as either gross or net employment effects. Gross effects refer to the total effect of the Proposed Scheme. This includes:

- direct effects (such as jobs required to lay the track in the construction phase or operatives employed at the Infrastructure Maintenance Depot required in the operational phase); and
- indirect effects (or knock-on effects, such as supply chain and expenditure effects, which are collectively referred to as multiplier effects).

12.4.6 In calculating net effects, economic adjustments such as leakage, displacement and substitution¹³¹ are applied to reflect the interrelated nature of the economy. These effects can be beneficial or adverse.

12.5 Wider socio-economic benefits

12.5.1 The Proposed Scheme would enable the realisation of wider socio-economic benefits for businesses, communities and local authorities including:

- completing the full 'Y network' generates benefits of £39 billion (present value 2015 prices) with a benefit cost ratio of 2.1:1¹³²;
- a further £10 billion of wider economic benefits. Together these give a benefit cost ratio of 2.6:1; and

¹³⁰ The term isolation refers to the physical islanding or isolation of a resource which results in a change to businesses' and organisations' environments as defined in the EIA SMR.

¹³¹ Economic adjustments: Leakage – The proportion of outputs that benefit those outside of the intervention's target area or group; Displacement - The proportion of outputs/outcomes elsewhere in the target area; and Substitution - This effect arises where a firm substitutes one activity for a similar one (such as recruiting a jobless person while another loses a job) to take advantage of public sector assistance. It can be thought of as 'within firm' displacement.

¹³² Department for Transport (2017), High Speed Two Phase Two Economic Case Moving Britain Ahead. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/634196/high-speed-two-phase-two-economic-case.pdf

- freeing up capacity on the conventional rail network as a consequence of passengers transferring from the conventional rail network to long distance services provided by the Proposed Scheme.

12.6 Socio-economic baseline

- 12.6.1 This section summarises key economic indicators for England and the regional economies of the North West, Yorkshire and the Humber, the West Midlands and the East Midlands, on which the Proposed Scheme would impact.
- 12.6.2 Gross value added (GVA) measures the contribution to the economy of each individual producer, industry or sector. England generated a total GVA of £1,433,200 million in 2015, of which the North West contributed £156,900 million, Yorkshire and the Humber contributed £109,700 million, the West Midlands contributed 119,800 million and the East Midlands contributed £97,900 million¹³³. GVA per person per year was £26,200 in England, while it was £21,900 in the North West, £20,400 in Yorkshire and the Humber, £20,800 in the West Midlands and £20,900 in the East Midlands. The largest percentage increase from 2014 was in the North West at 3.0%, while the East Midlands had the smallest percentage increase at 1.0%. The long term trend has been for both total GVA and GVA per person per year to grow¹³⁴.
- 12.6.3 In the period January 2017 to December 2017, employment in England for those aged 16-64 stood at 26 million, of which the North West contributed 3.3 million, Yorkshire and the Humber contributed 2.5 million, the West Midlands contributed 2.6 million and the East Midlands contributed 2.2 million¹³⁵. The majority of employment in England is in the service sector (85%), which is marginally greater than the North West (84%), Yorkshire and the Humber (82%), the West Midlands (82%) and the East Midlands (79%). A sector breakdown by industry in the regional economies of the North West, Yorkshire and the Humber, the West Midlands and the East Midlands, benchmarked against England, is shown in Figure 5.

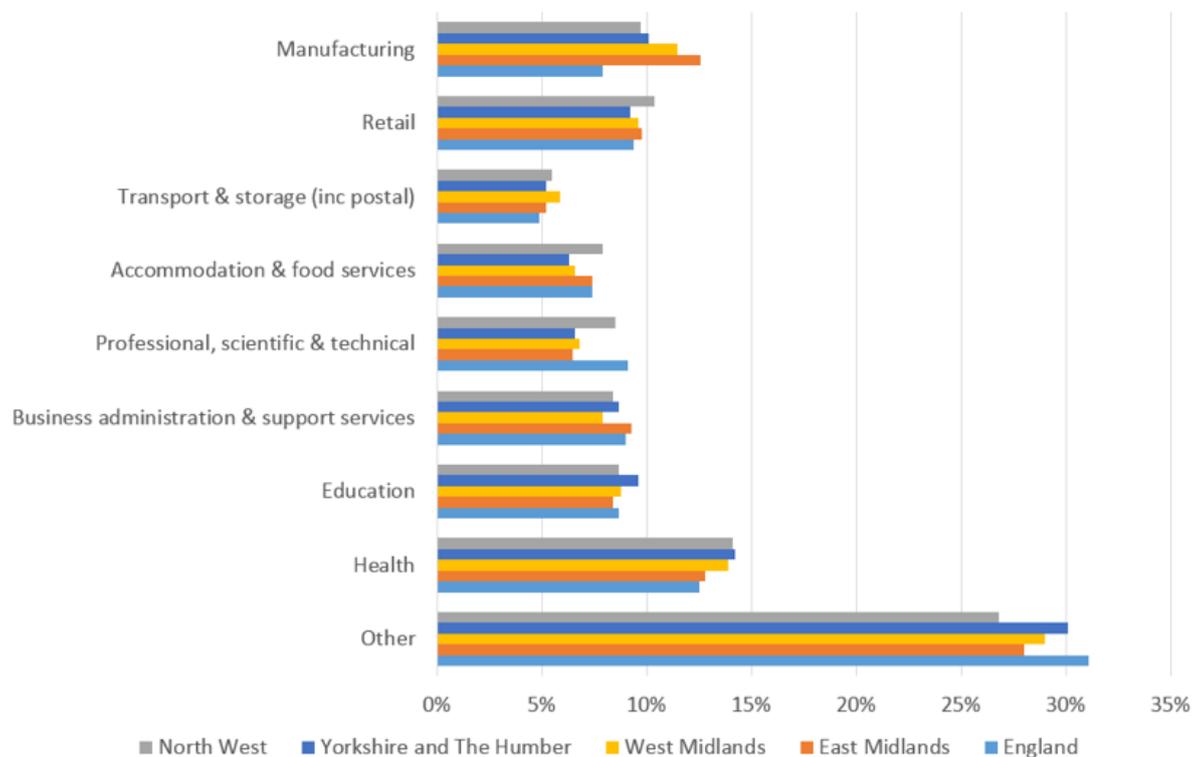
¹³³ ONS (2017) 'Regional gross value added (income approach), UK: 1997 to 2015'.

¹³⁴ Between 1997 and 2015 England's average annual rate of change in GVA per person is 3.5% in nominal terms (unadjusted for inflation)

¹³⁵ NOMIS, Office for National Statistics (2018), Annual Population Survey. Available online at: <https://www.nomisweb.co.uk>

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Figure 5: Proportion of employment by industry in the regional economies of North West, Yorkshire and the Humber, West Midlands and East Midlands and England^{136, 137}



12.6.4 Figure 5 shows some clear differences between the employment profile of the North West, Yorkshire and the Humber, the West Midlands and the East Midlands compared to the England average. All of the regions had a higher proportion of employment in manufacturing and health. However, all of the regions have a lower proportion of employment in the professional, scientific and technical sector, although the North West is closer to the England average than the other regions. All of the regions have similar proportions of employment to the England average in education, business administration and support services and transport and storage (including postal).

12.6.5 In the period January 2017 to December 2017 the average employment rate¹³⁵ for those aged 16–64 was 73% in the North West, 73% in Yorkshire and the Humber, 72% in the West Midlands and 74% in the East Midlands, compared with 75% for England as a whole. The average unemployment rate¹³⁵ in the same period for those aged 16–64 was 4.5% in the North West, 5.1% in Yorkshire and the Humber, 5.4% in the West Midlands and 4.5% in the East Midlands, compared with 4.3% for England as a whole.

12.7 Assessment of the effects of construction

12.7.1 There are broadly two types of impacts considered for the construction phase of the Proposed Scheme on a route-wide basis: employment associated with construction of the Proposed Scheme; and employment associated with businesses affected by construction of the Proposed Scheme.

¹³⁶ 'Other' includes Construction; arts, entertainment, recreation & other services; information & communication; wholesale; public administration & defence; financial & insurance; property; motor trades; agriculture, forestry & fishing; and mining, quarrying & utilities.

¹³⁷ Office for National Statistics (2016), *Business Register and Employment Survey 2015*.

Construction employment

- 12.7.2 The Proposed Scheme would support employment in the construction industry over the construction period. Overall, it is estimated that the construction phase would generate 88,700 person years of construction employment opportunities¹³⁸ (equivalent to 8,870 full time construction jobs¹³⁹), which would be a major beneficial effect and is, therefore, considered to be significant.
- 12.7.3 The number of these jobs that would likely be based at worksites along the Proposed Scheme will be assessed and reported in the formal ES. Depending on skill levels required, and the skills of local people, these jobs would be accessible to local residents and to others living within the travel to work area¹⁴⁰.
- 12.7.4 It is anticipated that direct construction jobs would potentially offer a range of occupations and skillsets, such as: skilled construction workers, labourers, tunnelling specialists, mechanical fitters, steel fixers, electricians, engineering professionals, and management and planning professionals.
- 12.7.5 HS2 Ltd has committed to providing a minimum of 2,000 apprenticeships over the lifetime of the entire project (which includes Phase One and Phase Two¹⁴¹). HS2 Ltd is committed to using the Proposed Scheme to maximise the creation of new apprenticeships, as well as affording existing apprentices employed in the supply chain the unique opportunity to experience working on the Proposed Scheme. Across the supply chain, apprentices would be employed in a wide range of trades and professions from construction to accountancy, quantity surveying to business administration.
- 12.7.6 The construction works would generate additional indirect demand for goods and services through the business supply chain and expenditure effects of workers, which could stimulate business growth and opportunities to generate further employment¹⁴². As a consequence, a further 44,400 person years of employment could be created (equivalent to 4,400 full-time jobs), which is a major beneficial significant effect.

Businesses affected

- 12.7.7 The construction phase would result in the displacement of some existing businesses through land required for the construction of the Proposed Scheme. These effects have been assessed and reported within the relevant Volume 2: Community area

¹³⁸ Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.

¹³⁹ Based on the total construction person years generated by the Proposed Scheme and a ratio of 10 construction person years to one full time permanent job.

¹⁴⁰ Travel to Work Areas (TTWAs) are a geography created to approximate labour market areas in which most people both live and work. The current criteria for defining TTWAs are that at least 75% of the area's resident workforce work in the area and at least 75% of the people who work in the area also live in the area (Office of National Statistics, 2016, 'Travel to work area analysis in Great Britain: 2016').

¹⁴¹ Department for Transport (2017), High Speed Two: Phase Two Strategic Case, July 2017 paragraph 4.43. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/629393/high-speed-two-phase-two-strategic-case.pdf

¹⁴² The additional impacts of construction employment creation on the business supply chain and their expenditure effects can be calculated using four economic adjustment factors: leakage, displacement, substitution and multiplier effects. These factors and their rates are explained in Homes and Communities Agency (2014), Additionality Guide (4th Edition). Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/378177/additionality_guide_2014_full.pdf

reports, Section 12. In most cases, it is concluded that the majority of businesses affected in this way would be able to relocate¹⁴³, given the availability of alternative premises and the payment of compensation, and thereby continue to operate. It is also concluded that a large proportion of employees who may lose their jobs as a consequence of their employer closing or relocating and contracting, would be able to secure new employment relatively quickly given the current size and strength of the relevant local labour markets (if these conditions were to be sustained).

- 12.7.8 Whilst it is not possible to predict accurately the numbers of jobs that are at risk of being lost route-wide (as a result of businesses failing to relocate and closing, or relocating and contracting, and employees being unable to find work in the short term), an assumption can be made by drawing on previous research. The London Development Agency (LDA) carried out research into the relocation of companies and jobs on account of the London 2012 Olympic Games. This research¹⁴⁴ indicated that the majority of businesses (88%) relocated while 12% of businesses did not continue to trade.
- 12.7.9 Therefore, for the purpose of this assessment, the indicative rate of successful relocation is judged to be 88% and employment at these businesses would not be lost¹⁴⁵. Based on this, there is predicted to be a total relocation of 11,600 jobs from businesses as a result of land required for construction of the Proposed Scheme. This figure excludes the loss of any agricultural jobs (full time equivalents) as a consequence of the permanent loss of land as a result of the Proposed Scheme. Any such losses will be assessed and reported in the formal ES.
- 12.7.10 If an assumption is made that 12% of all jobs associated with businesses directly affected businesses by the Proposed Scheme could be lost route-wide, then approximately 1,600 jobs could be lost.
- 12.7.11 The direct loss of businesses and employment would have knock-on effects through the business supply chain and expenditure effects alongside other economic adjustment factors¹⁴⁶. As a consequence, it is estimated that approximately 790 additional jobs could be lost through indirect effects, route-wide.
- 12.7.12 Businesses displaced by the Proposed Scheme would be compensated in accordance with the National Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to alternative premises and would, therefore, offer additional support to facilitate this.

¹⁴³ A business decision to relocate is dependent on a number of factors, including market conditions at the time of relocation, business vulnerability, state of preparation and owner-specific drivers.

¹⁴⁴ In total, 208 businesses providing 4,946 jobs were relocated as part of the Compulsory Purchase Order (CPO) process. In total, 183 (88%) businesses relocated and continued to trade and 25 (12%) closed. See London Development Agency (LDA) (30th June 2008), Request for Information/Freedom of Information Act by Mr Julian Cheyne, FO1291.

¹⁴⁵ Of the businesses which closed (or may close), these businesses represent only 2% of total employment within businesses displaced by London 2012. Given the potential complexities associated with relocating some of the affected businesses, for the purposes of the route-wide assessment, it is assumed that a worst-case figure of 12% to represent total employment lost as a result of the Proposed Scheme.

¹⁴⁶ These knock-on effects are calculated using four economic adjustment factors: leakage, displacement, substitution and multiplier effects. These factors and their rates are explained in Homes and Communities Agency (2014), *Additionality Guide* (4th Edition). Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/378177/additionality_guide_2014_full.pdf. Refer to Volume 1, Section 8 assumptions for further details on multipliers.

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- 12.7.13 For those socio-economic resources affected by land required for construction of the Proposed Scheme, there is predicted to be a total relocation of employment of approximately 11,600 jobs. It is considered that the route-wide impact would be of high magnitude. The route-wide sensitivity of businesses is assumed to be medium. As such, there would be a major adverse effect, which is considered to be significant.
- 12.7.14 In total, approximately 2,380 jobs could be lost route-wide from businesses directly and indirectly affected during the construction phase. This impact would be mitigated over time as the UK and regional economies grow and new opportunities for employment for people who have lost their jobs, and have been unable to find work, come forward. As outlined in the Economic Case for HS2¹⁴⁷ in the longer term, the Proposed Scheme would enhance these opportunities through increased investment and economic activity above the baseline. In the context of the economies of the North West, Yorkshire and the Humber, the West Midlands and the East Midlands, which provide over 10.5 million jobs, the potential level of job loss is a relatively small proportion of total employment. Table 4 provides a summary of this assessment of construction effects.

Table 4: Summary of the construction socio-economic assessment

Construction employment created (direct)	
Magnitude	High
Sensitivity	High
Overall significance	Major beneficial
Construction employment created (indirect):	
Magnitude	High
Sensitivity	High
Overall significance	Major beneficial
Employment in businesses directly affected:	
Magnitude	High
Sensitivity	Medium
Overall significance	Major adverse

¹⁴⁷ Department for Transport (2017), High Speed Two Phase Two Economic Case Moving Britain Ahead. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/634196/high-speed-two-phase-two-economic-case.pdf

12.8 Assessment of the effects of operation

- 12.8.1 There are two types of impacts considered for the operational phase of the Proposed Scheme: employment associated with the operation of the service; and, employment associated with businesses affected by operation of the service.

Direct operational employment

- 12.8.2 The Proposed Scheme would create direct operational employment; the likely significant effects will be assessed and reported in the formal ES.
- 12.8.3 The Proposed Scheme would create indirect employment opportunities associated with its operational employment. These indirect jobs would result from expenditure on supplies and services necessary for the operation of the Proposed Scheme. Indirect jobs would also result from expenditure by those directly employed operating and maintaining the Proposed Scheme and by workers employed by suppliers contracted to the Proposed Scheme. The likely significant effects will be assessed and reported in the formal ES.

Businesses directly affected

- 12.8.4 The socio-economic assessment has not identified any businesses that could be directly affected (either negatively or beneficially) by the operations of the Proposed Scheme beyond those already covered in the construction phase analysis.

Total operational employment

- 12.8.5 The likely significant effects from the total direct and indirect permanent jobs will be assessed and reported in the formal ES.

13 Sound, noise and vibration

13.1 Introduction

13.1.1 This section of the report explains that there is not considered to be potential for likely significant effects identified to date on sound, noise and vibration at a route-wide level arising from the construction and operation of the Proposed Scheme. A summary of any route-wide health effects arising from the operation of the Proposed Scheme and how these compare to health effects arising from exposure to existing noise sources in the study area will be presented in the health section of this report in the formal ES.

13.2 Scope, assumptions and limitations

13.2.1 The scope, assumptions and limitations for the sound, noise and vibration assessment are set out in Volume 1: Introduction and methodology, Section 8, and in the EIA Scope and Methodology Report (SMR)¹⁴⁸.

13.2.2 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES.

13.3 Assessment of the effects of construction

13.3.1 Noise and vibration effects from construction activities would be confined to local areas around construction operations. Construction noise and vibration effects have been assessed on a local basis and are described for each area within the Volume 2: Community area reports, Section 13.

13.3.2 At this stage in the design and assessment, it is considered that there would be no significant noise or vibration effects on a route-wide basis associated with the construction of the Proposed Scheme.

13.4 Assessment of the effects of operation

13.4.1 Noise and vibration effects from passing trains and fixed operational noise sources would occur locally on people and other sensitive receptors (including schools, churches, hospitals and offices). Operational noise and vibration effects have been assessed on a local basis and are described for each area within the Volume 2: Community area reports, Section 13.

13.4.2 At this stage in the design and assessment, it is considered that there would be no significant noise or vibration effects on a route-wide basis associated with the operation of the Proposed Scheme. This will be confirmed in Volume 3: Route-wide effects of the formal ES.

