E23

High Speed Rail (West Midlands - Crewe)

Environmental Statement

Volume 5: Technical appendices

Environmental Impact Assessment Scope and Methodology Report (CT-001-001)

July 2017

ES 3.5.0.1.1

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Department for Transport

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

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A report prepared for High Speed Two (HS2) Limited:

ARUP

ERM

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HS2 Phase 2a: West Midlands to Crewe

Environmental Impact Assessment Scope and Methodology Report

A report to Hs2 Ltd by Arup / ERM

September 2016

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- In January 2012, the Government announced its intention to develop a Y shaped high speed rail network (HS2). The network will be brought forward in phases, with powers sought initially for a London-West Midlands high speed line. The 2012 decision also confirmed the Government's preferred route for Phase One (between London and the West Midlands), following a consultation exercise. In November 2013, HS2 Ltd deposited a hybrid Bill with Parliament to seek powers for the construction and operation of Phase One of HS2. This Bill is currently proceeding through Parliament with the aim of achieving Royal Assent by the end of 2016, and commencing construction in 2017.

- In January 2013, the Government announced its initial preferred route for Phase Two of HS2 between the West Midlands, Leeds and Manchester. Following some minor amendments, in July 2013, the proposed route was consulted on for seven months until January 2014. Sir David Higgins, in his reports in 2014 (HS2 Plus[1] and Rebalancing Britain[2]) recommended accelerating the delivery of the Phase Two section of the route from the West Midlands to Crewe to deliver some of the benefits that HS2 will bring to the North sooner. In November 2015, the Government, having considered a number of options for accelerating part of the route, announced its intention to bring forward the route to Crewe, and set out the preferred line of route for what is known as Phase 2a. A further hybrid Bill will be prepared to authorise these proposals.

- This Scope and Methodology Report (SMR) outlines the proposed approach to the development of the Environmental Impact Assessment (EIA), and subsequent formal EIA Report, for Phase 2a (the 'Proposed Scheme'). The formal EIA Report will accompany the deposit of the hybrid Bill in Parliament and will be considered alongside the draft legislation.

- The EIA is required by European Union (EU) Directive[3] on the assessment of the effects of certain public and private projects on the environment (Directive 2014/52/EU) and Parliament's Private Business Standing Order 27A (SO27A)[4,5] which require the preparation of an EIA Report to inform the decision-maker of the likely significant effects of the Proposed Scheme on the environment. Although the UK voted to leave the EU on 23 June 2016, until exit negotiations are concluded, the UK remains a full member of the EU and all the rights and obligations of EU membership apply. Environmental assessment has been and will continue to be integral to the development of the Proposed Scheme.

- This SMR also sets out the methodology that is proposed for determining the likely environmental impacts and effects; and for assigning values of magnitude and significance to them. It also sets out the approach to the reporting of alternatives.

- In March 2016, HS2 Ltd consulted on a draft of this SMR (see Annex B for the list of consultees), to enable consultees and the public to comment on the approach proposed. Following consultation, the draft SMR was revised, taking into consideration comments received where appropriate. The Phase 2a EIA Scope and Methodology Report:

[1] Sir David Higgins, (2014), HS2 Plus
[2] Sir David Higgins, (2014), Rebalancing Britain: From HS2 towards a national transport strategy
[3] 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
[4] House of Commons, 2005, Standing Orders of the House of Commons - Private Business, The Stationery Office
[5] House of Lords, 2005, Standing Orders of the House of Lords - Private Business, The Stationery Office

Consultation Summary Report[6] summarises the consultation feedback and the project's response to them, and is published alongside this report[7].

- This SMR sets out, in Part A, the general EIA methodology and scope of assessment, covering temporal, geographic and technical scope; approach to mitigation; cumulative effects; defining significant effects; and notes assumptions in undertaking the EIA. It provides an overview of the reasonable alternatives to be described, including strategic and route-wide, route corridor and local alternatives.
- In Part B of this SMR, the scope and methodology for each environmental topic section is described. The topics addressed are:
    - agriculture, forestry and soils;
    - air quality;
    - climate change;
    - community;
    - cultural heritage;
    - ecology and biodiversity;
    - electromagnetic interference;
    - health;
    - land quality;
    - landscape and visual;
    - major accidents and natural disasters;
    - socio-economics;
    - sound, noise and vibration;
    - traffic and transport;
    - waste and material resources; and
    - water resources and flood risk.
- An outline of the proposed structure of the EIA Report is set out in Part C of this SMR.

[6] HS2 Phase 2a West Midlands to Crewe Environmental Impact Assessment Scope and Methodology Report: Consultation Summary Report
[7] www.gov.uk/hs2

Part A

1 Introduction

1.1 Purpose of this SMR

1.1.1 This Scope and Methodology Report (SMR) outlines the proposed scope and methodology for the Environmental Impact Assessment (EIA) and subsequent formal EIA Report for Phase 2a (West Midlands to Crewe) (the 'Proposed Scheme') of the proposed high speed railway linking London with Birmingham, Manchester and Leeds (HS2).

1.1.2 This SMR provides an outline description of the Proposed Scheme and sets out the proposed scope of the environmental effects to be considered during the EIA. For each environmental topic to be covered, issues to be addressed, the distance from the proposed works to be considered (i.e. the spatial scope) and the periods in time when the issues would be assessed (i.e. the temporal scope) are set out. Consideration is given to effects that would arise during construction and operation including temporary, permanent, direct, indirect and cumulative effects.

1.1.3 This SMR also sets out the methodology that is proposed for determining the likely environmental impacts and effects; and for assigning values of magnitude and significance to them. It also sets out the approach to the reporting of alternatives.