¹⁴⁸ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

14 Traffic and transport

14.1 Introduction

- 14.1.1 This section of the report provides an assessment of the route-wide impacts and likely significant effects identified to date on traffic and transport arising from the construction and operation of the Proposed Scheme. The geographical extent of the Proposed Scheme is such that for some traffic and transport significant effects, consideration at a regional, and where appropriate route-wide, scale is required. Traffic and transport effects at a local scale are assessed in the Volume 2: Community area reports, Section 14, and Volume 4: Off-route effects.
- 14.1.2 The construction assessment of impacts in relation to rail users has been based on analyses to identify works to the national rail network and includes consideration of the likely number, location, duration and nature of works. For impacts at a route-wide level on highway users, consideration will be given to the expected overall scale of increase in use of the national Strategic Road Network by HS2 construction traffic.
- 14.1.3 The operational assessment of traffic and transport impacts and effects at regional and route-wide levels is primarily based upon the output from the PLANET Framework Model¹⁴⁹, which forms the basis for the economic assessment.
- 14.1.4 Continued growth in demand is forecast for long distance rail travel to 2026 when HS2 Phase One opens, 2033 when Phase 2b commences operation and beyond. Without the Proposed Scheme, the West Coast Main Line (WCML), East Coast Main Line (ECML), London Midland (LM), Midland Main Line (MML) and other routes would become increasingly congested. The Proposed Scheme is expected to bring beneficial effect to transport users across a variety of trip types including commuter, business and leisure passengers. Key effects include:
- new additional rail capacity to accommodate future growth in demand for rail travel;
 - reduced journey times between key destinations;
 - increased capacity and reduced congestion on the WCML, ECML, LM and MML for medium distance and local services;
 - increased capacity for freight services; and
 - new travel opportunities for previously suppressed trips.

¹⁴⁹ The PLANET Framework Model (PFM) is the Department for Transport forecasting model which has been used to develop rail demand forecasts as a result of the Proposed Scheme. The PLANET Framework Model has been developed by HS2 Ltd from a suite of models originally developed by the Strategic Rail Authority (SRA). PFM is the most appropriate modelling tool to be used in terms of forecasting the demand of the Proposed Scheme given its strategic capability, covering all long-distance rail, car and air movements across England, Scotland and Wales. PFM has evolved over a number of years, and builds on existing model components. Its aim is to provide forecasts of demand and (generalised) costs to drive the appraisal of HS2. As is standard in transport modelling, 'generalised cost' is a combination of monetary costs and travel time components.

- 14.1.5 The traffic and transport effects set out in the Volume 2: Community area reports, Section 14, are structured to identify impacts by individual transport mode. The assessment of route-wide and regional effects in this report adopts the same approach and criteria for identifying impacts and assessing their effects.

14.2 Scope, assumptions and limitations

- 14.2.1 The scope, key assumptions and limitations for the route-wide traffic and transport assessment are set out in Volume 1: Introduction and methodology, Section 8, and the EIA Scope and Methodology Report (SMR)¹⁵⁰.
- 14.2.2 The route-wide study area for traffic and transport considers all transport movements across the UK rail and highway network. However, the particular focus of impacts comprises two corridors forming the 'Y-shaped' element of the HS2 network, with one corridor towards the North West (and Manchester, via Crewe) and connecting onto the WCML and the other corridor towards the North East (and Leeds, via the East Midlands and South Yorkshire) and connecting on to the ECML, together with parallel rail and highway routes.
- 14.2.3 The potential effects on traffic and transport have been assessed qualitatively, based on the Proposed Scheme design.
- 14.2.4 No quantitative assessment has been undertaken at this stage. A quantitative assessment and reporting of significant effects will be presented in the formal ES.

14.3 Environmental baseline

- 14.3.1 The Proposed Scheme comprises the route from Crewe to Manchester (and connections onto the WCML) (referred to as the 'western leg'), and from the West Midlands to Leeds (and connections onto the MML and the ECML) via the East Midlands and South Yorkshire (referred to as 'the eastern leg').
- 14.3.2 Details of the environmental baseline are reported in Volume 2: Community area reports, Section 14. In transport terms, the baseline includes the WCML, ECML and MML as well as the strategic road network.
- 14.3.3 Current quickest journey times by rail from London and Birmingham to the existing stations within the Phase 2b area and between a selection of the existing stations within the Phase 2b area are set out in Table 5.

¹⁵⁰ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

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Table 5: Current quickest journey times - Phase 2b network¹⁵¹

	Current journey time
London-Nottingham	1 hour 40 minutes
London-Derby	1 hour 25 minutes
London-Sheffield Midland	2 hours 1 minutes
London-Chesterfield	1 hour 45 minutes
London-Leeds	2 hours 11 minutes
London-Manchester Airport	2 hours 24 minutes
London-Manchester Piccadilly	2 hours 7 minutes
Birmingham-Manchester	1 hour 28 minutes
Birmingham-Nottingham	1 hour 9 minutes
Birmingham-Leeds	2 hours 30 minutes
Birmingham-York	2 hours 37 minutes
Nottingham-Sheffield	50 minutes
Sheffield-Leeds	40 minutes

14.4 Avoidance and mitigation measures

- 14.4.1 Details of avoidance and mitigation measures are reported in Volume 2: Community area reports, Section 14, and would vary depending on whether the measures apply to the construction or operational phase.
- 14.4.2 For construction, avoidance and mitigation measures relate to the following insofar as reasonably practicable: routing of HGV traffic; maintenance or local diversion of roads crossing the route of the Proposed Scheme; traffic management; provision of site haul routes; reuse of excavated material; and temporary alternatives for public rights of way (PRoW).
- 14.4.3 The draft Code of Construction Practice (CoCP)¹⁵² includes measures that aim to reduce the adverse impacts and effects on local communities and maintain public access during construction. The measures in the draft CoCP include controls on vehicle types, hours of site operation and routes for HGVs to reduce the impact of road-based construction traffic.
- 14.4.4 Where works would potentially affect Network Rail assets, disruption to travelling passengers and freight movements would be reduced insofar as reasonably

¹⁵¹ High Speed Two, Phase Two Strategic Case (2017), Department for Transport
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/629393/high-speed-two-phase-two-strategic-case.pdf

¹⁵² Supporting documents: Draft Code of Construction Practice

practicable by programming the construction works to coincide with planned possessions, planning works for short overnight stages and programming longer closures at weekends and on bank holidays.

- 14.4.5 For the operational phase, avoidance and mitigation measures relate to the operation of HS2 and would include provision for access to HS2 stations by sustainable mode, improvements to the highway and public transport network to accommodate users of the HS2 services, reinstatement of roads on or close to their existing alignments, where reasonably practicable and replacement, diversion or realignment of PRow where relevant. Travel plans would be developed for each HS2 station and depot and would include measures that aim to reduce the impacts and effects of traffic and transport movements.

14.5 Assessment of the effects of construction

- 14.5.1 The primary potential route-wide impacts during construction would result from:

- the combined impacts of construction traffic and of rail movements at a route-wide level; and
- the impacts of engineering works and possessions on the conventional rail network as a result of the construction of the Proposed Scheme.

- 14.5.2 The impacts of construction traffic are focused on the road network close to the Proposed Scheme, which includes the principal corridors for bulk material movements. These are considered within Volume 2: Community area reports, Section 14. The reuse of excavated material in the construction of the Proposed Scheme and the use of rail to transport bulk materials, where reasonably practicable, would help to reduce wider traffic impacts of such movements. Consequently, construction traffic movements are expected to represent a small proportion of total traffic on the strategic highway network.

- 14.5.3 The collective impacts associated with the movement of excavated and fill materials have, at this stage, been scoped out of further consideration at the route-wide level given the expected small impact on the wider network.

- 14.5.4 Rail movements of bulk material would use spare train paths on the conventional rail network and the approach to the use of rail has been developed taking into account likely availability of train paths. As a result, the movement of materials by rail would be planned so that it can be accommodated within available capacity and not have significant transport impacts or effects.

- 14.5.5 Engineering works required on the conventional rail network, and expected rail possessions during construction of the Proposed Scheme, would have the potential to cause disruption to services on the rail network. The assessment of such impacts will be based on the identification of expected works to the rail network that enable the likely number, location and nature of works, as well as how they would be implemented to be established. This will be reported in the formal ES.

- 14.5.6 A number of works on the conventional rail network would be required, including:
- remodelling existing station layouts and track alignment to accommodate the HS2 tracks;
 - protection of existing rail assets where the route of the Proposed Scheme would cross over, or run adjacent to or under existing rail infrastructure;
 - the use of existing rail sidings to support the construction and operation of the Proposed Scheme;
 - the linkage of temporary construction sidings to the rail network to support the construction process; and
 - works on the conventional rail network to accommodate HS2 services.
- 14.5.7 The potential scale of effect from these works would depend on a number of factors including the type and complexity of interaction, duration of interaction, level of use of the rail line affected and timing of the interaction. For example, railheads, rail sidings and asset protection works would not have a direct impact on the operation of the conventional rail network as they can generally be implemented without the need for disruptions to the railway and delay to passenger journeys. However, major track re-modelling has greater potential to affect services. In addition, while most railway works would be undertaken overnight or during weekend possessions (and thus would have limited impacts in isolation), a long programme of such works across a route could, over a period of time, cause extended disruption to the travelling public and freight services.
- 14.5.8 There are a number of works proposed that are of sufficient scale that they could potentially create disruption and delay to rail passenger and freight services individually. Any route-wide effects will be reported in the formal ES.
- 14.5.9 The method for implementing works would be through a series of planned possessions of the conventional rail network. This is a standard technique widely used for the maintenance of the railway. A number of standard possessions would be used that, depending on the scale and complexity of the works required, would in almost all locations be restricted to mid-week overnight possessions, with some weekend and public holiday possessions where the works are more complex. However, these would be of short duration, and in isolation, are not considered likely to result in significant effects.
- 14.5.10 The following are measures that HS2 Ltd would explore to reduce the impacts and effects on passengers from disruption due to possessions:
- any access to the operational railway would follow the recognised industry planning process controlled by Network Rail;
 - HS2 Ltd would seek to optimise the access to the operational railway across all HS2 works by planning works in association with the Network Rail enhancement and renewals plans eliminating possessions where possible and to use existing railway access where applicable. This harmonisation includes using existing planned disruptive possessions and maximising the use of

published Network Rail track access availability;

- HS2 Ltd would work with Network Rail to reduce works on routes that would cause disruption to the travelling public on national holidays and on days when major leisure/sporting events are occurring;
- due to programme constraints, concurrent works may occur at some locations. However, HS2 Ltd would seek to programme the works in such a way as to eliminate insofar as reasonably practicable concurrent works requiring major possessions of the railway affecting routes into major conurbations;
- where total closure is necessary HS2 Ltd would work with Network Rail to continue to operate rail services to keep passengers on trains, albeit with extended journey times via different routes that ultimately reach the original final destination;
- where the final destination is not achievable a similar alternative would be offered e.g. as above but diverted to another existing station in the area;
- provide rail replacement services where necessary when rail possessions are in place; and
- provide effective notification of disruption to the travelling public so that non-essential trips can be avoided or alternative routes can be easily established.

14.5.11 Any significant effects will be reported in the formal ES.

14.6 Assessment of the effects of operation

Introduction and methodology

- 14.6.1 During operation, there would be substantial changes to train patterns and frequencies on the conventional rail network, both as a direct result of the Proposed Scheme services and also to take advantage of the capacity released on the conventional rail network. This includes the potential for new services to take up conventional rail network train paths released by HS2 services taking over the role of providing for long distance travel. Together with the new HS2 services, these changes would provide journey time and accessibility benefits and are likely to reduce crowding and congestion on the conventional rail network. This, in turn, has the potential to result in substantial changes in overall use of rail services and mode shift from the private car, long distance coach and air during the operation of the Proposed Scheme.
- 14.6.2 The expected changes to frequencies, routes and calling patterns on the conventional rail network will be determined from the current assumptions embodied in the Economic Case for HS2. The analysis will be presented in the formal ES.
- 14.6.3 The PLANET Framework Model will be used to estimate travel on HS2 and other rail services and other transport modes; and hence, provide mode share information for car, rail and air modes both 'with' and 'without' the Proposed Scheme. The PLANET Framework Model will also forecast changes in passenger use at stations (including predicted passenger numbers at new stations of the Proposed Scheme). Stations that

are forecast to experience a substantial increase or decrease in daily weekday passenger numbers will be reported in the formal ES.

- 14.6.4 Substantial journey time benefits would be provided by the Proposed Scheme with the biggest proportionate benefits achieved where the service uses just the HS2 route. The introduction of Phase Two would further substantially reduce journey times with the journey time between London and Manchester reducing from two hours and seven minutes to one hour seven minutes; and travel time between London and Leeds reducing from two hours 11 minutes to one hour 21 minutes. Further likely significant effects will be assessed and reported in formal ES.

Released capacity

- 14.6.5 The transfer of long distance passengers from the conventional rail network to the Proposed Scheme would create the opportunity to provide additional services and to stop services at more locations on the conventional rail network. The actual service patterns, including the use of released capacity, would be determined nearer to the time of opening of the Proposed Scheme.
- 14.6.6 A released capacity timetable specification is being developed for the Economic Case for HS2. The general principles underpinning the use of the released capacity have been to increase capacity in corridors with high demand and to address some of the reliability and overcrowding issues that currently exist and that are otherwise forecast to intensify as a result of increased demand for rail travel.
- 14.6.7 Overall, the use of the released long distance train paths by medium distance and local services, coupled with the reduction in long distance passenger numbers using trains on the WCML, ECML and MML, would increase capacity and reduce congestion and passenger crowding. Likely significant effects will be assessed and reported in full in the formal ES.

Passenger demand

- 14.6.8 The increased capacity and improved journey times that would result from the Proposed Scheme and the additional services provided to take advantage of released capacity would generate increased demand for rail travel. The Proposed Scheme would provide an attractive substitute for many users of the long distance rail services that would operate in the absence of HS2. The improvements would also encourage changes in mode share from car and potentially air trips as well as generating new rail trips.
- 14.6.9 The PLANET Framework Model will be used to forecast demand for rail, car and air travel and to establish the extent of changes in mode share. Forecasts for 2033 and 2038, and potentially a further forecast year, will be considered for the future baseline cases and for the Proposed Scheme scenarios. This will be reported in the formal ES.
- 14.6.10 The number of rail passengers using HS2 Phase 2b stations, together with the differences in overall rail demand at existing stations in the adjacent area, will be reported in the relevant Volume 2: Community area reports of the formal ES.
- 14.6.11 The increase in the number of long distance rail passenger trips and reductions in long distance vehicle trips will be reported in the formal ES.

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- 14.6.12 The overall change in rail travel, with a proportion of HS2 trips being generated as new travel, demonstrates the levels of travel suppressed by capacity constraints and journey times. The overall change in rail travel shows the substantial travel opportunities and aspirations that the Proposed Scheme and the released capacity services would realise and will be assessed and reported in full in the formal ES.
- 14.6.13 The transfer of passengers from the conventional rail network and from mode transfer from car would result in benefits through reducing forecast future congestion on both the strategic highway and the conventional rail network. The extent of reduction in vehicle kilometres as a result of the Proposed Scheme will be assessed and reported in full in the formal ES.

15 Waste and material resources

15.1 Introduction

General

- 15.1.1 This section of the report presents a route-wide assessment of the likely significant environmental effects identified to date associated with the off-site disposal to landfill of solid waste that would be generated by the construction and operation of the Proposed Scheme. This assessment considers:
- the types and quantity of waste that would be generated;
 - the quantity of waste that would require off-site disposal to landfill; and
 - the availability of off-site landfill disposal capacity.
- 15.1.2 This assessment does not consider liquid waste, the direct and indirect effects of waste-related transport, or mineral resources located along the route of the Proposed Scheme. Liquid wastes¹⁵³, such as waste oil, are not considered as they would be immaterial in quantity compared to solid wastes and have, therefore, been scoped out. Effects related to pollution risk and water quality are assessed in Volume 2: Community area reports, Section 15, Water resources and flood risk. Waste related transport is considered as part of the traffic and transport assessment in Volume 2: Community area reports, Section 14. This assessment, in turn, is used by other topics, such as climate change, Section 4 of this report, to undertake their own assessments. Mineral resources are considered elsewhere within this report (Section 9, Land quality), and would be managed in accordance with the measures contained within the draft Code of Construction Practice (CoCP)¹⁵⁴.
- 15.1.3 Consideration of material resources in this assessment is limited to the beneficial reuse of excavated material arising from the construction of the Proposed Scheme.
- 15.1.4 Only if excavated material is not required or is unsuitable for the construction of the Proposed Scheme would it be considered for use beyond the Proposed Scheme or consigned as waste.

Context

Need for route-wide assessment

- 15.1.5 The movement of waste from source to final destination is a complex process, as waste is often transferred across waste planning authority boundaries for treatment and disposal according to the type of waste and the nature of the waste management facility required.
- 15.1.6 Waste planning authorities have a statutory duty to plan for an appropriate amount of waste infrastructure capacity to be available over a defined time period according to projected waste arisings, targets for diverting waste from landfill, requirements and

¹⁵³ Article 6 of Council Directive 1999/31/EC on the landfill of waste prohibits the disposal of liquid waste in a landfill.

¹⁵⁴ Supporting documents: Draft Code of Construction Practice

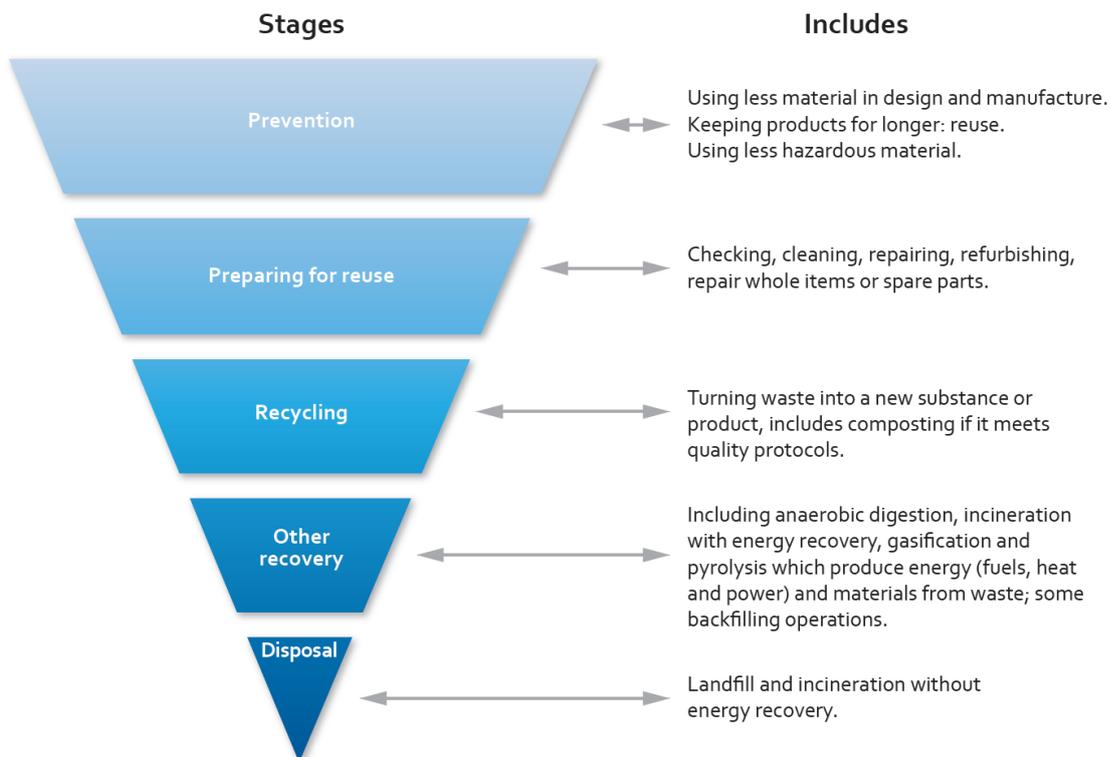
policies with regard to the separate collection of waste types, and the need to take account of waste that may be imported from other areas for treatment and disposal.