1.1.4 Between 8 March and 13 May 2016, HS2 Ltd consulted on a draft of this SMR (see Annex B for the list of consultees) to enable consultees and other stakeholders to comment on the proposed approach. Following consultation, the draft SMR was revised, taking into consideration the comments received where appropriate, to produce this report.

1.1.5 The Phase 2a EIA Scope and Methodology Report: Consultation Summary Report[8] summarises the consultation feedback and the project's response to it.

1.1.6 HS2 Ltd is consulting on a working draft EIA Report alongside the publication of this SMR. The formal EIA Report will accompany the deposit of the hybrid Bill in Parliament. At that point Parliament will consult and the public will have the opportunity to comment on the formal EIA Report. The consultation responses will be subject to independent analysis to further inform Parliament.

1.1.7 This SMR does not define the Proposed Scheme in detail at any location, nor the construction works or ancillary features associated with the Proposed Scheme. The design of the Proposed Scheme is being developed. The proposals are being made available for public consultation as part of the working draft EIA Report and particular changes are described in a design refinement consultation. Details of the consultations are available on-line at www.gov.uk/hs2.

1.1.8 This SMR provides the overarching methodology for conducting the EIA. In keeping with the approach adopted for the Phase One London - West Midlands ES, this SMR will be supplemented by a series of Technical Notes to provide detailed methodologies for the assessment of each topic set out in Part B of this document.

[8] HS2 Phase 2a West Midlands to Crewe Environmental Impact Assessment Scope and Methodology Report: Consultation Summary Report

Technical Notes for Phase 2a will be based on those prepared for Phase One (published as an addendum to the SMR for the Phase One scheme[9]) and updated to take into account any changes in proposed methodology as appropriate. The Technical Notes are being developed in consultation with statutory organisations to provide a robust basis for the EIA and will be published alongside the formal EIA Report. A list of the Phase One Technical Notes is set out in Annex A of this SMR.

1.2 Structure of this SMR

1.2.1 This SMR is divided into three main parts:

- Part A - an introduction to the Proposed Scheme, the background from the HS2 Phase Two Sustainability Statement[10], an outline of the hybrid Bill process, an overview of changes between the EIA process for Phase One and Phase 2a, a general description of the EIA assessment process (including the overall scope of the assessment) and a description of the approach to the study of reasonable alternatives;
- Part B - the environmental topic sections, describing the proposed scope and methodology for each topic; and
- Part C - an outline of the proposed structure of the EIA Report.

1.2.2 The annexes to this SMR include a list of consultees, a series of maps showing the Proposed Scheme and a list of Technical Notes which will supplement this SMR at a later date.

1.3 Introduction to HS2

1.3.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester, East Midlands and South Yorkshire will be served by high speed trains running at speeds of up to 360 kilometres per hour (kph) (225 miles per hour (mph))[11].

1.3.2 In January 2012, the Government announced its intention to develop a Y shaped high speed rail network, with a capacity to convey up to 18 trains per hour, at speeds of up to 360kph (225 mph). On some sections of the route, speeds would be lower than 360kph and speeds above 360kph would not be allowed unless the impacts of operation could be demonstrated to be no worse than assumed for operation at 360kph. Beyond the dedicated high speed track, high speed trains would also connect seamlessly with the existing West Coast Main Line (WCML) and East Coast Main Line (ECML) to serve passengers beyond the HS2 network to places including Warrington,

[9] HS2 Ltd, November 2013, London-West Midlands Environmental Statement, November 2013, Volume 5 Technical Appendices, Scope and Methodology Report Addendum (CT-001-000/2). Available online at: http://assets.hs2.org.uk/sites/default/files/Vol5_Scope_and_methodology_addendum_CT-001-000.2.pdf

[10] HS2 Ltd, November 2013, High Speed Rail: Consultation on the route from the West Midlands to Manchester, Leeds and beyond Sustainability Statement. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401154/pc205_vol_1_sustainability_statement_180713.pdf

[11] Note that the alignment of the route has been designed to allow for train speeds of up to 400kph (250mph) in the future. Operation at up to 400kph will require demonstration that improved train design enables services to operate at that higher speed without giving rise to additional significant environmental effects

Wigan, Preston, Runcorn, Liverpool, Lancaster, Oxenholme, Penrith, Carlisle, Lockerbie, Carstairs, Glasgow, York, Darlington, Durham, Newcastle, and Edinburgh.

1.3.3 The 2012 decision also confirmed the Government's preferred route for Phase One (between the London and the West Midlands), following a consultation exercise.

1.3.4 When the full Phase Two route is operational, HS2 trains will be up to 400 metres (m) long with 1,100 seats during peak hours. Two types of train will operate on HS2. 'Captive' trains will only be able to run on newly built high speed lines. They will be built to European dimensions, so they will be slightly taller and wider than typical UK mainline trains. 'Classic compatible' trains will be similar in performance to captive trains, but will be built to fit the existing UK infrastructure. They will not be as tall or as wide as the captive trains. This will allow them to serve existing UK stations and travel under existing bridges. They will be used to operate high speed services on HS2, and then continue on the existing UK network to locations such as Liverpool, Newcastle and Scotland. The Southeastern Javelin trains used on High Speed 1 (HS1) are examples of high speed trains that are adapted to fit UK railway infrastructure. Services using both the HS2 network and existing rail lines, will use classic compatible trains. When running on the existing rail network, the HS2 classic compatible trains will run at speeds achievable on this network.