- 15.1.7 For this reason, waste planning has traditionally been undertaken on a county-level basis and until early 2013, when regional plans were abolished, a regional-level basis that takes account of the need for the inter-regional movement of waste within England.
- 15.1.8 To reflect this broader county and regional-based approach to waste planning and management, an assessment of the likely significant environmental effects associated with the off-site disposal to landfill of solid waste that would be generated by the Proposed Scheme has been undertaken on a route-wide basis.
- 15.1.9 This route-wide approach takes into account waste arisings and waste infrastructure capacity data available at county and regional levels. Comprehensive waste data at district level is often limited and so has not been considered for use in this assessment.

Environmental effects of waste management

- 15.1.10 The waste hierarchy¹⁵⁵ (Figure 6) sets out the preferred approach to the management of waste from waste prevention, to preparation for reuse, recycling, other recovery and disposal to landfill as a last resort.

Figure 6: The waste hierarchy



¹⁵⁵ Adapted from: Department for Environment, Food and Rural Affairs (2011), *Government Review of Waste Policy in England 2011*. Her Majesty's Stationary Office, London.

- 15.1.11 The waste hierarchy supports the need to achieve efficient use of material resources, minimise the amount of waste produced (or otherwise increase its value as a resource) and reduce, as far as possible, the amount of waste that is disposed to landfill.
- 15.1.12 The waste hierarchy advocates the use of landfill disposal only as a last resort due to a range of potential adverse effects associated with its use. This includes natural resource depletion, methane production and nuisance effects (e.g. dust and odour). There is also a need to conserve existing landfill capacity for wastes for which there is currently no alternative treatment option that can be used to recover material resources and/or energy.
- 15.1.13 In England and Wales, waste producers have a legal duty to apply the waste hierarchy to decisions concerning the generation and management of waste¹⁵⁶. The availability of waste management infrastructure capacity is also important in light of national policy that supports the treatment and disposal of waste at one of the nearest appropriate installations¹⁵⁷.
- 15.1.14 For this reason, this assessment sets out the likely significant environmental effects associated with the off-site disposal to landfill of solid waste that would be generated by the construction and operation of the Proposed Scheme.

Design approach and mitigation

- 15.1.15 An integrated design approach has been developed that seeks to reuse excavated material to satisfy the necessary engineering and environmental mitigation earthworks requirements for the Proposed Scheme including the use of borrow pits where appropriate. It seeks to minimise the quantity of surplus excavated material generated and minimise off-site disposal to landfill. This includes reuse of all topsoil and agricultural subsoil as close to the point of excavation as practicable.
- 15.1.16 Materials Management Plans would be drafted in accordance with the CL:AIRE Code of Practice¹⁵⁸ in anticipation of implementing the integrated design approach. This would enable suitable excavated material to be used as a resource within the construction of the Proposed Scheme with the additional benefit of reducing the quantity of imported minerals required.
- 15.1.17 The nominated undertaker would seek opportunities for beneficial reuse of excavated material that cannot be reused in the earthworks of the Proposed Scheme. Such beneficial uses might include:
- use in other construction projects where opportunities arise at the time of construction; and/or
 - restoration of mineral or landfill sites.

¹⁵⁶ *The Waste (England and Wales) Regulations 2011 (SI 2011 No. 988) (as amended)*. Her Majesty's Stationary Office, London. Available online at: http://www.legislation.gov.uk/ukxi/2011/988/pdfs/ukxi_20110988_en.pdf

¹⁵⁷ Department for Communities and Local Government (October 2014), *National Planning Policy for Waste*.

¹⁵⁸ Contaminated Land: Applications in Real Environments (2011), *The Definition of Waste: Development Industry Code of Practice - Version 2*. Available online at: <http://www.claire.co.uk/projects-and-initiatives/dow-cop/28-framework-and-guidance/111-dow-cop-main-document>

- 15.1.18 Opportunities for beneficial reuse off-site would be pursued where the transportation of that material does not result in significant environmental effects.

15.2 Policy framework

General

- 15.2.1 The assessment and mitigation of the likely significant environmental effects associated with the off-site disposal to landfill of solid waste has been considered with respect to relevant waste planning and management policies. Those of relevance to this assessment are summarised within this section.

National policy framework

- 15.2.2 The National Planning Policy Framework (NPPF) does not contain any specific policies on waste planning. The National Planning Policy for Waste¹⁵⁹, published in October 2014, sets out waste planning policies that all local planning authorities must follow when discharging their responsibilities associated with waste management. The policy aims to:

- deliver sustainable development including through the provision of modern infrastructure that drives waste management up the waste hierarchy;
- ensure that waste management is considered alongside other spatial planning concerns, recognising the positive contribution that waste management can make to the development of sustainable communities;
- provide a framework for communities to take more responsibility for their waste;
- secure the reuse, recovery or disposal of waste without endangering human health or the environment; and
- ensure that the design and layout of new development supports sustainable waste management.

- 15.2.3 Government's 25 Year Plan to Improve the Environment¹⁶⁰, published in January 2018, aims to maximise resource efficiency, minimise environmental impacts at the end of life of materials and products, and embed the 'environmental net gain' principle in all new infrastructure projects. It is committed to eliminating all avoidable plastic waste by the end of 2042, and achieving an overall target of zero avoidable waste by the end of 2050. It also seeks to deliver a substantial reduction in litter and littering behaviour.

- 15.2.4 The Waste Management Plan for England¹⁶¹ provides an analysis of the waste management situation in England, as at the end of 2013, and a framework to support a more sustainable and efficient approach to resource use and management. Its

¹⁵⁹ Department for Communities and Local Government (2014), *National Planning Policy for Waste*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/364759/141015_National_Planning_Policy_for_Waste.pdf

¹⁶⁰ HM Government (2018), *A Green Future: Our 25 Year Plan to Improve the Environment*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

¹⁶¹ Department for Environment, Food and Rural Affairs (2013), *Waste Management Plan for England*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265810/pb14100-waste-management-plan-20131213.pdf

purpose is to consolidate a number of existing policies within the context of a single national waste management plan.

- 15.2.5 The Government's Review of Waste Policy in England¹⁶², published in 2011, contains the main policies of relevance to the Waste Management Plan for England. It sets out the Government's overarching approach to work towards a zero waste economy, to value waste as a resource (both financially and environmentally) and to work towards zero waste to landfill.
- 15.2.6 The Government's Waste Prevention Programme for England¹⁶³ was published in December 2013 as a requirement of the revised EU Waste Framework Directive¹⁶⁴. The programme establishes the Government's framework on measures to minimise the quantity of waste generated. It also develops the key roles and actions that need to be carried out during the transition towards a more resource efficient economy.
- 15.2.7 Construction 2025: industrial strategy for construction¹⁶⁵ is a joint Government and industry initiative that aims to promote the concept of sustainability within the construction industry by setting out a long-term strategic action plan to be followed by both the Government and industry. It recognises that outputs from the construction industry have a major effect on both the economy and the environment, and that significant construction, demolition and excavation waste (CDEW) is generated and not re-used due, in large part, to the approach to risk across the supply chain. In addition, many procurement processes are bureaucratic and consequently wasteful. Construction 2025 recognises that the practice of off-site construction can halve CDEW.
- 15.2.8 Government policy on hazardous waste is contained within the National Policy Statement for Hazardous Waste: A Framework Document for Planning Decisions on Nationally Significant Hazardous Waste Infrastructure¹⁶⁶. This Policy Statement sets out the need for large-scale hazardous waste infrastructure, and the framework for decision-making on relevant development consent applications within England.

15.3 Scope, assumptions and limitations

- 15.3.1 The scope of this assessment includes waste generated during construction and operation of the Proposed Scheme. It does not include material inputs to construction, i.e. waste associated with the manufacture of material inputs. The scope is set out in further detail within Volume 1: Introduction and methodology, Section 8, and the EIA Scope and Methodology Report (SMR)¹⁶⁷.

¹⁶² Department for Environment, Food and Rural Affairs (2011), *Government Review of Waste Policy in England 2011*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69401/pb13540-waste-policy-review110614.pdf

¹⁶³ HM Government (2013), *Prevention is Better Than Cure: The Role of Waste Prevention in Moving to a More Resource Efficient Economy*.

¹⁶⁴ The revised EU Waste Framework Directive was adopted on 20 October 2008, signed on behalf of the European Parliament and the Council on 19 November 2008, and published in the Official Journal of the European Union on 22 November (L312/3) as Directive 2008/98/EC. The revised EU Waste Framework Directive entered in to force on 12 December 2008. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN>

¹⁶⁵ HM Government (2013), *Construction 2025: Industrial Strategy: government and industry in partnership*, Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/210099/bis-13-955-construction-2025-industrial-strategy.pdf.

¹⁶⁶ Department for Environment, Food and Rural Affairs (2013), *National Policy Statement for Hazardous Waste: A Framework Document for Planning Decisions on Nationally Significant Hazardous Waste Infrastructure*.

¹⁶⁷ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

- 15.3.2 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES. Further assumptions and limitations relevant to this assessment are set out in Volume 1: Introduction and methodology, Section 8.

15.4 Environmental baseline

General

- 15.4.1 The baseline comprises environmental conditions with respect to the types, quantities and management routes of waste generated in England, and within each of the counties and former regional planning areas through which the route of the Proposed Scheme would pass.
- 15.4.2 The types of waste described in this context are:
- CDEW that would be generated during the construction phase of the Proposed Scheme (2023 to 2033);
 - commercial and industrial (C&I) waste that would be generated from worker accommodation sites during the construction phase of the Proposed Scheme (2023 to 2033); and
 - C&I waste that would be generated during the first complete year of operation of the Proposed Scheme (2034).
- 15.4.3 The baseline also comprises the availability (types and capacity) of waste infrastructure within each of the county and former regional planning areas through which the route of the Proposed Scheme would pass.
- 15.4.4 Baseline conditions are presented as existing environmental conditions (based on latest available published data), and then as predicted future baseline conditions for the period 2023 to 2033 (construction period) and 2034 (first full year of operation).
- 15.4.5 The study area for this assessment is defined as the four regions shown in Table 6. These regions comprise the former regional planning areas through which the Proposed Scheme would pass. The four regions also represent the administrative areas within which the various waste streams are likely to be managed, and the areas for which waste arisings and waste infrastructure data is available¹⁶⁸.
- 15.4.6 Reference is also made in the assessment to specific local areas (shown in Table 6) within the four regions. These local areas comprise of local authority administration areas through which the route of the Proposed Scheme would pass.

¹⁶⁸ Comprehensive data for waste arisings and waste infrastructure capacity is not available on a community area basis.

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Table 6: Study area for assessment

Regional area	Waste planning authority	Local area
North West	Cheshire East Council, Cheshire West and Chester Council, Warrington Borough Council, Trafford Council, Metropolitan Borough of Wigan, Manchester City Council, Greater Manchester Combined Authority	Cheshire East, Cheshire West and Chester, Warrington, Trafford District, Wigan District, and Manchester District
West Midlands	Warwickshire County Council	North Warwickshire District, and Tamworth District
East Midlands	Leicestershire County Council, Derbyshire County Council, Nottinghamshire County Council, Nottingham City Council, Chesterfield Borough Council	North West Leicestershire District, Rushcliffe District, Erewash District, Broxtowe District, City of Nottingham, Ashfield District, Bolsover District, North East Derbyshire District, and Chesterfield District
Yorkshire and the Humber	Rotherham Metropolitan Borough Council, Doncaster Council, Wakefield Council, Barnsley Council, Leeds City Council, North Yorkshire County Council, West Yorkshire Combined Authority	Rotherham District, Doncaster District, Wakefield District, Barnsley District, Leeds District, and Selby District

- 15.4.7 Baseline and future baseline information is presented by both local and waste planning authority area, as there is often a need to manage waste outside of the immediate administrative area in which it is generated. This is dependent upon the type of waste infrastructure required, and the available capacity of such facilities to receive and manage the type(s) of waste generated.

Waste arisings and management

National construction, demolition and excavation waste

- 15.4.8 Latest available data shows that a total of 107,600,000 tonnes of CDEW¹⁶⁹ was generated in England in 2014¹⁷⁰. Of this amount, 49,100,000 tonnes comprised non-hazardous waste, of which 44,900,000 tonnes (approximately 91%) were recovered. In 2012, Defra ceased publication of national estimates for the recycling and recovery of CDEW. However, based on the estimated proportion of CDEW sent to landfill in 2010¹⁷¹, the last year for which data is available, it has been forecast that of the

¹⁶⁹ European Competition Commission (undated). 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).

¹⁷⁰ Department for Environment, Food and Rural Affairs (2018), UK Statistics on Waste. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/683051/UK_Statistics_on_Waste_statistical_notice_Feb_2018_FIN_AL.pdf

¹⁷¹ Department for Environment, Food and Rural Affairs (2012), Construction, Demolition and Excavation Waste Generation Estimate: England, 2008 to 2010. Document now archived.

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107,600,000 tonnes of CDEW generated in England in 2014, 27,600,000 tonnes (approximately 26%) were sent to landfill.

- 15.4.9 Comprehensive information on the likely future growth of CDEW arisings across England is limited. However, Eurostat data¹⁷² shows that CDEW generation across the UK has been on an upward trend since 2004, (the first year for which data is available), with UK CDEW arisings increasing 21% between 2004 and 2014, as shown in Table 7.

Table 7: UK CDEW generation trend data, 2004 to 2014

Area	2004	2006	2008	2010	2012	2014
United Kingdom	99,234,124	109,545,987	100,999,493	102,231,321	100,230,495	120,356,253

- 15.4.10 The Eurostat data shows an average annual CDEW growth trend of 2.01%. Based on this growth, the projected quantity and management of CDEW in England during the construction phase of the Proposed Scheme (2023 to 2033) has been calculated (see Table 8) to develop the baseline and future baseline.

Table 8: Baseline and future baseline national CDEW arisings

Year	Landfill (tonnes)	Diverted from landfill (tonnes)	Total (tonnes)
2017	29,285,369	84,934,838	114,220,207
2023 - 2033	401,774,454	1,165,245,616	1,567,020,070

Regional construction, demolition and excavation waste

- 15.4.11 Regional CDEW arisings and management data have not been published by Defra in the UK since 2011. This data is considered too out-of-date to represent a reasonable baseline with respect to the generation and management of CDEW in the four regional areas through which the route of the Proposed Scheme would pass. To develop a baseline and future baseline for the four regional areas, waste generation and management data, and projected trends were taken, analysed, and summed, from the Local Plans of each of the waste planning authorities within the respective areas (see Table 9).

Table 9: Baseline and future baseline CDEW arisings and management by region

Year	Waste Quantity	North West (tonnes)	West Midlands (tonnes)	East Midlands (tonnes)	Yorkshire and the Humber (tonnes)	Total (tonnes)
2017	Landfilled	2,726,964	1,812,648	2,839,400	1,724,980	9,103,993
	Recovered	2,843,535	5,970,568	7,959,314	5,755,854	22,529,271
	Total	5,570,499	7,783,216	10,798,714	7,480,834	31,633,263
2023 - 2033	Landfilled	31,906,045	20,191,807	31,439,996	20,260,613	103,798,461

¹⁷² Eurostat (2017), 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

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Year	Waste Quantity	North West (tonnes)	West Midlands (tonnes)	East Midlands (tonnes)	Yorkshire and the Humber (tonnes)	Total (tonnes)
	Recovered	35,958,413	68,227,769	88,194,235	67,507,027	259,887,444
	Total	67,864,457	88,419,576	119,634,231	87,767,640	363,685,905

Local construction, demolition and excavation waste

15.4.12 Local CDEW arisings and management for the year 2017 (baseline) and the period 2023 to 2033 (future baseline) will be presented in detail in the formal ES.

15.4.13 The local CDEW arisings and management information, to be presented in the formal ES, originates from the same information sources used to develop the regional CDEW baseline and future baseline, and contributes to the CDEW arisings and management data presented in Table 9.

National commercial and industrial waste

15.4.14 Latest available information¹⁷⁰ reports that, in 2016, a total of approximately 32.2 million tonnes of C&I waste were produced in England according to returns made under the EU Waste Statistics Regulation. C&I waste generation is extremely difficult to estimate owing to data limitations and data gaps, and the 2016 figure will remain provisional until it has been approved by Eurostat following the submission of the 2016 Waste Statistics Regulation return in June 2018. A 2011 survey by Defra¹⁷³ represents the most recently published set of detailed data regarding the national treatment and disposal routes for C&I waste. Based on the waste management methods identified in the 2011 Defra survey, it is expected that of the approximately 32.2 million tonnes of C&I waste estimated to have been generated in 2016:

- 16,767,138 tonnes (52%) was reused, recycled or composted;
- 5,417,055 tonnes (17%) was diverted from landfill via various treatment and recovery methods;
- 7,578,368 tonnes (23%) was disposed to landfill; and
- the destination of 2,437,439 tonnes (8%) was unknown.

15.4.15 Estimates of waste generation by the C&I sectors in England have been calculated by Defra as part of the Waste Statistics Regulation returns, published by Eurostat. Estimates between 2010 and 2016¹⁷⁰ show that C&I waste generation across the UK has been fluctuating between annual decreases and annual increases, with C&I waste arisings in England estimated to have increased 8% between 2010 and 2016, as shown in Table 10.