1.3.5 The case for HS2 revolves around four key elements: extra capacity; improved connectivity; local growth and direct opportunities for people and businesses. This is set out in the Command paper High Speed Two: East and West, The next steps to Crewe and beyond (November 2015)[12] and is further reflected in Section 5 of this report.

1.3.6 HS2 will be built in phases. Phase One comprises the first section of the HS2 network of approximately 230km (143 miles) between London and Birmingham and the West Midlands that will become operational in 2026. It was the subject of an Environmental Statement (ES) deposited with the High Speed Two (London – West Midlands) Bill in 2013 and ES deposited with Additional Provisions to that Bill in 2014 and 2015. The Bill is currently proceeding through Parliament with the aim of achieving Royal Assent by the end of 2016 and commencing construction in 2017.

1.3.7 Phase Two of HS2 would extend the line to the north-west and north-east, to Manchester with connections to the WCML at Crewe and Golborne, and to Leeds with a connection to the ECML approaching York, completing what is known as the 'Y network'.

1.3.8 In January 2013, the Government announced its initially preferred route for Phase Two between the West Midlands, Leeds and Manchester. Following some minor amendments in July 2013, the proposed route was consulted on for seven months until January 2014.

[12] HS2 Ltd, 2015, High Speed Two: East and West, The next steps to Crewe and beyond. November 2015. Available online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480712/hs2-east-and-west.pdf

1.3.9 Sir David Higgins, in his reports in 2014 (HS2 Plus[13] and Rebalancing Britain[14]) recommended accelerating the delivery of the Phase Two section of the route from the West Midlands to Crewe to deliver some of the benefits that HS2 will bring to the North sooner. In the November 2015 Command Paper, the Government, having considered a number of options for accelerating delivery of part of the route, announced its intention to bring forward the route to Crewe, and set out the preferred line of route for what is known as Phase 2a. Phase 2a will involve construction of the first part of the western leg of Phase Two from the end of the Phase One route to Crewe, with a connection to the WCML at Crewe. The proposed HS2 route highlighting the route to Crewe is shown in Figure 1.

1.3.10 Phase 2a (the Proposed Scheme) would connect with Phase One near Fradley, to the north-east of Lichfield, and connect to the WCML south of Crewe, to provide onward services beyond the HS2 network, to the north-west of England and to Scotland. Construction of the Proposed Scheme would commence in 2020, ahead of the rest of Phase Two, with operation planned to start in 2027 one year after the opening of Phase One. This is six years earlier than originally planned bringing some of the benefits of HS2 to the North sooner.

1.3.11 The powers for this section will be sought through a separate hybrid Bill with the aim of achieving Royal Assent by the end of 2019.

1.3.12 Accelerating delivery of the Phase 2a route will provide faster journeys from London to Crewe, Manchester, Liverpool, Preston, Warrington, Wigan and Glasgow sooner. Accelerating construction of the route to Crewe means that the North West and Scotland will see more of the benefits of HS2 more quickly, and this will bring economic benefits sooner. It would also relieve pressure on bottlenecks on the existing WCML at Colwich Junction and around Stafford, which should improve the reliability and performance on the existing main line and it could also open up more capacity, including for freight.

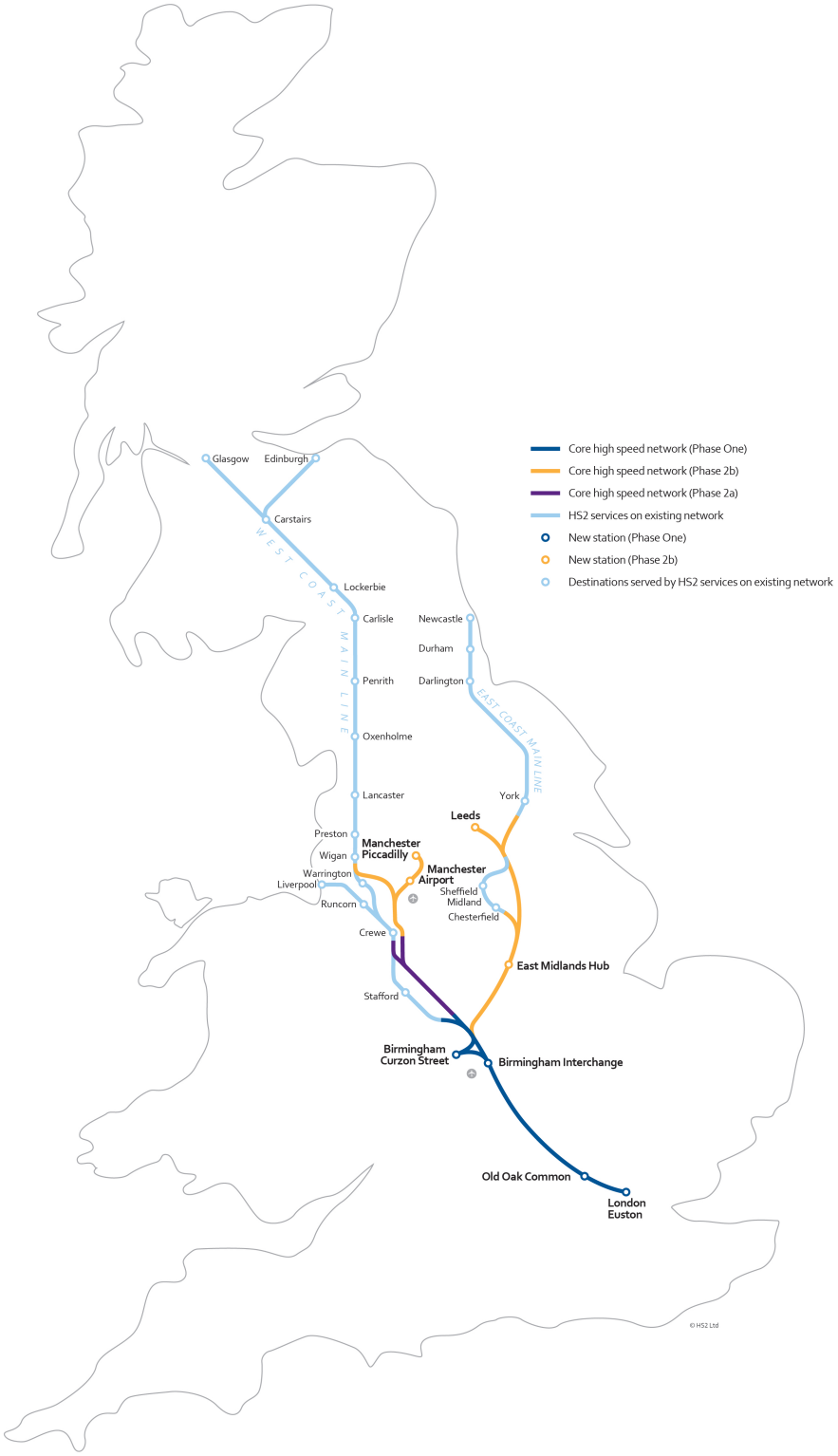
1.3.13 It will also allow passengers travelling to or from a wide range of places to connect onto HS2 services given that Crewe is already a major hub on the rail network with regional and long distance connections to the wider North West, East Midlands, and North and South Wales.

1.3.14 An announcement on the rest of the Phase Two route from Crewe to Manchester and from the West Midlands to Leeds, referred to as Phase 2b, is expected in Autumn 2016. Construction of Phase 2b would commence in approximately 2023, with operation planned to start around 2033.

[13] 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

[14] 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

Figure 1 - The HS2 core network[15]



[15] On 7 July 2016, Sir David Higgins' report Sheffield and South Yorkshire Report 2016 was published and indicated that a different route through South and West Yorkshire should be considered, which would remove the previously proposed Meadowhall station. This is currently being considered by the Secretary of State

1.4 Description of the HS2 Phase 2a route

1.4.1 The following sections provide a summary description of the route of the Proposed Scheme based on the current stage of design. Annex C contains a series of Phase 2a route maps. Further detailed maps of the Proposed Scheme are available within the working draft EIA Report, available at HS2 Ltd's website[16].

1.4.2 The Phase 2a route comprises a high speed railway line from the Phase One route near Fradley, to Crewe. It would run north-east of Stafford and south-west of Stone, crossing a mainly rural area with small settlements in Staffordshire and Cheshire East.

1.4.3 Phase 2a would connect with the Manchester spur that forms part of Phase One near Fradley, to the north-east of Lichfield. It would continue northwards across the River Trent floodplain, over a distance of approximately 3km, on a series of embankments and viaducts. Maintenance loop sidings would be located to the north of Pipe Ridware.

1.4.4 The route of the Proposed Scheme would pass between the villages of Stockwell Heath and Colton on embankment, before crossing Moreton Brook on viaduct. It would continue into a cutting with a retaining wall past Moreton House, a Grade II listed building used as a residential home for Rugeley School (The Mayfield Centre), emerging onto embankment. The route would cross the Colwich to Manchester railway, run adjacent to the Great Haywood Marina, cross the Trent and Mersey Canal and then cross the River Trent. The route would then cross Lionlodge Covert, an area of deciduous woodland and designated local wildlife site (LWS), on an embankment. At this point, the route would be approximately 1km to the south of Pasturefields Salt Marsh Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI).

1.4.5 The route of the Proposed Scheme would enter a cutting through Ingestre Park Golf Club then pass through part of Staffordshire County Showground. It would pass through the village of Hopton in a false cutting behind a landscaped retaining wall, and south-west of Hopton Heath registered battlefield. It would then pass Marston on embankment and continue on a series of embankments and cuttings, following the M6 corridor and crossing Filly Brook and the Norton Bridge to Stone Railway on a viaduct. The route would cross the M6 near Stone and Yarnfield. A construction railhead is proposed to be located adjacent to the M6 to the west of Stone, utilising land both north and south of the Norton Bridge to Stone Railway.

1.4.6 The route would pass to the north of Swynnerton on an embankment close to an area of historic landscape that includes Swynnerton Historic Parkland. Continuing north, the route would pass Swynnerton Old Park in a cutting. It would continue into the Meece valley on an embankment and then cross Meece Brook on a viaduct, before passing through the higher ground west of Whitmore.

1.4.7 The route would cross the A53 Newcastle Road to the south-east of Whitmore Heath, in a cut and cover tunnel of approximately 250m in length. This would be followed by twin bored tunnels of approximately 750m in length under the settlement of Whitmore Heath. The route would emerge and pass through Whitmore Wood Ancient

[16] www.gov.uk/hs2

Woodland in a cutting with a retaining wall. The route would enter the River Lea valley on an embankment, passing several historical landscape features, including Hey House, a Grade II listed building, and Old Madeley Manor Scheduled Monument. It would continue on a viaduct over the River Lea, WCML and the out of use Silverdale line of the Stoke to Market Drayton Railway.

1.4.8 Extending northwards towards Crewe, the route would continue in a cutting before entering a bored tunnel, approximately 670m in length, to the west of Madeley close to Barhill Ancient Woodland. The route would continue in a shallow cutting before continuing onto embankment and crossing Checkley Brook and the River Lea floodplain on a viaduct.