¹⁷³ Department for Environment, Food and Rural Affairs (2011), Survey of Commercial and Industrial Waste Arisings 2010 - Revised Final Results. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/400595/ci-statistics-release.pdf

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Table 10: England C&I waste generation trend data, 2010 to 2016

	2010 (tonnes)	2011 (tonnes)	2012 (tonnes)	2013 (tonnes)	2014 (tonnes)	2015 (tonnes)	2016 (tonnes)
Total C&I waste generation in England	29,700,000	32,400,000	34,200,000	32,900,000	32,800,000	32,100,000	32,200,000

- 15.4.16 The Defra estimates show an average annual C&I waste increase of 1.45%. Based on this growth, the projected quantity and management of C&I waste in England during the construction phase of the Proposed Scheme (2023 to 2033), and during the first full year of operation of the Proposed Scheme (2034) has been calculated (see Table 11) to develop the baseline and future baseline.

Table 11: Baseline and future baseline national C&I waste arisings

Year	Landfill (tonnes)	Diverted from landfill (tonnes)	Total (tonnes)
2017	7,688,490	24,979,414	32,667,905
2023 - 2033	84,573,394	274,773,559	359,346,953
2034	7,688,490	24,979,414	32,667,905

Regional commercial and industrial waste

- 15.4.17 Regional C&I waste arisings and management data has not been published by Defra in the UK since 2011. This is considered too out-of-date to represent a reasonable baseline with respect the generation and management of C&I waste in the four regional areas through which the route of the Proposed Scheme would pass. To develop a baseline and future baseline for the four regional areas, waste generation and management data, and projected trends were taken, analysed, and summed, from the Local Plans of each of the waste planning authorities within each of the respective former regional planning areas (see Table 12).

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Table 12: Baseline and future baseline C&I waste arisings and management by region

Year	Waste quantity	North West (tonnes)	West Midlands (tonnes)	East Midlands (tonnes)	Yorkshire and the Humber (tonnes)	Total (tonnes)
2017	Landfilled	1,751,369	1,981,742	2,292,196	1,407,869	7,433,176
	Recovered	5,681,920	5,598,184	3,443,177	3,912,663	18,635,944
	Total	6,316,289	7,579,926	5,735,373	5,320,532	24,952,120
2023 - 2033	Landfilled	18,485,070	20,718,567	22,786,693	15,913,648	77,903,979
	Recovered	70,198,881	76,902,409	40,277,317	46,215,851	233,594,457
	Total	88,683,951	97,620,976	63,064,011	62,129,499	311,498,436
2034	Landfilled	1,741,345	1,911,834	2,045,690	1,492,955	7,191,824
	Recovered	6,657,545	7,199,163	3,692,783	4,340,601	21,890,092
	Total	7,244,890	9,110,998	5,738,473	5,833,556	27,927,916

15.4.18 Table 12 indicates that approximately 75% of all C&I waste generated regionally is currently diverted from landfill.

Local commercial and industrial waste

15.4.19 Local C&I waste arisings and management data for the baseline and future baseline years will be presented in detail in the formal ES.

15.4.20 The local C&I waste arisings and management information, to be presented in the formal ES, originates from the same information sources used to develop the regional C&I waste baseline and future baseline, and contributes to the C&I waste arisings and management data presented in Table 12.

Waste infrastructure

General

15.4.21 Latest available information published by the Environment Agency has been used 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 route of the Proposed Scheme would pass. National waste infrastructure capacity is not provided as it is not required for use in this assessment.

15.4.22 Whilst information on waste infrastructure is also available from waste planning authorities, this information may not always be presented in a way that is directly and readily comparable. Environment Agency data provides both a credible and reliable source of information that is consistent and comparable across all counties and regions. Permitted landfill capacity data from the Environment Agency has also been used to inform the significance criteria used in this assessment¹⁷⁴.

¹⁷⁴ Supporting document: HS2 Phase 2b Environmental Impact Assessment Scope and Methodology Report

Current baseline

15.4.23 Table 13 provides baseline landfill void space capacity data for the four regions through which the Proposed Scheme would pass¹⁷⁵. The baseline information presented is based on permitted capacity for the year 2016, published by the Environment Agency.

15.4.24 Baseline waste infrastructure capacity data for the relevant waste planning authorities within each of the four regions will be presented in the formal ES.

Table 13: Baseline landfill void space capacity by region, 2016

Facility type	North West	West Midlands	East Midlands	Yorkshire and the Humber	Total ¹⁷⁶
	Capacity (tonnes)	Capacity (tonnes)	Capacity (tonnes)	Capacity (tonnes)	Capacity (tonnes)
Inert waste landfill	10,020,747	21,838,289	35,286,296	25,120,500	92,265,831
Non-hazardous waste landfill	32,648,406	35,645,923	32,406,520	49,955,210	150,656,059
Hazardous waste landfill	9,946,871	802,572	1,560,000	3,771,551	16,080,993
Total	52,616,024	58,286,783	69,252,816	78,847,261	259,002,883

15.4.25 In relation to the information presented in Table 13, landfill capacity information is published by the Environment Agency in cubic metres, but has been converted to tonnes using the following landfill density conversion factors:

- 1.5 tonnes per cubic metre for inert waste landfill;
- 0.83 tonnes per cubic metre for non-hazardous waste landfill; and
- 1.5 tonnes per cubic metre for hazardous waste landfill.

15.4.26 Table 14 provides baseline capacity and unused capacity data for waste recovery infrastructure (i.e. incineration) for the four regions through which the route of the Proposed Scheme would pass, published by the Environment Agency¹⁷⁷. Unused capacity comprises the difference between the annual inputs and the permitted capacity for the year 2016.

¹⁷⁵ Environment Agency (2016), Waste Management Information 2016. Available online at: <https://www.gov.uk/government/publications/waste-management-for-england-2016>

¹⁷⁶ Numbers do not sum to total due to rounding.

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Table 14: Baseline waste recovery infrastructure capacity by region, 2016

Facility type	North West		West Midlands		East Midlands		Yorkshire and the Humber		Total	
	Capacity (tonnes)	Unused Capacity (tonnes)	Capacity (tonnes)	Unused Capacity (tonnes)	Capacity (tonnes)	Unused Capacity (tonnes)	Capacity (tonnes)	Unused Capacity (tonnes)	Capacity (tonnes)	Unused Capacity (tonnes)
Municipal solid waste, C&I waste incineration	977,100	23,011	1,842,000	329,665	430,000	97,000	1,536,000	173,000	4,785,100	622,676
Other incineration	489,312	205,741	425,960	318,783	688,000	462,000	375,000	243,000	1,978,272	1,229,524
Total	1,466,412	228,752	2,267,960	648,448	1,118,000	559,000	1,911,000	416,000	6,763,372	1,852,200

15.4.27 Table 15 provides baseline waste transfer, waste treatment and metal recycling infrastructure input data for the four regions through which the route of the Proposed Scheme would pass. Waste treatment comprises material recovery facilities, composting and other biological treatment facilities, and other facilities processing waste using physical, physio-chemical, and chemical treatment processes. The baseline information presented is based on site inputs for the year 2016, published by the Environment Agency.

Table 15: Baseline waste transfer, treatment and metal recycling infrastructure input data by region, 2016

Facility type	North West	West Midlands	East Midlands	Yorkshire and the Humber	Total
	Inputs (tonnes)	Inputs (tonnes)	Inputs (tonnes)	Inputs (tonnes)	Inputs (tonnes)
Waste transfer	6,036,646	4,547,464	4,027,000	4,878,000	19,489,110
Waste treatment	15,782,547	5,776,231	6,017,000	8,451,000	36,026,779
Metal recycling	2,368,270	1,685,773	964,000	1,965,000	6,983,043
Total	24,187,464	12,009,469	11,008,000	15,294,000	62,498,932

15.4.28 The data presented in Table 15 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 15.

Future baseline landfill capacity

15.4.29 Taking into account the purpose and scope of this assessment, the future baseline for waste infrastructure capacity is primarily focussed on landfill disposal capacity. It is expected that landfill capacity would continue to be available during the period 2023 to 2033 (for construction) and in 2034 (for first full year of operation).

15.4.30 Landfill void would experience some draw-down of available capacity as waste is deposited and space is used up. Government policy measures to divert waste from landfill should result in less waste being sent to landfill overall.

- 15.4.31 Permitted capacity data published by the Environment Agency has been used to provide an indication of projected landfill capacity for the future baseline. This method provides an indication of projected landfill disposal capacity for each class of landfill as defined by Council Directive 1999/31/EC (the Landfill Directive). This relates to the capacity of inert, non-hazardous and hazardous waste landfill that would be available during the period 2023 to 2033 (for construction) and 2034 (for first full year of operation) within each of the regional areas through which the Proposed Scheme would pass.
- 15.4.32 Projected landfill capacity is based on the average percentage change in permitted landfill capacity for the years 2005 to 2016 as reported by the Environment Agency. The average percentage change has then been applied to the reported 2016 permitted landfill capacity and projected forward to 2034.
- 15.4.33 This method assumes that the average percentage change in permitted capacity for each class of landfill remains constant. Use of an average value taken from historical data provides a reasonable allowance for potential future increases in permitted capacity for each class of landfill, and takes account of waste generation trends driven by development in the respective regional areas. Committed developments of sufficient scale to have the potential to disrupt the general trend in available landfill capacity are assessed separately in the cumulative effects sections.
- 15.4.34 Waste planning authorities have a responsibility under the National Planning Policy for Waste¹⁵⁹, to make provision for sufficient waste infrastructure capacity based on projected waste arisings (over a defined time period), including targets to divert waste from landfill and the need to take account of waste that may need to be imported from other areas for treatment and disposal. Trends in waste generation, the way in which waste is managed, and the timeline of landfill waste diversion policies, show that there is likely to be a continued demand for landfill capacity beyond the assessment period. It is, therefore, likely that waste planning authorities will continue to plan for new landfill sites, both to ensure continued capacity as available void space is exhausted, but also to restore former mineral workings. Subject to receipt of planning permission and other criteria stipulated by waste planning authorities, new permitted landfill capacity is likely to be provided to meet any future gaps in inert, non-hazardous and hazardous waste landfill capacity.
- 15.4.35 The information presented is, therefore, considered to be a reasonable scenario with respect to future landfill capacity within the four regions that form the scope of the study area. This approach takes account of future draw-down and increases in permitted capacity, as well as government policy measures to divert waste from landfill and the requirement for waste planning authorities to provide for future landfill capacity needs.

Future baseline waste treatment and recovery capacity

- 15.4.36 It is expected that various types of waste treatment (recycling) and recovery (incineration) infrastructure capacity would continue to be available during the period 2023 to 2033 (for construction) and in 2034 (for first full year of operation).

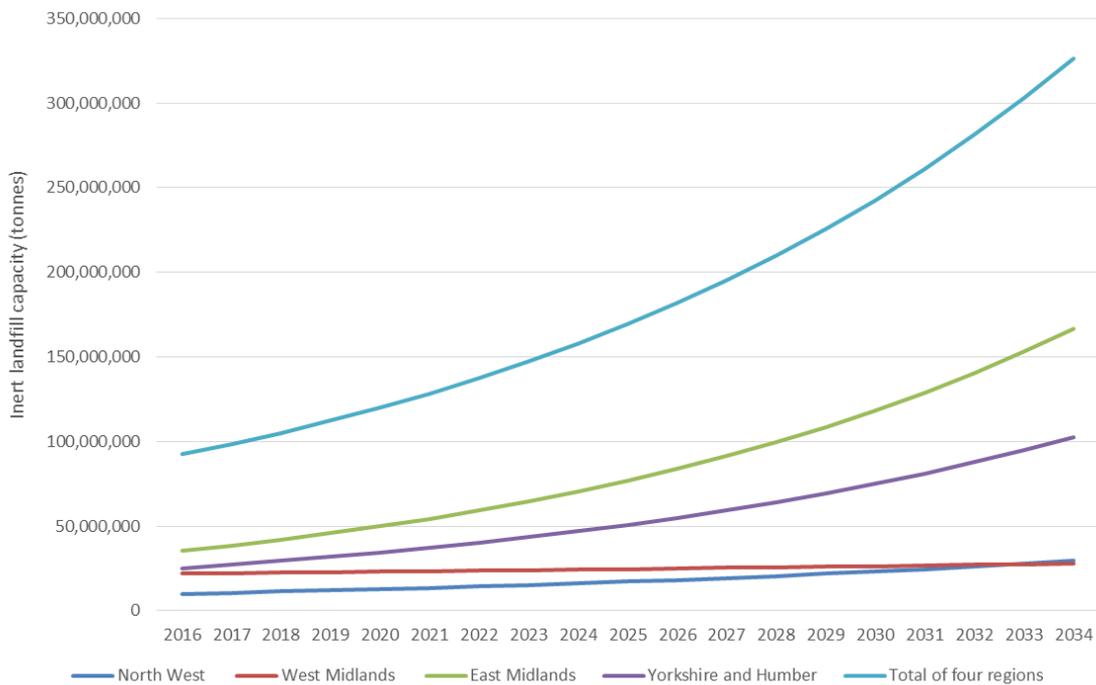
- 15.4.37 Permitted capacity data published by the Environment Agency has been used to provide an indication of projected waste recovery capacity for the future baseline. Data published by the Environment Agency relating to waste treatment infrastructure is limited to inputs (waste received) only; to derive projections of waste treatment infrastructure capacity, it has been assumed that the relationship between inputs and capacity matches that found in the waste recovery market.
- 15.4.38 Waste treatment and recovery facilities are typically characterised by large annual throughput capacities; consequently, large step changes in capacity (as single facilities are commissioned) have an exaggerated impact on the historical trend. Waste treatment and recovery infrastructure capacity and unused capacity cannot, therefore, be realistically projected forward based on the average historical percentage change in permitted capacity as reported by the Environment Agency.
- 15.4.39 Waste infrastructure responds to market demands, and historical trends show that infrastructure is added or removed, not least to cope with changes in waste generation and management. The projected waste treatment and recovery infrastructure capacity has been based on the most recent available data, as presented in Table 13, Table 14 and Table 15, and has been projected forward by aligning growth in capacity with the forecast regional C&I waste growth rates, as presented in Table 12. The average unused capacity has been taken from the Environment Agency data over the years for which consistent data is available, and has been applied to the projected capacity.
- 15.4.40 This method assumes that the quantity of unused waste treatment and recovery infrastructure capacity as a proportion of the total capacity remains constant, and assumes that waste treatment and recovery infrastructure capacity would grow in direct proportion to the waste generation rates in the respective regions.
- 15.4.41 Waste planning authorities have a responsibility to make provision for sufficient waste infrastructure capacity based on projected waste arisings (over a defined time period), including targets to divert waste from landfill and the need to take account of waste that may be imported from other areas for treatment and disposal. Subject to receipt of planning permission and other criteria stipulated by waste planning authorities, new, permitted waste recovery infrastructure capacity is likely to be provided to meet any future gaps.
- 15.4.42 The information presented is, therefore, considered to be a reasonable scenario with respect to future waste treatment and recovery infrastructure capacity within the four regions that form the scope of the study area.

Inert waste landfill capacity

- 15.4.43 Using the latest available published data for the year 2015 as a starting point, Figure 7 shows projected inert waste landfill capacity for the future baseline period 2023 to 2033 (for construction) and the year 2034 (for first full year of operation).

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Figure 7: Projected (future baseline) inert waste landfill capacity by region, 2016 to 2034



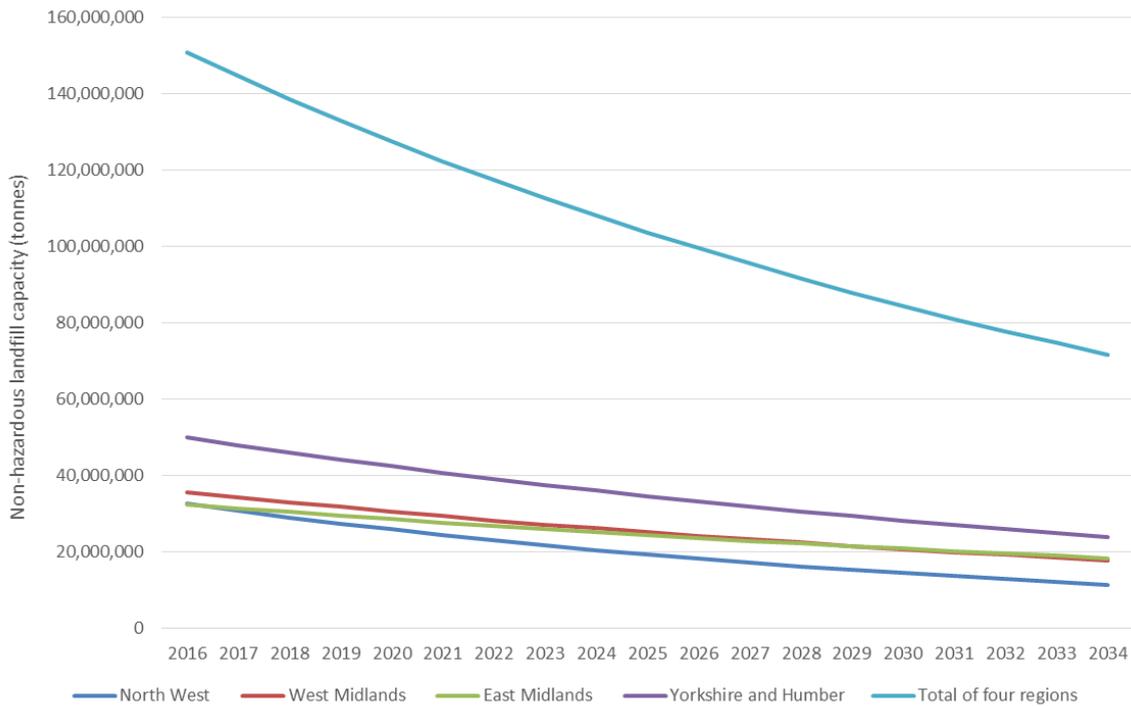
15.4.44 Figure 7 shows that, by 2034, there is forecast to be a combined total of approximately 326 million tonnes of inert waste landfill capacity remaining in the four regions through which the route of the Proposed Scheme would pass. This is a projected increase from approximately 92 million tonnes of inert waste landfill capacity in 2016, which reflects a gradual increase in inert waste landfill capacity in the North West and West Midlands regions during the period, and a more rapid increase in the East Midlands and Yorkshire and Humber regions. The projected growth in inert waste landfill capacity is based on historical trends. However, the forecast relies on a number of external factors including the waste planning authorities making provisions for new waste infrastructure, interest from parties in developing suitable landfill sites, and continued market demand for additional landfill void capacity. Changes in any of these factors would disrupt the projected growth, and may cause future changes in capacity to deviate significantly from the projections shown.

Non-hazardous waste landfill capacity

15.4.45 Using latest available published data for the year 2016 as a starting point, Figure 8 shows projected non-hazardous waste landfill capacity for the future baseline period 2023 to 2033 (for construction) and the year 2034 (first full year of operation).