1.4.9 The route of the Proposed Scheme would then run on embankment before transitioning into a shallow cutting, passing under an overbridge and towards Den Lane.

1.4.10 Continuing northwards, the route of the Proposed Scheme would pass under a viaduct, which would carry two spurs over the route to connect with the WCML to the east of the Proposed Scheme. For the Proposed Scheme to integrate with the existing WCML, modifications would be required including a new section of WCML and modifications to the southern and northern parts.

1.4.11 The route of the Proposed Scheme would continue in a retained cut for approximately 1.5km before reaching a headwall[17]. This would form the boundary between the Phase 2a route and Phase 2b, and be the point from which tunnelling works for a tunnel under Crewe would be constructed, as part of the Phase 2b route to Manchester.

1.4.12 Access tracks to connect the route of the Proposed Scheme with an Infrastructure Maintenance Depot (IMD) would run along the western side of the route of the Proposed Scheme. It is currently anticipated that permanent maintenance facilities, in the form of an IMD would be located at the northern end of the area, on an area of approximately 37 hectares and extending for 3km to the west of the Proposed Scheme. The IMD would provide a central store and maintain high speed trains on the Phase 2a route, as well as the full western leg of Phase Two (to Manchester) once the full Y network is operational. The IMD would be supported by maintenance loop facilities at Pipe Ridware, in the Fradley to Colton area (community area 1) (see Figure 3 for a map showing the community area boundaries).

1.4.13 As part of the developing design, an alternative option to relocate the permanent maintenance facilities in the Stone and Swynnerton area (community area 3) at the site identified for the temporary Stone railway main compound, is being considered. This is being evaluated and should it be selected as the preferred location for permanent maintenance facilities, the impacts of this would be assessed and reported in the formal EIA Report.

[17] A wall built at the end of the retained cut

1.5 Phase 2a interfaces

Phase One and 2a interface

1.5.1 The Phase 2a route would connect with the Manchester spur that forms part of Phase One near Fradley. This interface has been located and designed to enable Phase 2a to be constructed without adversely affecting the operation of Phase One.

1.5.2 As part of Phase One, a junction with the existing WCML will be developed near Handsacre. The proposed spur provided in Phase One for the Phase Two route commences alongside Fradley Park. The spur passes over the HS2 line connecting to the WCML at Handsacre (the Handsacre link). The spur will include the junction off the Phase One line and an embankment approximately 1.3km in length, with an underpass for the realigned Wood End Lane and a viaduct over the Trent and Mersey Canal. The construction of the spur will end just to the north of the Trent and Mersey Canal near Fradley. Landscape mitigation planting proposed, as part of Phase One, for the area at the end of the spur would be modified to enable the connection to the Phase 2a scheme.

Interface between Phase 2a and 2b

1.5.3 A new junction would be constructed with the WCML to allow classic compatible trains using the Proposed Scheme to access Crewe Station and onward connections to the existing network towards Manchester, Liverpool, Warrington and North Wales.

1.5.4 Provision is made in the design for the HS2 mainline tracks to later continue northwards to Manchester using a tunnel under Crewe, which would be constructed as part of the Phase 2b route. The Phase 2a route terminates at a headwall, which would form the southern end of this tunnel.

1.6 Previous environmental assessment work on the Proposed Scheme

1.6.1 HS2 Ltd has examined a substantial number of route-wide alternatives to the proposed Phase Two alignment. This work has been supported by an appraisal of sustainability process (AoS). The AoS process was used to appraise and report on the sustainability performance of Phase Two, and Phase 2a, proposals throughout their development.

1.6.2 In July 2013, the Government published the HS2 Phase Two Sustainability Statement[18] as part of a public consultation on HS2 Phase Two and to inform the Government's decision on the preferred route for Phase Two. The Sustainability Statement described the extent to which the Government's proposed scheme for Phase Two of HS2 (including Phase 2a) supported objectives for sustainable development, following the AoS. Four sustainable development priorities were used for the assessment:

- reducing greenhouse gas emissions and combating climate change;

[18] HS2 Ltd, 2013, Sustainability Statement - Volume 1: main report of the Appraisal of Sustainability. Available online at: http://assets.hs2.org.uk/sites/default/files/consultation_library/pdf/PC205%20Vol%201%20Sustainability%20Statement%20180713.pdf

- protecting natural and cultural resources and providing environmental enhancement;
- creating sustainable communities; and
- enabling sustainable consumption and production.

1.6.3 Using 18 sustainability topics, each under one of four headings described above, the Phase Two Consultation Sustainability Statement 2013 provided a systematic review of the scheme proposals. This informed both the Proposed Scheme designs and the selection of alternative options for Phase Two as a whole, taking into account wider transport and economic objectives, operational requirements, cost and practicality. This was incorporated into decision making on the development of the route, which helped refine the number of options down to a single preferred route. This process is described in full in the Sustainability Statement. The proposed approach to reporting alternatives is provided in Section 5 of this SMR.

1.6.4 Consultation on the proposed route of HS2 Phase Two took place from July 2013 for a period of seven months, closing at the end of January 2014. The collation and reporting of responses to the consultation was independently carried out by Ipsos MORI and a Consultation Report[19] summarising the overall response to the Phase Two consultation was published. As part of the consultation, HS2 Ltd reviewed the responses to Question 7 of the consultation which asked for feedback on the AoS process. HS2 Ltd produced the 'Response to HS2 Phase Two Consultation: Appraisal of Sustainability (Question 7) Report[20] for Government to respond to the issues raised. The report was published by Government in November 2015 as part of the decision to proceed with the Proposed Scheme.

1.6.5 During this time HS2 Ltd also reviewed the consultation scheme in light of experience gained from the development of the Phase One route for the hybrid Bill. In response to the feedback received during consultation and as a result of the experience gained from Phase One, a number of areas were investigated for possible modifications to the scheme, taking into account potential effects on the environment and communities. Further scheme revisions were driven by an initiative to improve the technical performance of the design or deliver cost efficiencies.

1.6.6 To account for these changes HS2 Ltd published the Phase Two post-consultation Sustainability Report[21] in November 2015, which set out:

- refinements to the Phase 2a West Midlands to Crewe consultation scheme;

[19]Ipsos MORI, High Speed Rail: Investing in Britain's future. Consultation on the route from the West Midlands to Manchester, Leeds and beyond. Final Report, 2014. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69738/hs2-phase-two-command-paper.pdf

[20]HS2 Ltd, December 2015, HS2 Phase Two Response to HS2 Phase Two Consultation: Appraisal of Sustainability (Question 7), HS2 Ltd. December 2015. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/481570/Response_to_HS2_Phase_Two_consultation_-_Appraisal_of_Sustainability.pdf

[21] HS2 Ltd, November 2015, High Speed Rail: Preferred Route to Crewe, Sustainability Report, Phase Two Post-Consultation Update: West Midlands to Crewe,. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480667/Sustainability_Report_Phase_Two_Post-Consultation_Update_West_Midlands_Crewe.pdf

- a preferred scheme route resulting from these refinements; and
- the potential environmental and community impacts of the preferred scheme and how these compare with the scheme that was presented at consultation.

1.6.7 The Sustainability Statement and post-consultation Sustainability Report have been taken into account in developing this SMR for the EIA of the Phase 2a Proposed Scheme.

1.6.8 Issues raised during consultation on the Sustainability Statement have helped to define the scope of the EIA topics, as described in the consultation section of each topic (see Sections 6 to 21).

1.7 Monitoring of performance against sustainability and environmental goals

1.7.1 As described in Section 1.6, the Phase 2a post-consultation Sustainability Report described the extent to which the 2015 preferred scheme would satisfy sustainable development objectives and identified some potential significant effects. During the EIA process, the potential significant effects identified in the Sustainability Statement and the post-consultation Sustainability Report will be reviewed and assessed in the context of the Proposed Scheme.

1.7.2 HS2 Ltd's Sustainability Policy (contained in Annex E) sets out its priority for sustainable design which will facilitate the reduction of such effects. The policy stresses HS2 Ltd.'s commitment to develop *"an exemplar project"*, and to *"limit* [the scheme's] *negative impacts through design, mitigation and by challenging industry standards,* [while looking] *for environmental enhancements and benefits"*. The themes used by the policy as a basis for realising HS2 Ltd.'s ambitions were also addressed by the Phase Two Consultation Sustainability Statement 2013 , as described in Section 1.3 of the Phase Two Sustainability Statement. The policy sets out the role of HS2 in delivering sustainable economic growth and the commitment to balance community, economic and environmental issues in taking the scheme forward.

1.7.3 Practicable measures will be considered further to avoid or reduce the potential environmental effects of the Proposed Scheme as part of a continuing effort to improve the sustainability performance of the new railway during construction and operation. The EIA will identify the likely significant environmental effects of the Proposed Scheme and determine options for further mitigation.

1.7.4 As described in Volume 1 of the Phase One Environmental Statement (ES), in order to ensure that the environmental effects of the Proposed Scheme will not significantly exceed those assessed in the formal EIA Report, the Secretary of State is expected to establish a set of controls known as Environmental Minimum Requirements (EMR) for the Proposed Scheme. The EMR will be contained in a suite of documents that will sit alongside the provisions set out in the hybrid Bill itself. The nominated undertaker is the body to be appointed to take forward the detailed design and implementation of the Proposed Scheme after the hybrid Bill has been enacted. The nominated undertaker will be required to comply with the EMR and the other hybrid Bill controls.

1.7.5 The EMR, together with the controls in the hybrid Bill, will ensure that the impacts assessed in the formal EIA Report will not be exceeded, unless this results from a

change in circumstances that was not foreseeable at the time the formal EIA Report was prepared; or any such changes will be unlikely to have significant adverse environmental effects; or will be subject to a separate consent process and further EIA.

1.7.6 The EMR will also impose requirements on the nominated undertaker to use reasonable endeavours to adopt measures to further reduce the adverse environmental effects reported in the formal EIA Report, provided that this does not add unreasonable cost or delay to the construction or operation of the Proposed Scheme.

1.7.7 The EMR will include:

- general principles, in which the Secretary of State commits that the environmental effects reported in the formal EIA Report are not exceeded by application of the environmental mitigation assessed in the formal EIA Report;
- a Code of Construction Practice (CoCP), which will set out measures to provide effective planning, management and control during construction;
- an Environmental Memorandum, which is a framework for HS2 Ltd and its contractors and stakeholders, such as the Environment Agency and Natural England, to work together to ensure that the design and construction of Phase 2a is carried out with due regard for environmental considerations;
- a Planning Memorandum, which will set out the rules of conduct and administrative arrangements for HS2 Ltd and planning authorities related to the processing of detailed planning approvals under the provisions of the Bill including the design and appearance of bridges, noise barriers and earthworks;
- a Heritage Memorandum, which will set out a commitment to limit the impact on the historic environment and will address the elements of the design and construction works that have a direct impact on heritage assets; and
- undertakings and assurances given during the passage of the hybrid Bill.