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Figure 8: Projected (future baseline) non-hazardous waste landfill capacity by region, 2016 to 2034



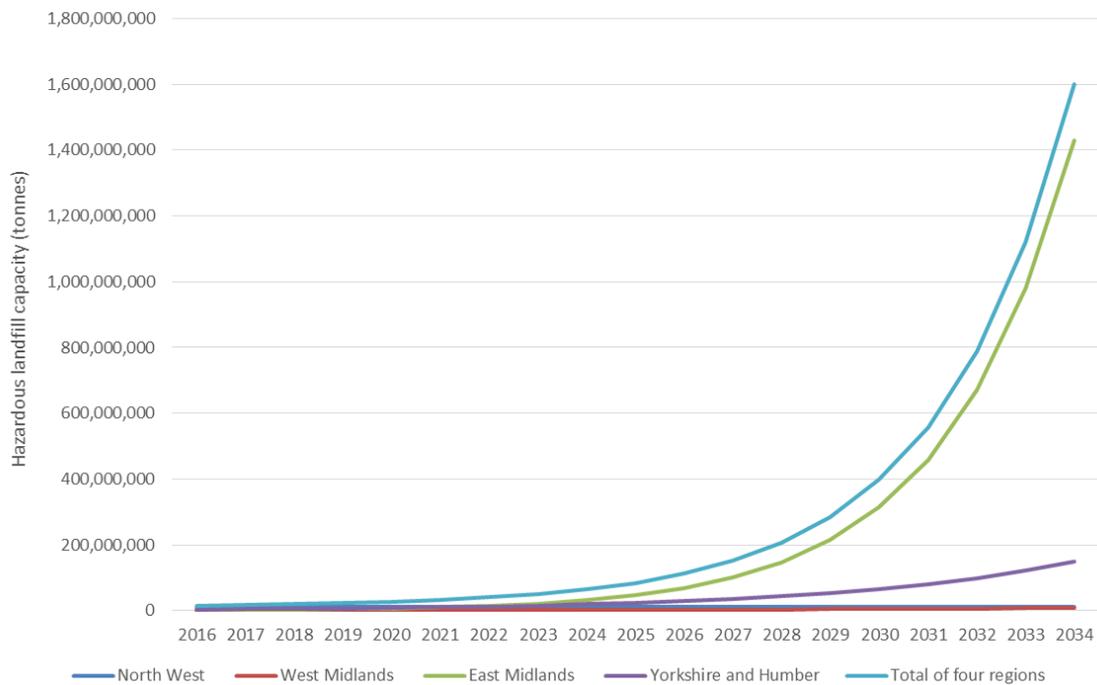
15.4.46 Figure 8 shows that, by 2034, there is forecast to be a combined total of approximately 72 million tonnes of non-hazardous waste landfill capacity remaining in the four regions through which the Proposed Scheme would pass. This is a reduction from approximately 151 million tonnes of non-hazardous waste landfill capacity in 2016, which reflects a gradual decline in non-hazardous waste landfill capacity in all four regions. The projected growth in hazardous waste landfill capacity is based on historical trends. However, the forecast relies on a number of external factors including the waste planning authorities making provisions for new waste infrastructure, interest from parties in developing suitable landfill sites, and continued market demand for additional landfill void capacity. Changes in any of these factors would disrupt the projected growth, and may cause future changes in capacity to deviate significantly from the projections shown.

Hazardous waste landfill capacity

15.4.47 Using the latest available published data for the year 2016 as a starting point, Figure 9 shows projected hazardous waste landfill capacity for the future baseline period 2023 to 2033 (for construction) and the year 2034 (first full year of operation).

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Figure 9: Projected (future baseline) hazardous waste landfill capacity by region, 2016 to 2034



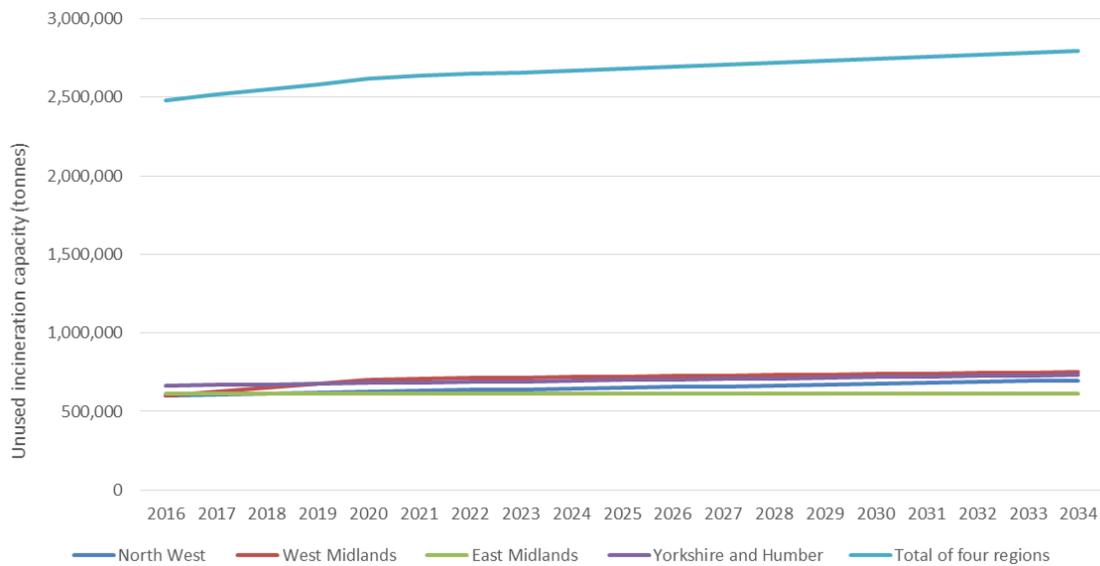
15.4.48 Figure 9 shows that, by 2034, there is projected to be a combined total of approximately 1.6 million tonnes of hazardous waste landfill capacity remaining in the four regions through which the Proposed Scheme would pass. This is an increase from approximately 16 million tonnes of hazardous waste landfill capacity in 2016. The substantial increase in hazardous waste landfill capacity reflects trends in the East Midlands (particularly) and Yorkshire and Humber regions, driven by large hazardous waste landfill sites becoming permitted at a time when capacity was low; this generates large proportional changes in capacity from one year to the next, which is reflected as a large annual increase in capacity in the historical trend used to project forward.

Waste recovery infrastructure capacity

15.4.49 Using the latest available published data for the year 2016 as a starting point, Figure 10 shows projected unused waste recovery infrastructure capacity for the future baseline period 2023 to 2033 (for construction) and the year 2034 (first full year of operation).

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Figure 10: Projected (future baseline) unused waste recovery infrastructure capacity by region, 2016 to 2034

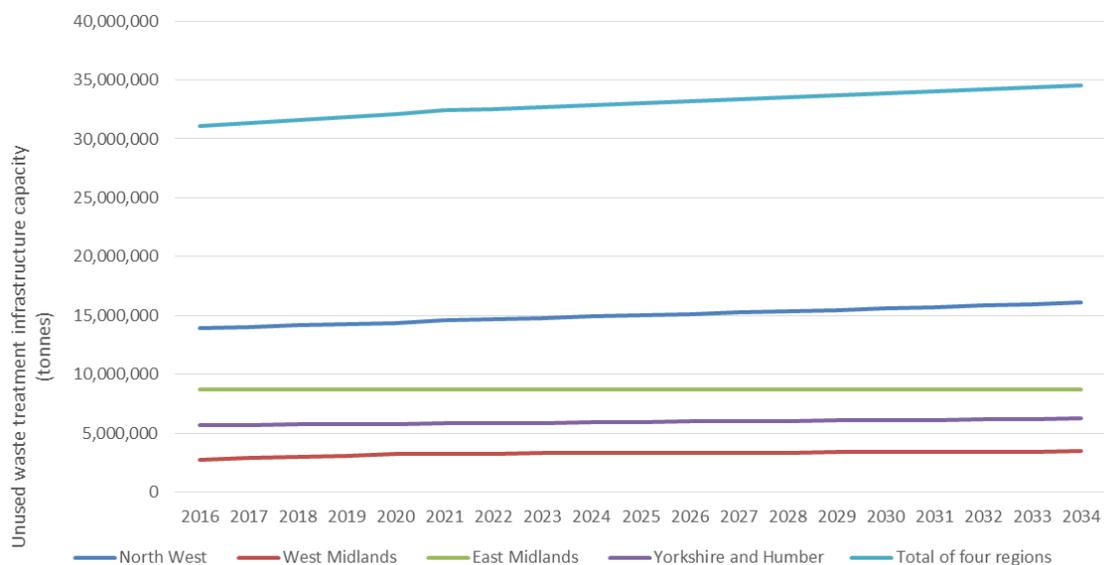


15.4.50 Figure 10 shows that, by 2034, there is forecast to be a combined total of approximately 2.8 million tonnes per annum of unused waste recovery infrastructure capacity in the four regions through which the route of the Proposed Scheme would pass. This represents approximately 36% of the total waste recovery infrastructure capacity projected to be available. This is an increase from approximately 2.5 million tonnes of unused waste recovery infrastructure capacity in 2016, which reflects a gradual increase in all four regions.

Waste treatment infrastructure capacity

15.4.51 Using the latest available published data for the year 2016 as a starting point, Figure 11 shows projected unused waste treatment infrastructure capacity for the future baseline period 2023 to 2033 (for construction) and the year 2034 (first full year of operation).

Figure 11: Projected (future baseline) unused waste treatment infrastructure capacity by region, 2016 to 2034



15.4.52 Figure 11 shows that, by 2034, there is forecast to be a combined total of approximately 34.6 million tonnes per annum of unused waste treatment infrastructure capacity in the four regions through which the route of the Proposed Scheme would pass. This represents approximately 36% of the total waste treatment infrastructure capacity projected to be available. This is an increase from approximately 31.1 million tonnes of unused waste treatment infrastructure capacity in 2016, which reflects a gradual increase in all four regions.

15.5 Assessment of the effects of construction

Assessment of impacts and effects

Excavated material

15.5.1 Table 16 presents a route-wide summary of the forecast excavated material quantities for the Proposed Scheme. This is based on the calculated figures for the integrated earthworks design and reflects the balance of excavated material arising from the Proposed Scheme design. The Proposed Scheme is committed to seeking 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 Proposed Scheme. For the purpose of this assessment, it has been assumed as a worst-case scenario that all surplus material would be disposed off-site to landfill. A detailed excavated material quantity forecast will be provided in the formal ES.

Table 16: Forecast excavated material quantities for the Proposed Scheme, 2023 to 2033

Excavated material management methods	Total quantity (tonnes)	Proportion of Proposed Scheme total
Quantity of excavated material reused for engineering and environmental mitigation earthworks (including all topsoil and agricultural subsoil)	84,635,306	60%
Quantity of surplus excavated material for off-site disposal to landfill ¹⁷⁸	57,199,338	40%
Total	141,834,645	100%

15.5.2 The Proposed Scheme would generate approximately 142 million tonnes of excavated material during the period 2023 to 2033.

15.5.3 It is estimated that 60% of the excavated material generated by the Proposed Scheme would be used to satisfy the necessary requirements for fill on a route-wide basis. The fill requirement for the Proposed Scheme comprises predominantly engineering fill for rail and highways use and environmental mitigation fill for bunds and landscaping. Excavated material used as engineering fill material and for environmental mitigation

¹⁷⁸ All topsoil and agricultural subsoil generated by the Proposed 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 Proposed Scheme. It is expected that beneficial reuse opportunities would be found for surplus topsoil and agricultural subsoil, either within the Proposed Scheme, or off-site in nearby development projects.

earthworks within the Proposed Scheme would include the following classes of material as defined by the Specification for Highway Works, Series 601 Classification, Definitions and Uses of Earthworks Materials¹⁷⁹:

- Class 1 and Class 3 general railway fill;
- Class 2 general railway fill and general highway fill;
- Class 4 environmental mitigation earthworks fill;
- Class 6 selected fill;
- unacceptable material classes U1A and U1B (treated)¹⁸⁰; and
- topsoil and agricultural subsoil.

15.5.4 The estimated quantity of surplus excavated material that would not be reused within the construction of the Proposed Scheme would be approximately 4.0% of the overall excavated material that would be generated on a route-wide basis, based on the current level of design. This would comprise:

- 55,966,844 tonnes of general fill and landscape fill, not required for use in the Proposed Scheme, which would require off-site disposal to inert landfill;
- 172,779 tonnes of chemically unacceptable U1B materials¹⁸¹, which cannot be treated on-site, and would require off-site disposal to non-hazardous landfill; and
- 202,824 tonnes of chemically unacceptable U2 materials, which would require off-site disposal to hazardous landfill.

Demolition material and waste

15.5.5 Demolition material quantities have been estimated using the Waste & Resources Action Programme 'Demolition bill of quantities estimator'¹⁸², which uses the basic dimensions and typology of buildings to be demolished. Using this methodology, the Proposed Scheme would generate approximately 1.68 million tonnes of demolition material during the construction period of 2023 to 2033.

15.5.6 Table 17 presents a summary of the forecast demolition material and waste quantities for the Proposed Scheme. A regional and route-wide summary is shown to indicate where along the route demolition materials would be generated and managed. A detailed demolition material and waste quantity forecast will be provided in the formal ES.

¹⁷⁹ Department for Transport (2014 and as amended), Manual of Contract Documents for Highway Works, Volume 1 – Specification for Highway Works. Available online at: <http://www.standardsforhighways.co.uk/ha/standards/mchw/vol1/index.htm>

¹⁸⁰ 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).

¹⁸¹ 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.

¹⁸² Waste & Resources Action Programme (2016), Net Waste Tool. Available online at: <http://nwttool.wrap.org.uk/>

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Table 17: Forecast demolition material and waste quantities (by region) for the Proposed Scheme, 2023 to 2033

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	512,313	461,081	51,231
West Midlands	53,624	48,262	5,362
East Midlands	318,538	286,684	31,854
Yorkshire and Humberside	794,467	715,020	79,447
Total	1,678,942	1,511,047	167,894

- 15.5.7 The quantity of demolition material that would 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). Whilst 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 the Proposed Scheme. It has been chosen as a reasonable worst-case scenario likely to represent a realistic achievement. It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment that the remaining 10% of demolition material would be disposed of off-site to landfill.
- 15.5.8 The quantity of demolition waste that would require off-site disposal to landfill during the construction period of 2023 to 2033 would be approximately 167,900 tonnes. The remaining 1.51 million tonnes is expected to require management at suitable waste recovery and treatment infrastructure.
- 15.5.9 The Overview of Demolition Waste in the UK¹⁸³ 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 approximately 3% of demolition waste produced in the UK is hazardous and a further 6% of demolition waste is sent to non-hazardous waste landfill. For the purpose of this assessment, it has been assumed that 60% of the quantity of demolition waste requiring off-site disposal to landfill would be non-hazardous waste and 40% would be hazardous waste.
- 15.5.10 Based on this assumption, the class of landfill to which demolition waste would be sent for disposal is shown in Table 18.

¹⁸³ Waste & Resources Action Programme (2009), Overview of Demolition Waste in the UK. Available online at: <http://www.wrap.org.uk/sites/files/wrap/CRWP-Demolition-Report-2009.pdf>

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Table 18: Quantity of demolition waste requiring off-site disposal to landfill (by class of landfill), 2023 to 2033

Class of landfill	Total quantity (tonnes)	Proportion
Quantity of demolition waste for off-site disposal to inert waste landfill	0	0%
Quantity of demolition waste for off-site disposal to non-hazardous waste landfill	100,736	60%
Quantity of demolition waste for off-site disposal to hazardous waste landfill	67,158	40%
Total	167,894	100%

Construction waste

- 15.5.11 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 Proposed Scheme is forecast to generate approximately 4.18 million tonnes of construction waste during the construction period of 2023 to 2033.
- 15.5.12 Table 19 presents a summary of the forecast construction waste quantities for the Proposed Scheme. A regional and route-wide summary is shown to provide an indication of where along the route of the Proposed Scheme construction waste would be generated and managed. A detailed construction waste quantity forecast will be provided in the formal ES.

Table 19: Forecast construction waste quantities (by region) for the Proposed Scheme, 2023 to 2033

Regional area	Total quantity of waste (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	1,212,842	1,091,558	121,284
West Midlands	209,268	188,341	20,927
East Midlands	1,294,381	1,164,943	129,438
Yorkshire and the Humber	1,459,488	1,313,540	145,949
Total	4,175,980	3,758,382	417,598

- 15.5.13 The quantity of construction waste that would 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). Whilst HS2 Ltd is seeking, in its works contracts, to achieve a landfill diversion of construction 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 the Proposed Scheme. It has been chosen as a reasonable worst-case scenario likely to represent a realistic achievement. The quantity of construction waste that would require management using available waste treatment and recovery infrastructure

during the construction period of 2023 to 2033 would be approximately 3.76 million tonnes.

- 15.5.14 It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment, that the remaining 10% of construction waste generated would be disposed of off-site to landfill. The quantity of construction waste that would require off-site disposal to landfill during the construction period of 2023 to 2033 would be approximately 417,600 tonnes.
- 15.5.15 It has been assumed for the purpose of this assessment that all of the construction waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill. This is based on indicative construction waste composition information published by the Building Research Establishment¹⁸⁴, Strategic Forum for Construction¹⁸⁵ and Waste & Resources Action Programme¹⁸⁶. 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

- 15.5.16 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 Proposed Scheme would generate approximately 3,799 tonnes of worker accommodation site waste during the construction period of 2023 to 2033. Worker accommodation site waste would be managed as C&I waste. A detailed worker accommodation waste quantity forecast will be provided in the formal ES.
- 15.5.17 Table 20 presents a summary of the forecast worker accommodation site waste quantities for the Proposed Scheme. A regional and route-wide summary is shown to provide an indication of where along the route worker accommodation site waste would be generated and managed.

¹⁸⁴ Building Research Establishment (2001), SMARTWaste case studies: reducing construction waste. Available online at: <http://www.smartwaste.co.uk/smartaudit/downloads/chiswick.pdf>

¹⁸⁵ Strategic Forum for Construction (2011), Waste: An Action Plan for halving construction, demolition and excavation waste to landfill. Available online at: <http://www.greenconstructionboard.org/otherdocs/10WasteActionPlan.pdf>

¹⁸⁶ Waste & Resources Action Programme (2005), Reference document on the status of wood waste arisings and management in the UK. Available online at: <http://www.bvsde.paho.org/bvsacd/cd43/wood.pdf>

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Table 20: Forecast worker accommodation site waste quantities (by region) for the Proposed Scheme, 2023 to 2033

Regional area	Total quantity of waste (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	194	97	97
West Midlands	580	290	290
East Midlands	1,784	892	892
Yorkshire and the Humber	173	87	87
Total	2,732	1,366	1,366

- 15.5.18 The quantity of worker accommodation site waste that would be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 50%. Waste generated by occupants of worker accommodation sites would be similar in composition to household waste. As such, this rate has been selected based on a review of national household waste targets for England and Wales. The quantity of worker accommodation site waste that would require off-site management through waste treatment and recovery infrastructure during the construction period of 2023 to 2033 would be approximately 1,366 tonnes.
- 15.5.19 It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment, that the remaining 50% of worker accommodation site waste would be disposed of off-site to landfill. The quantity of worker accommodation site waste that would require off-site disposal to landfill during the construction period of 2023 to 2033 would be approximately 1,366 tonnes.
- 15.5.20 It has been assumed for the purpose of this assessment that all of the worker accommodation site waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill.