1.7.8 The revised EIA Directive 2014/52/EU makes provision for post-EIA monitoring of significant adverse effects on the environment in appropriate cases. HS2 Ltd will work with the relevant responsible authorities to develop the necessary monitoring in appropriate cases.

1.7.9 The provisions of the EMR (including the need for Environmental Management Systems) and implementation of the provisions of the CoCP will provide that appropriate monitoring of environmental effects will be undertaken during construction.

1.7.10 In addition, for certain topics, there may be the need for monitoring of specific mitigation activities over an extended period. Monitoring strategies will be developed with responsible authorities, as appropriate. Further details of any proposed topic based monitoring will be provided in the formal EIA Report.

1.8 Hybrid Bill powers

1.8.1 The Government will deposit a hybrid Bill for consideration by Parliament. If passed, the Bill becomes an Act of Parliament conferring powers, including deemed planning permission, to build the railway line and thereafter to operate and maintain it. The powers would include:

- authority to nominate an undertaker to build, operate and maintain the railway line;
- a planning regime necessary for the nominated undertaker to make applications for approval of details for certain matters defined by the Act, to local planning authorities;
- giving the nominated undertaker the rights to construct, operate and maintain the railway and associated major works as described in the Act (and its accompanying plans and sections) and other ancillary works;
- powers of compulsory acquisition or temporary possession of land and properties required for the Proposed Scheme;
- powers to divert or protect gas, water, telecommunications and electricity infrastructure which might be affected by the Proposed Scheme; and
- powers over rights of way.

1.9 EIA programme and other consultations

1.9.1 HS2 Ltd is consulting on a working draft EIA Report on HS2 Ltd's website[22] alongside the publication of this SMR. The formal EIA Report will accompany the deposit of the hybrid Bill in Parliament. At that point Parliament will consult and the public will have the opportunity to comment on the formal EIA Report. The consultation responses will be subject to independent analysis to further inform Parliament.

1.9.2 The working draft EIA report presents preliminary environmental information in the form of baseline data gathered to-date and:

- the likely environmental impacts of the Proposed Scheme (and, where possible, the likely significant environmental effects); and
- the proposed mitigation measures that have been identified to address any significant adverse effects.

1.9.3 A design refinement consultation and a consultation on a working draft Equality Impact Assessment (EQIA) Report are taking place in parallel to the consultations on the working draft EIA Report.

[22] www.gov.uk/hs2

1.9.4 The consultations will aim to bring relevant information forward to local people, local authorities and organisations to enable them to contribute their views on the Proposed Scheme and assist the development of the measures to avoid or reduce the environmental and equality effects. Details of all the consultations are available on HS2 Ltd's website.

2 Changes between Phase One and Phase 2a approach to EIA

2.1 The Phase One SMR

2.1.1 The Phase One EIA SMR was issued in draft for consultation in April 2012 and following the consultation process, was amended and published in September 2012. An EIA for Phase One London to West Midlands was carried out and an ES (the main ES) deposited alongside the hybrid Bill in November 2013.

2.1.2 For the Phase One main ES, an SMR addendum (Phase 1 ES, SMR Addendum, Volume 5, Technical Appendices (CT-001-000/2))[23] was published and was supplemented by a series of Technical Notes, specifying in more detail the assessment process for each topic. Subsequently a series of amendments to the Phase One SMR and some of the Technical Notes were prepared and published alongside the Phase One Supplementary Environmental Statements (SES) and Additional Provision (AP) ES documents, as follows:

- SMR addendum 2 – July 2015 - appended to the SES and AP2 ES;
- SMR addendum 3 – September 2015 – appended to the SES2 and AP3 ES; and
- SMR addendum 4 – October 2015 – appended to the SES3 and AP4 ES.

2.1.3 This Phase 2a SMR consolidates the Phase One SMR and addenda and introduces a number of updates in line with evolving legislation, guidance and best practice, as set out below.

2.1.4 Changes to this SMR will be accompanied by changes to the Technical Notes. The Technical Notes are being developed in consultation with statutory organisations to provide a robust basis for the EIA and will be published alongside the formal EIA Report. A list of the Technical Notes already published for Phase One is set out in Annex A of this SMR.

2.2 Changes to the EIA Directive

2.2.1 The Phase One ES and subsequent SES and AP ES were prepared in accordance with Parliamentary Standing Orders, the codified EIA Directive 2011/92/EU and the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999/293) (the 'EIA Regulations'). The formal EIA Report for Phase 2a is being prepared in accordance with UK and European legislation on environmental impact assessment, and relevant guidance.

2.2.2 On 23 June 2016, the UK voted to leave the EU. The Department for Exiting the European Union will now lead work across Government on the process that will make that happen and to consider what it will mean for the UK. In due course the

[23] Phase One ES, SMR Addendum, Volume 5, Technical Appendices (CT-001-000/2)). Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/260153/Vol5_Scope_and_methodology_report_addendum_CT-001-000.2.pdf

Government will need to take initial decisions on how to proceed with the UK's withdrawal from the EU and on the negotiation for the UK's future relationship with the EU. Until exit negotiations are concluded, the UK remains a full member of the EU and all the rights and obligations of EU membership apply. Environmental assessment has been and will continue to be integral to the development of the Proposed Scheme.