Impact of construction on future baseline waste arisings

Construction, demolition and excavation waste

- 15.5.21 Table 21 provides a summary of material and waste quantities forecast to be generated by excavation, demolition and construction works for the Proposed Scheme during the period 2023 to 2033.

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Table 21: Summary of material and waste quantities that would be generated by excavation, demolition and construction works of the Proposed Scheme, 2023 to 2033

Source	Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Excavation	141,834,645	84,635,306	57,199,338
Demolition	1,678,942	1,511,047	167,894
Construction	4,175,980	3,758,382	417,598
Total	147,689,567	89,904,736	57,784,831
Proportion	100%	61%	39%

- 15.5.22 Table 21 shows that the Proposed Scheme would generate approximately 148 million tonnes of excavated material, demolition material and construction waste during the period 2023 to 2033. Approximately 61% of this quantity would be diverted from landfill via reuse, recycling and recovery, based on current level of design.
- 15.5.23 The impact of this material and waste generation and its off-site treatment, recovery or disposal to landfill is shown in Table 22 as the percentage difference between future baseline CDEW arisings with and without the Proposed Scheme.
- 15.5.24 Future baseline CDEW arisings are presented as the total quantity projected to be generated during the period 2023 to 2033. This is to provide a direct comparison with the total quantity of excavated material, demolition material and construction waste that would be generated during construction of the Proposed Scheme.

Table 22: Impact of CDEW would be generated by the Proposed Scheme, 2023 to 2033

Future baseline scenario with and without the Proposed Scheme	National change			Regional change ¹⁸⁷		
	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to landfill (tonnes)	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to landfill (tonnes)
Future baseline waste arisings 2023 to 2033 without the Proposed Scheme	1,567,020,070 ¹⁸⁸	1,165,245,616	401,774,454	363,685,905 ¹⁸⁹	259,887,444	103,798,461
Proposed Scheme material and waste arisings 2023 to 2033	147,689,567	5,269,429	57,784,831	147,689,567	5,269,429	57,784,831

¹⁸⁷ Based on future baseline CDEW arisings and CDEW to landfill for the aggregated four regions.

¹⁸⁸ Based on the future baseline national CDEW arisings projections as set out in Table 8.

¹⁸⁹ Based on the future baseline regional CDEW arisings projections as set out in Table 9.

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Future baseline scenario with and without the Proposed Scheme	National change			Regional change ¹⁸⁷		
	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to landfill (tonnes)	CDEW arisings (tonnes)	CDEW arisings to treatment and recovery (tonnes)	CDEW arisings to landfill (tonnes)
Future baseline waste arisings 2023 to 2033 with the Proposed Scheme	1,714,709,637	1,170,515,045	459,559,285	511,375,471	265,156,873	161,583,292
Increase in future baseline waste arisings with the Proposed Scheme	9%	0.5%	14%	41%	2.0%	56%

15.5.25 Table 22 shows that the total quantity of excavated material, demolition material and construction waste generated by the Proposed Scheme would be equivalent to approximately 9% of national and 41% of regional future baseline CDEW arisings during the period 2023 to 2033.

15.5.26 The total quantity of surplus excavated material, demolition waste and construction waste generated by the Proposed Scheme that would require off-site disposal to landfill would be equivalent to approximately 14% of national and 56% of regional future baseline CDEW arisings to landfill during that time.

15.5.27 The total quantity of demolition waste and construction waste generated by the Proposed Scheme that would require off-site management in waste recovery and treatment infrastructure would be equivalent to approximately 0.5% of national and 2% of regional future baseline CDEW arisings managed in waste recovery and treatment infrastructure during that time.

Commercial and industrial waste

15.5.28 The impact of worker accommodation site waste generation and off-site treatment, recovery or disposal to landfill is shown in Table 23 as the percentage difference between future baseline C&I waste arisings with and without the Proposed Scheme.

15.5.29 Future baseline C&I waste arisings are presented as the total quantity projected to be generated during the period 2023 to 2033. This is to provide a direct comparison with the total quantity of C&I waste that would be generated during construction of the Proposed Scheme.

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Table 23: Impact of C&I waste arisings generated by the Proposed Scheme, 2023 to 2033

Future baseline scenario with and without the Proposed Scheme	National change			Regional change ¹⁹⁰		
	C&I waste arisings (tonnes)	C&I waste arisings to treatment and recovery (tonnes)	C&I waste arisings to landfill (tonnes)	C&I waste arisings (tonnes)	C&I waste arisings to treatment and recovery (tonnes)	C&I waste arisings to landfill (tonnes)
Future baseline waste arisings 2023 to 2033 without the Proposed Scheme	421,585,172 ¹⁹¹	322,363,825	99,221,348	311,498,436 ¹⁹²	233,594,457	77,903,979
Proposed Scheme material and waste arisings 2023 to 2033	3,799	1,899	1,900	3,799	1,899	1,900
Future baseline waste arisings 2023 to 2033 with the Proposed Scheme	421,588,971	322,365,724	99,223,248	311,502,235	233,596,356	77,905,879
Increase in future baseline waste arisings with the Proposed Scheme	0.0009%	0.0006%	0.0019%	0.0012%	0.0008%	0.0024%

15.5.30 Table 23 shows that the total quantity of worker accommodation site waste generated by the Proposed Scheme would be equivalent to less than 0.01% of national and regional future baseline C&I waste arisings during the period 2023 to 2033.

15.5.31 The total quantity of worker accommodation site waste that would require off-site disposal to landfill would be equivalent to less than 0.01% of national and regional future baseline C&I waste arisings to landfill during that time.

15.5.32 The total quantity of worker accommodation site waste generated by the Proposed Scheme that would require off-site management in waste treatment and recovery infrastructure would 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.

Likely significant environmental effects

Inert waste landfill capacity

15.5.33 Subject to waste acceptance criteria set out in the Landfill Directive¹⁹³ and the Proposal for a Council Decision Establishing Criteria and Procedures for the

¹⁹⁰ Based on future baseline CDEW arisings and CDEW to landfill for the aggregated four regions.

¹⁹¹ Based on the future baseline national C&I arisings projections as set out in Table 11.

¹⁹² Based on the future baseline regional C&I arisings projections as set out in

Table 12

¹⁹³ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>

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Acceptance of Waste at Landfills, the total quantity of inert waste arising from the construction of the Proposed Scheme that would require off-site disposal to landfill during the period 2023 to 2033 is approximately 56.8 million tonnes (see Table 24). This quantity represents approximately 98% of the total waste generated during construction requiring off-site disposal to landfill.

Table 24: Quantity of waste requiring off-site disposal to inert waste landfill, 2023 to 2033

Waste source	Total quantity (tonnes)	Proportion
Excavation	56,823,735	100%
Demolition	0	0%
Construction	0	0%
Worker accommodation sites	0	0%
Total	56,823,735	100%

- 15.5.34 Off-site disposal of inert surplus excavated material to landfill would result in an overall reduction of inert waste landfill void space of approximately 56.8 million tonnes.
- 15.5.35 This would be equivalent to a 19% reduction in inert waste landfill capacity void space across the aggregated four regions according to the amount of capacity projected to be available at the end of construction in 2033 (approximately 303 million tonnes). On this basis, it is considered that there would be sufficient inert waste landfill capacity available in the aggregated four regions to accept the forecast quantity of inert surplus excavated material for off-site disposal to landfill.
- 15.5.36 The western leg of the Proposed Scheme is isolated from the eastern leg by a considerable distance; it is, therefore, considered likely that inert waste generated in this leg of the Proposed Scheme would be managed within the regional area in which it is generated. The western leg of the Proposed Scheme is entirely situated within the North West former regional planning area, and it is therefore likely to be reliant on inert waste landfill void space in this single region for managing inert waste.
- 15.5.37 Off-site disposal to landfill of inert surplus excavated material generated by the western leg of the Proposed Scheme, would result in an overall reduction of inert waste landfill void space of approximately 7.3 million tonnes. This would be equivalent to a 26% reduction in inert waste landfill capacity void space across the North West region according to the amount of capacity projected to be available at the end of construction in 2033 (approximately 28 million tonnes). On this basis, it is considered that there would 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.
- 15.5.38 The draw-down of inert waste landfill void space as a result of the Proposed Scheme would 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 would take place primarily over a seven-year period during the construction of the Proposed Scheme.

- 15.5.39 All of the inert waste forecast to arise would be surplus excavated material and assuming that the earthworks take place primarily over a seven-year period at a fairly constant rate of generation throughout this period, the total quantity of inert surplus excavated material requiring off-site disposal to landfill would be approximately 8.1 million tonnes per annum.
- 15.5.40 Significance criteria for inert waste landfill capacity, state that a regional-scale reduction in inert waste landfill void space capacity of between two and ten million tonnes per annum may be judged to be of importance in the regional planning context.
- 15.5.41 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 Proposed Scheme would be moderate adverse, which is considered to constitute a significant effect.

Non-hazardous waste landfill capacity

- 15.5.42 Subject to waste acceptance criteria set out in the Landfill Directive¹⁹⁴ and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills¹⁹⁵, the total quantity of non-hazardous waste arising from the construction of the Proposed Scheme that would require off-site disposal to landfill during the period 2023 to 2033 is approximately 693,000 tonnes (see Table 25). The majority (approximately 60%) would comprise construction waste. Smaller quantities of non-hazardous waste would be generated by excavation, demolition and worker accommodation activities.

Table 25: Quantity of waste requiring off-site disposal to non-hazardous waste landfill, 2023 to 2033

Waste source	Total quantity (tonnes)	Proportion
Excavation	172,779	24.9%
Demolition	100,736	14.5%
Construction	417,598	60.3%
Worker accommodation sites	1,900	0.3%
Total	693,013	100%

- 15.5.43 Off-site disposal of non-hazardous surplus excavated material, demolition, construction and worker accommodation waste would result in an overall reduction of

¹⁹⁴ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>

¹⁹⁵ 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/LexUriServ/LexUriServ.do?uri=CELEX:52002PC0512:EN:NOT>

non-hazardous waste landfill void space of 693,000 tonnes throughout the ten-year construction period.

- 15.5.44 This would be equivalent to a 0.93% reduction in non-hazardous waste landfill capacity void space across the aggregated four regions according to the amount of capacity projected to be available at the end of construction in 2033 (approximately 75 million tonnes).
- 15.5.45 On this basis, it is considered that there would be sufficient non-hazardous waste landfill capacity available in the aggregated four regions to accept the forecast quantity of non-hazardous surplus excavated material, demolition and construction waste for off-site disposal to landfill.
- 15.5.46 The western leg of the Proposed Scheme is separated from the eastern leg by the Pennine Hills and a considerable distance (approximately 50-80km). It is therefore considered likely that non-hazardous waste generated in the western leg of the Proposed Scheme would be managed within the regional area in which it is generated. The western leg of the Proposed Scheme is entirely situated within the North West former regional planning area, and it is therefore likely to be reliant on non-hazardous waste landfill void space in this region for managing non-hazardous waste.
- 15.5.47 Off-site disposal to landfill of non-hazardous waste generated by the western leg of the Proposed Scheme, would result in an overall reduction of non-hazardous waste landfill void space of approximately 152,700 tonnes. This would be equivalent to a 1.25% reduction in inert waste landfill void space capacity across the North West region according to the amount of capacity projected to be available at the end of construction in 2033 (approximately 12 million tonnes). This represents a marginally greater impact than the route-wide picture presents. On this basis, it is considered that there would be sufficient non-hazardous waste landfill capacity available in the North West region to accept the forecast quantity of non-hazardous waste for off-site disposal to landfill. Table 25 shows that non-hazardous waste would be generated by a range of construction activities that would occur throughout the ten-year duration of construction of the Proposed Scheme.
- 15.5.48 Consequently, the draw-down of non-hazardous waste landfill void space as a result of the Proposed Scheme would occur over a period of several years and is unlikely to draw-down projected capacity to an extent where there is an immediate, significant need for additional non-hazardous waste landfill capacity to be made available in these areas.
- 15.5.49 Assuming a constant rate of waste generation throughout the construction period, the total quantity of non-hazardous waste requiring off-site disposal to landfill would be approximately 69,301 tonnes per annum.
- 15.5.50 Significance criteria for non-hazardous waste landfill capacity state that a regional-scale reduction in non-hazardous waste landfill void space of between 50,000 and 250,000 tonnes per annum, may be judged to be important in the local planning context.

- 15.5.51 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 Proposed Scheme would be moderate adverse, which is considered to constitute a significant effect.

Hazardous waste landfill capacity

- 15.5.52 Subject to waste acceptance criteria set out in the Landfill Directive¹⁹⁶ and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills¹⁹⁷, the total quantity of hazardous waste arising from the construction of the Proposed Scheme requiring off-site disposal to landfill during the period 2023 to 2033 is approximately 270,000 tonnes (see Table 26). This quantity comprises Unacceptable Class U2 surplus excavated material that would be unsuitable for use in the construction of the Proposed Scheme due to its hazardous properties, and hazardous waste generated by demolition activities.

Table 26: Quantity of waste requiring off-site disposal to hazardous waste landfill, 2023 to 2033

Waste source	Total quantity (tonnes)	Proportion
Excavation	202,824	75%
Demolition	67,158	25%
Construction	0	0%
Worker accommodation sites	0	0%
Total	269,982	100%

- 15.5.53 Off-site disposal of hazardous waste would result in an overall reduction of hazardous waste landfill void space of approximately 270,000 tonnes throughout the construction period of 10 years.
- 15.5.54 This would be equivalent to a 0.02% reduction in hazardous waste landfill void space across the aggregated four regions according to the amount of capacity projected to be available at the end of construction in 2033 (approximately 1,120 million tonnes). The projected capacity in 2033 reflects a trend driven by large increases in hazardous waste landfill capacity in the East Midlands, and is likely to present an overoptimistic scenario of the quantity of hazardous waste landfill void space available in the East Midlands in 2033. Nevertheless, the total quantity of hazardous waste that would be generated by the Proposed Scheme, could be disposed of in hazardous waste landfill in any one of the four regions through which the route passes, without the reduction in hazardous waste landfill void space in that region exceeding 3% according to the amount of capacity projected to be available at the end of construction in 2033.

¹⁹⁶ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>

¹⁹⁷ 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/LexUriServ/LexUriServ.do?uri=CELEX:52002PC0512:EN:NOT>

- 15.5.55 The western leg of the Proposed Scheme is separated from the eastern leg by the Pennine Hills and a considerable distance (approximately 50-80km). However, due to the distances that hazardous waste is commonly transferred for disposal due to there being fewer hazardous waste landfill sites compared to inert and non-hazardous landfill sites, it is likely that hazardous waste generated in the western leg of the Proposed Scheme would be managed within any of the four regions through which the route of the Proposed Scheme passes. There is therefore no justification for considering the western leg of the Proposed Scheme in isolation from the east leg.
- 15.5.56 Assuming a constant rate of waste generation throughout the construction period, the total quantity of hazardous waste requiring off-site disposal to landfill would be approximately 27,000 tonnes per annum.
- 15.5.57 Significance criteria for hazardous waste landfill capacity state that a regional-scale reduction in hazardous waste landfill void space capacity of between 20,000 and 100,000 tonnes per annum, may be judged to be important in the local planning context.
- 15.5.58 According to the significance criteria applicable to hazardous waste landfill capacity, the likely significant environmental effects associated with the off-site disposal to landfill of hazardous surplus excavated material, construction and demolition waste generated by the Proposed Scheme would be moderate adverse, which is considered to constitute a significant effect.

Other mitigation measures

General

- 15.5.59 Management of CDEW and worker accommodation site waste generated by the Proposed Scheme would be subject to the Environmental Minimum Requirements (EMR) presented within Volume 1: Introduction and methodology, Section 1.
- 15.5.60 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.
- 15.5.61 It is likely that a large proportion of the hazardous demolition waste would 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 and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills. This would reduce reliance on hazardous waste landfill capacity.

Waste recovery

- 15.5.62 The total quantity of waste arising from the construction of the Proposed Scheme that would be diverted from landfill and would require off-site management in waste treatment and recovery infrastructure during the period 2023 to 2033 is approximately 5.3 million tonnes (see Table 27). This quantity comprises waste generated by

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demolition, construction, and worker accommodation camps that would be diverted from landfill through segregation.

Table 27: Quantity of waste requiring off-site management in waste treatment and recovery infrastructure, 2023 to 2033

Waste source	Total quantity (tonnes)	Proportion
Excavation	0	0%
Demolition	1,511,047	29%
Construction	3,758,382	71%
Worker accommodation sites	1,900	0%
Total	5,271,329	100%

- 15.5.63 Assuming a constant rate of waste generation throughout the ten-year construction period, the total quantity of demolition, construction and worker accommodation waste diverted from landfill would be approximately 527,100 tonnes per annum. Off-site management of this waste in waste recovery and treatment infrastructure, would result in an overall reduction equivalent to 1.4% of unused waste treatment and recovery infrastructure capacity across the aggregated four regions according to the amount of unused capacity projected to be available in the final year of construction in 2033 (approximately 37 million tonnes).
- 15.5.64 On this basis, it is considered that there would be sufficient unused waste recovery and treatment infrastructure capacity available in the aggregated four regions to accept the forecast quantity of demolition, construction and worker accommodation waste diverted from landfill.
- 15.5.65 The western leg of the Proposed Scheme is separated from the eastern leg by the Pennine Hills and a considerable distance (approximately 50-80km). It is therefore considered likely that the demolition, construction and worker accommodation waste diverted from landfill in the western leg of the Proposed Scheme would be managed within the regional area in which it is generated. The western leg of the Proposed Scheme is entirely situated within the North West former regional planning area, and it is therefore likely to be reliant on waste treatment and recovery infrastructure in this region for managing the waste.
- 15.5.66 Off-site management of the waste diverted from landfill in the western leg of the Proposed Scheme, at waste treatment and recovery infrastructure, would result in a reduction equivalent to 0.97% of unused waste treatment and recovery infrastructure capacity in the North West region. This represents a lower impact than the route-wide picture presents, and results from the large quantity of unused waste treatment and recovery capacity projected to be available in the North West in the final year of construction in 2033 (approximately 16 million tonnes), as shown in Figure 10 and Figure 11. On this basis, it is considered that there would be sufficient waste treatment and recovery infrastructure capacity available in the North West region to accept the forecast quantity of waste diverted from landfill.

Summary of likely residual significant environmental effects

15.5.67 On the basis of the other mitigation measures proposed, the likely residual significant environmental effects from construction would be:

- moderate adverse in relation to inert waste landfill capacity;
- moderate adverse in relation to non-hazardous waste landfill capacity; and
- moderate adverse in relation to hazardous waste landfill capacity.

15.6 Assessment of the effects of operation

Avoidance and mitigation measures

15.6.1 Outline waste segregation and storage strategies have been developed to inform the preliminary design of railway stations for the Proposed Scheme. This is to ensure that sufficient waste storage and collection access provision is incorporated early on in the design process to facilitate segregation of waste and recyclable materials during operation. Measures would include:

- provision of public realm litter and recycling bins for train passengers and other users of railway stations;
- provision of secure containers for use by train operating companies and railway station tenants; and
- use of compactors and baling equipment to improve collection payloads and facilitate opportunities to derive revenue streams for large quantities of recyclable material such as cardboard.

15.6.2 During operation, waste from passenger trains and rolling stock depots would be managed in accordance with the waste hierarchy by the train operating company (or its fleet maintenance contractor in the case of rolling stock maintenance waste). Waste generated by track maintenance and other ancillary infrastructure would also be managed in accordance with the waste hierarchy by Network Rail and/or the train operating company.

Assessment of impacts and effects

Waste forecast

Railway station and train waste

15.6.3 Railway station and train waste refers to waste that would arise at railway stations along the route of the Proposed Scheme including East Midlands hub¹⁹⁸, Leeds¹⁹⁹, Crewe²⁰⁰, Manchester Airport²⁰¹ and Manchester Piccadilly²⁰².

15.6.4 All stations would produce waste associated with their individual operating functions such as retail units and food and beverage outlets, but only terminus stations would

¹⁹⁸ Lo5 Kegworth to Stapleford (inclusive of the East Midlands Hub station at Toton)

¹⁹⁹ LA18 Leeds Station

²⁰⁰ MAo1 Hough to Walley's Green

²⁰¹ MAo6 Hulseheath to Manchester Airport

²⁰² MAo8 Manchester Piccadilly Station

produce waste from trains that is associated with their operation, such as on-board passenger litter bins and catering carriages.

- 15.6.5 Table 28 presents a regional and route-wide summary of forecast railway stations and train waste quantities for the Proposed Scheme in 2034. It has been assumed that railway station and train waste would be largely managed within the region in which it arises. A detailed railway station and train waste quantity forecast will be provided in the formal ES.
- 15.6.6 Railway station and train waste quantities have been estimated based on a waste generation rate of 0.085 kg per station user²⁰³. Recent trends in waste generation data indicate a decline in waste generation per station user; waste forecasts undertaken using this generation rate are therefore likely to represent a worst-case scenario. The Proposed Scheme would generate approximately 4,262 tonnes of railway station and train waste during the first full year of operation in 2034.

Table 28: Forecast railway station and train waste quantities by region, 2034

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	1,825	1,095	730
West Midlands	0	0	0
East Midlands	1,164	699	466
Yorkshire and the Humber	1,272	763	509
Total	4,262	2,557	1,705

- 15.6.7 The quantity of railway station and train waste that would be diverted from landfill by reuse, recycling and recovery is based on a landfill diversion rate of 60%. This rate has been selected based on the revised EU legislative proposals for waste, targeting a minimum of 60% reuse and recycling of municipal waste by weight by 2025, and 65% by 2030.
- 15.6.8 It has been assumed, as a reasonable worst-case scenario for the purposes of this assessment that the remaining 40% of railway station and train waste would be disposed of off-site to landfill. The quantity of railway station and train waste that would require off-site disposal to landfill in 2034 would be approximately 1,705 tonnes.
- 15.6.9 It has been assumed that for the purposes of this assessment that all railway station and train waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill.

²⁰³ Defined as number of passengers entering and exiting through ticket barriers. For further details, see Waste forecast and assessment methodology technical note, which can be found in the EIA SMR.

Rolling stock maintenance waste

- 15.6.10 Rolling stock maintenance waste refers to waste that would be generated by the relevant train operating company rolling stock maintenance depots in Stourton to Hunslet, Wimboldsley to Lostock Gralam and Pickmere to Agden and Hulseheath.
- 15.6.11 Table 29 presents a regional and route-wide summary of the forecast rolling stock maintenance waste quantities for the Proposed Scheme in 2034²⁰⁴.
- 15.6.12 Rolling stock maintenance waste has been estimated based in a waste generation rate of 0.3 tonnes per square metre per year applied to the gross floor area of the rolling stock maintenance and people mover depot areas²⁰⁵. Using this methodology, the Proposed Scheme would generate 21,000 tonnes of rolling stock maintenance waste during the first full year of operation in 2034. A detailed rolling stock maintenance waste quantity forecast will be provided in the formal ES.

Table 29: Forecast rolling stock maintenance depot waste quantities by region, 2034

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	9,000	7,200	1,800
West Midlands	0	0	0
East Midlands	0	0	0
Yorkshire and the Humber	12,000	9,600	2,400
Total	21,000	16,800	4,200

- 15.6.13 The quantity of rolling stock maintenance waste that would be diverted from landfill by reuse, recycling, and recovery is based on a landfill diversion rate of 80%. This rate has been selected following a review of the evidence base from Network Rail and other organisations involved in train fleet maintenance in the UK.
- 15.6.14 It has been assumed, as a reasonable worst-case scenario for the purposes of this assessment, that the remaining 20% of rolling stock maintenance waste would be disposed of off-site to landfill. The quantity of rolling stock maintenance waste that would require off-site disposal to landfill in 2034 would be approximately 4,200 tonnes.
- 15.6.15 It has been assumed for the purposes of this assessment that all the rolling stock maintenance waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill. It has been assumed that the potential for hazardous waste arisings is negligible and consequently the impacts on hazardous waste landfill have not been assessed.

²⁰⁴ It has been assumed that rolling stock maintenance waste would be largely managed within the region in which it would be generated.

²⁰⁵ For further details, see Waste forecast and assessment methodology technical note, which can be found in the EIA SMR.

Track maintenance waste

- 15.6.16 Track maintenance waste would comprise:
- ballast track and other rail components (e.g. steel railway tracks, sleepers, switches and crossings); and
 - slab track, which comprises the steel rails and associated components (e.g. fastener clips and bolts and rubber dampener).
- 15.6.17 Both ballast and slab track would be used in the construction of the Proposed Scheme. As part of the routine maintenance activities, ballast and slab track would be periodically replaced along the Proposed Scheme.
- 15.6.18 Table 30 presents a route-wide summary of the forecast track maintenance waste quantities for the Proposed Scheme in 2034²⁰⁶. A detailed track maintenance waste quantity forecast will be provided in the formal ES.
- 15.6.19 The annual quantity of ballast and slab track maintenance waste would be forecast according to the total length of rail within each community area. The annual quantity of slab track maintenance waste has been calculated using a waste generation rate of 0.05495 tonnes per metre of track per year²⁰⁷.
- 15.6.20 The annual quantity of ballast track maintenance waste has been calculated using a waste generation rate of 8.23 tonnes per kilometre per year²⁰⁶. These are the same waste generation rates as used for Phase One and Phase 2a and based on a reasonable worst-case scenario.
- 15.6.21 Using this methodology, the Proposed Scheme would generate approximately 14,692 tonnes of ballast and slab track maintenance waste during the first full year of operation in 2034.
- 15.6.22 In practice, the nature of the high speed track is such that very little track maintenance waste would be generated during the first few years after construction (including the operational assessment year of 2034). The largest quantity of track maintenance waste would occur as the ballast and slab track reaches the end of its service life and requires replacement. For ballast track, this is unlikely to occur until at least 25 years after construction, and for slab track this is unlikely to occur until approximately 60 years after construction both of which are beyond the temporal scope of this assessment.
- 15.6.23 The methodology used to forecast ballast and slab track maintenance waste, therefore, provides a reasonable worst-case scenario in terms of waste generation for the purpose of this assessment.

²⁰⁶ It has been assumed that track maintenance waste would be largely managed within the region in which it would be generated.

²⁰⁷ For further details, see Waste forecast and assessment methodology technical note, which can be found in the EIA SMR.

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Table 30: Forecast track maintenance (ballast and slab) waste quantities by region, 2034

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	4,357	4,210	147
West Midlands	288	245	43
East Midlands	9,344	9,212	132
Yorkshire and the Humber	703	598	105
Total	14,692	14,264	427

15.6.24 The quantity of slab track maintenance waste that would be diverted from landfill by reuse, recycling and recovery is based on a landfill diversion rate of 100%. This rate has been selected based on the assumption that slab track maintenance waste consists solely of steel rails and clips, and rubber pads all of which are fully recyclable or recoverable.

15.6.25 The quantity of slab track maintenance waste that would require off-site disposal to landfill in 2034 is zero tonnes.

15.6.26 The quantity of ballast track maintenance waste that would be diverted from landfill by reuse, recycling and recovery is based on a landfill diversion rate of 85%. This rate has been selected based on data provided by Network Rail across a range of material types for track maintenance waste. It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment, that the remaining 15% of ballast track maintenance waste would be disposed of off-site to landfill. The quantity of ballast track maintenance waste that would require off-site disposal to landfill in 2034 would be approximately 427 tonnes.

15.6.27 It has been assumed for the purpose of this assessment that all of the ballast track maintenance waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill. It has been assumed that the potential for hazardous waste arisings is negligible and consequently the impacts on hazardous waste landfill have not been assessed.

Ancillary infrastructure waste

15.6.28 Ancillary infrastructure waste refers to waste that would arise from rolling stock depots, signalling locations, operations and maintenance sites excluding track maintenance waste and rolling stock maintenance waste.

15.6.29 Table 31 presents a regional and route-wide summary of the forecast ancillary infrastructure waste quantities for the Proposed Scheme in 2034²⁰⁸. A detailed ancillary infrastructure waste quantity forecast will be provided in the formal ES.

²⁰⁸ It has been assumed that ancillary infrastructure waste would be largely managed within the region in which it would be generated.

- 15.6.30 Ancillary infrastructure waste would be generated along the entire route of the Proposed Scheme. Quantities have been estimated based on a waste generation rate of 0.692 tonnes per kilometre of track per year²⁰⁸. Using this methodology, the Proposed Scheme would generate approximately 336 tonnes of ancillary infrastructure waste during the first full year of operation in 2034.

Table 31: Forecast ancillary infrastructure waste quantities by region, 2034

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
North West	125	75	50
West Midlands	24	15	10
East Midlands	127	76	51
Yorkshire and the Humber	60	36	24
Total	336	202	135

- 15.6.31 The quantity of ancillary infrastructure waste that would be diverted from landfill by reuse, recycling and recovery is based on a landfill diversion rate of 60%. This rate has been selected based on the revised EU legislative proposals for waste, targeting a minimum of 60% reuse and recycling of municipal waste by weight by 2025, and 65% by 2030.
- 15.6.32 It has been assumed that, as a reasonable worst-case scenario for the purpose of this assessment, the remaining 40% of ancillary infrastructure waste would be disposed off-site to landfill. The quantity of ancillary infrastructure waste that would require off-site disposal to landfill in 2034 would be approximately 135 tonnes.
- 15.6.33 It has been assumed for the purpose of this assessment that all of the ancillary infrastructure waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill. It has been assumed that the potential for hazardous waste arisings is negligible and consequently the impacts on hazardous waste landfill have not been assessed.

Impact of operation on future baseline waste arisings

- 15.6.34 Table 32 provides a summary of operational waste arisings for the Proposed Scheme that would be generated in 2034. This represents the total quantity of operational waste that would be generated during the first year of operation of the Proposed Scheme, and this would be managed as C&I waste.

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Table 32: Summary operational waste forecast, 2034

Waste source	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Railway station and train	4,262	2,557	1,705
Rolling stock depot	21,000	16,800	4,200
Track maintenance	14,692	14,264	427
Ancillary infrastructure	336	202	135
Total	40,290	33,823	6,467
Proportion	100%	84%	16%

15.6.35 Table 32 shows that the Proposed Scheme would generate approximately 40,300 tonnes of operational waste in 2034. Approximately 86% of this quantity would be diverted from landfill via reuse, recycling and recovery and approximately 16% would require off-site disposal to landfill.

15.6.36 The impact of operational waste generation and off-site disposal to landfill is shown in Table 33 as the percentage difference between future baseline C&I waste arisings with and without the Proposed Scheme.

Table 33: Impact of commercial and industrial waste arisings generated by the Proposed Scheme, 2034

Waste source	National change		Regional change	
	C&I waste arisings (tonnes)	C&I waste arisings to landfill (tonnes)	C&I waste arisings (tonnes)	C&I waste arisings to landfill (tonnes)
Future baseline waste arisings 2034 without the Proposed Scheme	41,747,767	9,825,464	29,081,916	7,191,824
Proposed Scheme waste arisings 2034	40,290	6,467	40,290	6,467
Future baseline waste arisings 2034 with the Proposed Scheme	41,747,767	9,825,464	29,081,916	7,191,824
Increase in future baseline waste arisings with the Proposed Scheme	0.10%	0.07%	0.14%	0.09%

15.6.37 Table 33 shows that the total quantity of operational waste generated by the Proposed Scheme in 2034 is equivalent to approximately 0.10% of national future baseline C&I waste arisings and approximately 0.14% of regional future baseline C&I waste arisings.

15.6.38 The total quantity of operational waste generated by the Proposed Scheme that would require off-site disposal to landfill in 2034 would be equivalent to approximately 0.07% of national and 0.09% regional baseline C&I waste arisings to landfill during that year.

Likely significant environmental effects

Non-hazardous waste landfill capacity

- 15.6.39 It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment, that operational waste generated by the Proposed Scheme would predominantly be non-hazardous in nature. This would be subject to waste acceptance criteria set out in the Landfill Directive²⁰⁹ and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills²¹⁰.
- 15.6.40 The total quantity of non-hazardous operational waste requiring off-site disposal to landfill in 2034 would be 6,467 tonnes (see Table 32). This comprises non-hazardous waste that would be generated in railway stations and on passenger trains, and by rolling stock maintenance, track maintenance and ancillary infrastructure activities.
- 15.6.41 Off-site disposal of non-hazardous operational waste to landfill would result in an overall reduction of non-hazardous waste landfill void space of 6,467 tonnes in 2034. This would be equivalent to a less than 0.009% reduction in non-hazardous waste landfill capacity across the aggregated four regions according to the capacity projected to be available in 2034 (approximately 75 million tonnes).
- 15.6.42 On this basis, it is considered that there would be sufficient non-hazardous waste landfill capacity available in the aggregated four regions to accept the forecast quantity of non-hazardous operational waste for off-site disposal to landfill.
- 15.6.43 The western leg of the Proposed Scheme is isolated from the eastern leg by a considerable distance. It is therefore considered likely that non-hazardous waste generated in this leg of the Proposed Scheme would be managed within the regional area in which it is generated.
- 15.6.44 Off-site disposal to landfill of non-hazardous waste generated by the western leg of the Proposed Scheme, would result in an overall estimated reduction of non-hazardous waste landfill void space equivalent to a 0.13% reduction in non-hazardous waste landfill capacity void space across the North West region according to the amount of capacity projected to be available in 2034 (approximately 11.5 million tonnes). On this basis, it is considered that there would be sufficient non-hazardous waste landfill capacity available in the North West region to accept the forecast quantity of non-hazardous waste for off-site disposal to landfill.
- 15.6.45 Off-site disposal to landfill of non-hazardous waste generated by the eastern leg of the Proposed Scheme would result in an overall estimated reduction of non-hazardous waste landfill void space equivalent to a 0.04% reduction in non-hazardous waste landfill capacity void space across the East Midlands, West Midlands, and Yorkshire and the Humber regions according to the amount of capacity projected to be available in 2034 (approximately 60 million tonnes). On this basis, it is considered

²⁰⁹ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>

²¹⁰ 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>

that there would be sufficient non-hazardous waste landfill capacity available in these three regions to accept the forecast quantity of non-hazardous waste for off-site disposal to landfill.

- 15.6.46 Significance criteria²¹¹ for non-hazardous waste landfill capacity state that there is unlikely to be any appreciable adverse effect where there is:
- an insignificant increase in waste arisings relative to the future baseline; or
 - an insignificant reduction in landfill void space capacity for non-hazardous waste.
- 15.6.47 According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely significant environmental effects associated with the off-site disposal to landfill of non-hazardous operational waste generated by the Proposed Scheme would be negligible.

Other mitigation measures

General

- 15.6.48 The circular economy is an alternative approach to the typical 'linear' way of using resources. By finding opportunities of remanufacturing, reusing or recycling materials and keeping them in use for longer, both resource use and waste generation can be reduced. The principles of the circular economy would be proactively considered throughout specification, design, procurement, construction and operation of the Proposed Scheme, in accordance with the HS2 Circular Economy Principles²¹².
- 15.6.49 Recycling is a necessary component of a circular economy, though should only be considered when there are no other alternatives for reuse, remanufacture or repair. This is the basic premise of the waste hierarchy, which prioritises the most effective solutions to waste management. As waste is pushed up the waste hierarchy it creates greater resource efficiency and security by reducing the need to extract and import new raw materials.
- 15.6.50 A closed loop approach to resource recovery and waste management is based on the principle of controlling material inputs to maximise recycling and recovery of materials, minimising waste sent to landfill whilst greatly reducing the environmental footprint.
- 15.6.51 Implementing circular economy principles with regards to waste and material management could deliver efficiencies and benefits including:
- reduced virgin non-renewable material use; and
 - reduced waste, carbon emissions, and environmental impact.
- 15.6.52 Some of the non-hazardous waste generated during the operation of the Proposed Scheme would also be suitable for energy recovery (i.e. incineration). This would reduce reliance on non-hazardous waste landfill capacity.

²¹¹ Rationale for landfill significance criteria technical note, which can be found in the EIA SMR.

²¹² High Speed Two (2017), HS2 Circular Economy Principles. Available online at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/657833/hs2_circular_economy_principles.pdf

Waste recovery infrastructure

- 15.6.53 The total quantity of non-hazardous operational waste requiring off-site management in 2034 would be approximately 33,823 tonnes (see Table 34). This comprises non-hazardous waste that would be generated in railway stations and on passenger trains, and by rolling stock maintenance, track maintenance and ancillary infrastructure activities.

Table 34: Quantity of waste requiring off-site management in waste treatment and recovery infrastructure, 2034

Waste source	Total quantity (tonnes)	Proportion
Railway station and train	2,557	8%
Rolling stock depot	16,800	50%
Track maintenance	14,264	42%
Ancillary infrastructure	202	1%
Total	33,823	100%

- 15.6.54 The total quantity of operational waste diverted from landfill would be approximately 33,823 tonnes per annum. Off-site management of this waste in waste treatment and recovery infrastructure, would result in an overall reduction of approximately 1.2% of unused waste treatment and recovery infrastructure capacity across the aggregated four regions according to the amount of unused capacity projected to be available in the first year of operation in 2034 (approximately 2.8 million tonnes).
- 15.6.55 On this basis, it is considered that there would be sufficient unused waste treatment and recovery infrastructure capacity available in the aggregated four regions to accept the forecast quantity of operational waste diverted from landfill.

Summary of likely residual significant environmental effects

- 15.6.56 Based on the assessment, the likely residual significant environmental effects associated with operation of the Proposed Scheme would be negligible.

16 Water resources and flood risk

16.1 Introduction

16.1.1 This section of the report will consider the likely significant route-wide effects on surface water and groundwater resources (quality and quantity) and flood risk. In general these effects, which relate to potential impacts on individual water bodies, springs and water supplies, are site-specific and localised in nature and are, therefore, scoped out of the route-wide assessment on that basis. Any local impacts and effects are described in the Volume 2: Community area reports, Section 15, Water resources and flood risk.

16.1.2 The water resources and flood risk issues considered on a route-wide basis relate to:

- an assessment of the potential route-wide effects of the Proposed Scheme on surface water and groundwater resources, with particular reference to the risk of accidents or spillages from trains using the Proposed Scheme during its operational phase;
- summary details of how the Proposed Scheme would aim to comply with the statutory requirements of the Water Framework Directive (WFD); and
- an assessment of the route-wide impacts of the Proposed Scheme on flood risk, with specific reference to application of the Sequential Test and Exception Test in the National Planning Policy Framework (NPPF).

16.2 Scope, assumptions and limitations

16.2.1 The assessment made for this working draft ES is provisional and has been undertaken on a precautionary basis. A complete assessment of significant effects will be included in the formal ES.

16.3 Water resources assessment

16.3.1 Localised impacts and effects related to pollution risk and water quality are assessed in the Volume 2: Community area reports, Section 15, Water resources and flood risk. These assessments include consideration of:

- potential impacts on individual surface water and groundwater bodies, springs and water supplies resulting from rail and highway runoff;
- potential impacts of spillages during construction;
- mobilisation of existing contaminants during excavation and dewatering operations; and
- point sources of pollution such as treated wastewater effluent and fuel storage areas.

16.3.2 Assessment of these issues has, therefore, been scoped-out of this route-wide assessment.

16.3.3 During operation of the Proposed Scheme there is potential for pollution of the water environment from spillages. This risk is considered very low as trains, with the possible exception of diesel maintenance trains, would be electric passenger trains, and the

Proposed Scheme would not be used to transport freight. Spillages on the route of the Proposed Scheme are only likely following derailments, collisions, or major on board incidents, all of which are considered highly improbable. This issue is considered in Section 11, Major accidents and disasters, of this report.

- 16.3.4 If a spillage of a pollutant does occur, it would not necessarily lead to a pollution incident, as the pollutant may not reach a receiving water body, either because of prompt action by emergency personnel or as a result of pollution control measures, such as shut-off valves, balancing ponds, and silt traps, or because the pollutant is absorbed by soil or vegetation.
- 16.3.5 Specific mitigation proposed to address this risk includes:
- inclusion of shut-off valves on attenuation ponds, which can be used to isolate pollutants before they enter the wider water environment. If the procedures for closing valves on these systems were not operated in time, the ponds would still significantly reduce the amount of pollutant entering the wider water environment; and
 - an operation and maintenance manual would be prepared that makes specific provision for notifying the emergency and environmental services and procedures for isolating pollutants within the drainage systems.
- 16.3.6 It can, therefore, be concluded that there are not likely to be significant regional or route-wide adverse effects on water resources related to route-wide accident and spillage risks.

16.4 WFD compliance assessment

- 16.4.1 The eastern leg of the Proposed Scheme would lie wholly within the Humber River Basin District; and the western leg wholly within the North West River Basin District. The statutory objectives of relevance to all surface water and groundwater bodies potentially affected by the Proposed Scheme are recorded within the Humber River Basin Management Plan and the North West River Basin Management Plan. The current status of each element of each water body is also recorded within these documents, which were updated in 2015.
- 16.4.2 A route-wide WFD compliance assessment is being undertaken for the Proposed Scheme for inclusion in the formal ES. The approach being adopted is based on guidance developed in close consultation with the Environment Agency and will be finalised and agreed with Environment Agency specialists. This guidance is aligned with planning advice note 18 published by the Planning Inspectorate²¹³. The assessment will take into account the mitigation built into the design of the Proposed Scheme. In addition, the mitigation identified in the formal ES Volume 2: Community area reports, Section 7, Ecology and biodiversity; and Section 15, Water resources and flood risk, will be taken into account in the WFD compliance assessment.

²¹³ Water Framework Directive Planning Advice Note 18, The Planning Inspectorate, June 2017. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf

- 16.4.3 The risk of the Proposed Scheme resulting in long term deterioration in any element used to determine the WFD status of these water bodies would be reduced as far as is reasonably practicable.
- 16.4.4 In the unlikely event that the measures proposed do not fully mitigate the risks of deterioration of current status or potential or the prevention of future status objectives occurring, then the assessment will include the evidence required to satisfy the requirements of Article 4.7 of the WFD legislation, namely that:
- all practicable steps have been taken to mitigate the adverse impact on the status of the water body;
 - the reasons for the modifications or alterations are specifically set out and explained in the River Basin Management Plan (RBMP);
 - the reasons for the modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the Article 4.1 objectives are outweighed by the benefits of the new modifications or alterations to (among other things) sustainable development; and
 - the beneficial objectives served by the modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.
- 16.4.5 Where an Article 4.7 exemption is identified as being required as part of the WFD assessment it will be reported as a significant effect within the formal ES. The WFD compliance assessment will outline the measures that would be taken in these circumstances to ensure that the Proposed Scheme would still achieve compliance with WFD legislation. There is currently one location, on Wyke Beck in Leeds, where the current proposals would give rise to the need for an Article 4.7 exemption. However, detailed consideration is currently being given to development of the design in this location, in consultation with Environment Agency specialists. The aim of this design development work is to mitigate adverse impacts on Wyke Beck as far as is reasonably practicable and to incorporate additional mitigation nearby.

16.5 Route-wide flood risk assessment

- 16.5.1 Sections of the Proposed Scheme would be located in flood zones, including numerous crossings of main rivers and ordinary watercourses and areas at heightened risk of flooding from surface water sources. Details of these can be found in Volume 2: Community area reports, Section 15, Water resources and flood risk.
- 16.5.2 The design of the Proposed Scheme has been developed to avoid flood hazards, wherever this is reasonably practicable, and to help ensure that the Proposed Scheme would not increase flood risk to vulnerable receptors. The formal ES will include separate flood risk assessments for each community area providing details of how these design aims would be achieved.
- 16.5.3 The only flood risk issue considered on a route-wide basis is how the Proposed Scheme has aligned with the Sequential Test and Exception Test policies in the NPPF.

- 16.5.4 NPPF states that *'the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding'*.
- 16.5.5 Avoidance of areas with a high probability of flooding was a key consideration in the original route engineering assessment and appraisal of sustainability. A wide range of potential route options was considered and flood risk was one of the environmental constraints used to inform the selection of a preferred route. Consequently, the route of the Proposed Scheme avoids flood zones wherever reasonably practicable. The route of the Proposed Scheme has, therefore, been selected based on application of the sequential approach advocated in the NPPF.
- 16.5.6 The Proposed Scheme, which is essential infrastructure, inevitably has to pass through flood zones in order to cross rivers and surface water flow paths. In such circumstances, the Exception Test requires evidence to be provided that the development provides wider sustainability benefits to the community that outweigh flood risk. It also requires that a site specific flood risk assessment (FRA) must demonstrate 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, will reduce flood risk overall.
- 16.5.7 An overall assessment is being made of any potential route-wide effects on flood risk, with specific reference to demonstrating alignment with the NPPF tests and non-statutory sustainable drainage systems (SuDS) guidance. A key focus of ongoing analysis relates to the proposed new East Midlands Hub station and Leeds HS2 station, which are both within, or directly adjacent to, areas at heightened risk of flooding. The design will aim to achieve alignment with Exception Test requirements at these locations and this will be reported in the formal ES.
- 16.5.8 The potential for the Proposed Scheme to have an adverse impact on the severity of major natural disasters, including floods, is also assessed on a route-wide basis in Section 11, Major accidents and natural disasters of this report.

16.6 Conclusions

- 16.6.1 Localised impacts and effects related to pollution risk and water quality are assessed in the Volume 2: Community area reports, Section 15, Water resources and flood risk. It is not anticipated that there would be significant regional or route-wide temporary or permanent adverse effects on surface water resources as a result of construction. Route-wide permanent adverse impacts on surface water resources arising during operation would be avoided or mitigated through measures included in the design.
- 16.6.2 Spillage risks associated with accidental releases of contaminants from trains, and the pollution risk associated with accidents, are being assessed on a route-wide basis. These risks are unlikely to result in significant effects, once the relevant mitigation has been implemented in full. A draft operation and maintenance plan for water resources and flood risk, which makes specific provision for this issue, will be prepared and included in the formal ES.

- 16.6.3 WFD compliance assessments will be included in the formal ES for the eastern and western legs of the Proposed Scheme. It is anticipated that the Proposed Scheme would comply with WFD legislation on the basis of the approach proposed.
- 16.6.4 This route-wide assessment outlines how the Proposed Scheme aims to align with the principles of the Sequential Test and Exception Test as set out in the NPPF. The design approach has aimed, where reasonably practicable, to avoid locating new vulnerable infrastructure assets in zones that are at higher risk of flooding. Where infrastructure components have exceptionally, and unavoidably, been located in flood risk zones, the wider sustainability benefits afforded by the Proposed Scheme are considered sufficient to outweigh the risks. As a result of the mitigation proposed, the Proposed Scheme is likely to be safe from flooding over its lifetime and should not increase flood risk elsewhere. Consequently, it is currently foreseen that the effects of the Proposed Scheme related to route-wide flood risk should not be significant. This will be confirmed through ongoing modelling and analysis work, and reported in the formal ES.

17 Phase One, Phase 2a and Phase 2b combined impacts

17.1 Summary

17.1.1 This section of the report provides a summary of the potential total impacts (individually and combined) of Phase One, Phase 2a revised scheme (Supplementary Environmental Statement and Additional Provision Environmental Statement²¹⁴) and Phase 2b identified to date which is presented in Table 35.

17.1.2 A complete assessment of significant effects will be included in the formal ES and the potential impacts of Phase 2b will be updated for the formal ES.

Table 35: Combined impacts of Phase One, Phase 2a and Phase 2b

	Phase One	Phase 2a AP revised scheme	Phase 2b	Overall total (Phase One, Phase 2a AP revised scheme and Phase 2b total)
Route characteristics (km)				
Total	216 ²¹⁵	58 ²¹⁶	279.3	553.3
At grade	0	1.1	19.3	20.4
Tunnel	49.5	2.2	21.7	73.4
Cutting	74.7	28 ²¹⁷	89.4	192.1
Viaduct	16.3	5.5 ²¹⁷	38.5	60.3
Embankment	62.5	21.2 ²¹⁷	110.4	194.1
Property and settlements				
Demolitions (residential)	326 dwellings (218 buildings)	26 dwellings	536	888
Demolitions (community)	19 community facilities	0 community facilities	8 community facilities ²¹⁸	27 community facilities

²¹⁴ High Speed Rail (West Midlands – Crewe) Supplementary Environmental Statement (SES) and Additional Provision (AP) Environmental Statement (2018). Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/692620/G18_Volume_3_WEB.pdf

²¹⁵ Includes an additional 13km of route attributable to retaining walls and stations.

²¹⁶ There are also two spurs each of approximately 6km in length which run parallel to the main line of the original scheme, connecting it to the WCML south of Crewe.

²¹⁷ Change due to AP-003-001.

²¹⁸ Does not include all community facilities lost as some lie within commercial properties lost.

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	Phase One	Phase 2a AP revised scheme	Phase 2b	Overall total (Phase One, Phase 2a AP revised scheme and Phase 2b total)
Demolitions (commercial/retail/manufacturing/industrial/miscellaneous)	372 units (309 buildings) ²¹⁹	49 units ^{220,221}	564 ²²²	985
Total demolitions (including residential)	546 buildings	86 buildings ²²³	1,108 ²²²	1,740
Employment and housing				
Permanent jobs created	2,200 ²²⁴	140	Refer to footnote ²²⁵	2,340 ²²⁶
Construction jobs created	14,600 ²²⁷	2,260 ²²⁸	8,870	25,730
Jobs displaced	7,950 ²²⁹	40	11,600	19,590
Noise				
Monetary valuation of noise impacts	n/a ²³⁰	£-3.18m ²³¹	Refer to footnote ²³²	-
Landscape				
AONB crossed at surface (km)	7.6	0	0	7.6
Historic Environment				
Scheduled Monuments directly affected	1	0	1	2
Registered Battlefields directly affected	1	0	0	1
Grade I and II* structures directly affected	2	0	0	2
Grade II structures directly affected	17	3	12	32
Registered Parks and Gardens directly affected	2	0	0	2

²¹⁹ This figure includes some properties which also provide community resources, e.g. public house, local services.

²²⁰ Total includes outbuildings at farm holdings.

²²¹ This includes one additional demolition to that reported in Volume 3 of Phase 2a main ES. This additional demolition is provided as a correction in the Phase 2a SES and AP ES Volume 2, Community area 1 report (2017).

²²² Includes total of residential, community and miscellaneous buildings and structures including outbuildings associated with residential properties and structures such as pylons and wind turbines for example.

²²³ Includes total of residential, community, commercial and miscellaneous buildings including outbuildings associated with residential properties.

²²⁴ Indicative direct operational employment figure was estimated to the nearest 100 jobs.

²²⁵ Value not presented in the Phase 2b Sustainability Statement nor assessed in the Phase 2b working draft ES. Total direct and indirect permanent jobs will be reported in the Phase 2b formal ES.

²²⁶ Excludes Phase 2b as not presented in the Phase 2b Sustainability Statement.

²²⁷ Number reported as an approximate equivalent of permanent full time construction jobs.

²²⁸ The estimated permanent full time construction jobs for the Phase 2a AP revised scheme is lower than reported in Volume 3 of the Phase 2a main ES. This is due to changes in construction assumptions described in SES and AP ES Volume 2, Community area 1, 2, 3 and 5 reports and the correction included in Table 2 of this report.

²²⁹ 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 scheme (see the HS2 Phase One main ES, Volume 3 (Section 11) for details) (2013).

²³⁰ The assessment method has materially changed since that used for the AP5 ES (December 2015) and hence the levels are not directly comparable.

²³¹ Total net present value of change in noise.

²³² Value not presented in the Phase 2b Sustainability Statement. To be reported in the formal ES.

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	Phase One	Phase 2a AP revised scheme	Phase 2b	Overall total (Phase One, Phase 2a AP revised scheme and Phase 2b total)
Conservation Areas directly affected	2	4	12	18
Biodiversity and wildlife				
Natura 2000 sites affected	0	0	1	1
SSSIs directly affected	3	0	12	15
Habitats of Principal Importance directly affected	41	83 ²³³	Refer to footnote ²³⁴	124
Ancient Woodlands directly affected	32	10 ²³⁵	19 ²³⁶	61
Water resources and flood risk				
Major ²³⁷ rivers diverted	8	0	1	9
Route through Flood Zone 3 (km)	12	2.4	20	34.4
Station/depot occupation of Flood Zone 3 (ha)	2.1	0.6 ²³⁸	2.49	5.19
Cutting or tunnel through SPZ 1 or 2 (km)	6.7	1.1	0.6	8.4
Land use resources				
Active landfills crossed	0	0	6	6
Grade 1 and 2 agricultural land (km)	22	9.9	20.7 ²³⁹	52.6
Waste and material resources				
Excavated material (million m ³)	63.4 ²⁴⁰	16.4 ²⁴¹	16.0	95.8
Concrete (million tonnes)	13.04	2.10	4.65	19.79
Steel (million tonnes)	1.3	0.13	0.51	1.94

²³³ This figure is the number of distinct areas of habitat of principal importance (e.g. individual qualifying grasslands and woodlands) that are within, or partially within, the land required for the Phase 2a AP revised scheme.

²³⁴ Value not presented in the Phase 2b Sustainability Statement. To be reported in the formal ES.

²³⁵ Total of 10 ancient woodlands, comprising two Ancient Woodland Inventory sites and eight additional ancient woodlands sites that have been added to the Ancient Woodland Inventory as a result of heritage surveys undertaken.

²³⁶ Relates to Ancient Woodland Inventory sites only.

²³⁷ Major rivers are defined, in the context of this table, as those with a catchment area greater than 50km² at the point of the route crossing. This definition is set out in the Phase 2b Sustainability Statement.

²³⁸ Volume 3 of the Phase 2a main ES reported this area as 2.1ha, which included the Infrastructure Maintenance Base – Rail (IMB-R) (equivalent to infrastructure maintenance depot reported in Phase 2b) near Stone and surrounding area of land required for construction of the IMB-R. The area of land permanently required within Flood Zone 3 for the IMB-R in the original scheme is 0.6ha. Therefore, there is no change in the area of land permanently required for the IMB-R in the Phase 2a AP revised scheme compared to the original scheme.

²³⁹ The distance of Grade 1 and 2 agricultural land crossed is currently based on publicly available information and will be confirmed in the formal ES once agricultural land surveys are complete.

²⁴⁰ 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.

²⁴¹ This figure is the estimated quantity of excavated material that will be generated from the construction of the Phase 2a AP revised scheme (including waste generated as a result of Phase 2a SES changes and AP amendments). It includes excavated material that will be reused in the construction process as well as excavated material that may require off-site disposal.

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HS2

www.hs2.org.uk

High Speed Two (HS2) Limited

Two Snowhill,

Snow Hill Queensway,

Birmingham B4 6GA

Freephone: 08081 434 434

Minicom: 08081 456 472

Email: HS2enquiries@hs2.org.uk