2.2.3 A new EIA Directive 2014/52/EU[24] on environmental impact assessment is required to be transposed into national legislation of Member States by 16 May 2017. HS2 Ltd has therefore adopted the principles of the new EIA Directive for Phase 2a in advance of new UK regulations and guidance, liaising with the Department for Transport (DfT) and the Department for Communities and Local Government (DCLG) on the implications for the EIA of Phase 2a, where possible.

2.2.4 Phase 2a will be subject to authorisation through the hybrid Bill process. The objectives of EIA will, therefore, be pursued through the Parliamentary process. The formal EIA Report will be prepared in accordance with the requirements of Standing Order 27A as well as any additional requirements of the new EIA Directive 2014/52/EU (with any differing or revised requirements of the new EIA Directive superseding those in Part II Schedule 4).

2.2.5 The 2014 Directive recognises that environmental issues, such as resource efficiency, sustainability, biodiversity protection, climate change and the risks of major accidents and natural disasters should be included in assessment and decision making processes.

2.2.6 There are a number of changes in the 2014 Directive, which include the following:

- the sustainable use of soil and the need to address the 'land take' of projects (the term 'Land' is introduced in Article 3 of the Directive which lists the factors to be addressed by environmental impact assessment);
- the need to address the significant effects of projects on biodiversity, to avoid or minimise such effects (Article 3 refers to 'Biodiversity with particular reference to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC');
- the need to assess the impacts of projects on climate (for example greenhouse gas (GHG) emissions) and their vulnerability to climate change;
- the need to consider the vulnerability of major infrastructure projects to major accidents and/or natural disasters and consequential significant adverse effects on the environment;
- in relation to historical and cultural heritage and landscape - the need to address the visual impacts of projects, in relation to the built or natural landscape and urban areas;

[24] 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

- a specific reference to assessment of human health is introduced (Article 3 uses the terms 'Population and human health' instead of 'human beings' in the 2011 Directive);
- developers are required to provide a description of the 'reasonable alternatives' studied of relevance to the project (for example in terms of project design, technology, location, size and scale) and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects; previously the 2011 Directive referred to the 'main alternatives'; and
- provision for post-EIA monitoring of significant adverse effects on the environment in appropriate cases.

2.2.7 The 2014 Directive defines the environmental impact assessment process as leading to the preparation of an 'environmental impact assessment report'. Previously, in the United Kingdom (UK), this has generally been referred to as an 'environmental statement'.

2.2.8 The application of EIA Directive 2014/52/EU introduces additional topics for assessment within the EIA and expands the scope of previous assessment topics, as described in the following sections.

2.3 Integrated assessment

2.3.1 To address the driver for further integration of human health and the environment within Directive 2014/52/EU, and in consideration of the development of Health Impact Assessment practice, an integrated assessment is being proposed to support Phase 2a. This will take the form of one assessment process which will consider relevant issues concerning environment, health and wellbeing together from the outset.

2.3.2 In addition to meeting the requirements of the EIA and health assessment processes, the integrated approach also addresses stakeholder expectations that the proposals are assessed collectively, to assist in understanding the interplay of environmental and human factors. Stakeholder engagement will be pivotal to this integrated assessment process (see Section 4 for further details).

2.4 Other changes

2.4.1 In addition, since the Phase One EIA was conducted, guidance for some topic assessments has been revised and other changes have occurred which affect the technical scope of the assessment, including:

- changes in external policies and guidance (e.g. repeal by the Government of the Site Waste Management Plans Regulations 2008);
- changes in HS2 policies and strategies (e.g. as set out in HS2 Phase One Information Paper E20, Control of airborne noise);
- updates to best practice resulting from updated guidance from professional bodies or institutions (e.g. revised Landscape Institute Guidelines for Landscape and Visual Impact Assessment, Third Edition);

- new technical issues arising from the route and environment through which it passes, specific to Phase 2a; and
- third party consultation undertaken by HS2 Ltd.

2.4.2 The technical scope has been refined and adapted in accordance with these additions and revisions, whilst also taking into account recent EIA practice for rail and other linear transport infrastructure projects, particularly the Phase One EIA.

2.4.3 The environmental topic areas proposed for inclusion in the EIA are set out in Table 1. The table sets out the list of topics to be assessed in the EIA for the Proposed Scheme, highlighting where a change from the Phase One EIA methodology will be applied (for example through introduction of revised guidance, or in response to the draft SMR consultation) and topics which are new additions to the EIA as a result of applying EIA Directive 2014/52/EU.

Table 1 - Changes in topic methodologies from Phase One SMR for Phase 2a

Environmental topic to be included in the EIA	**Change in methodology**
Agriculture, forestry and soils	Minor technical updates resulting from revised interpretation of policy and revised guidance, particularly Directive 2014/52/EU, updated Technical Information Note 049 (Natural England) and Planning Practice Guidance. Extension of soil surveys to woodlands and other open spaces to collect soils data to inform the restoration of land for agriculture, landscape mitigation planting and habitat creation and translocation. Countryside Stewardship Scheme has replaced Environmental Stewardship Scheme. Refined assessment criteria will be used to determine the magnitude of impacts on soil and soil sensitivity following feedback from Natural England on the draft SMR.
Air quality	In line with the requirement to assess the health impacts of projects in the Directive 2014/52/EU, PM2.5 will be included in the assessment to provide inputs to the assessment of health impacts.
Climate change	In line with the greater emphasis on the impacts of projects on climate in the 2014 Directive, this section of the EIA will comprise an integrated climate assessment methodology and will report on the assessment of GHG, in-combination climate change impacts (adaptation) and climate change resilience. Also technical updates have been made to the assessment methodologies for both areas reflecting new guidelines and standards. In particular the scope and methodology for the GHG assessment have been updated in response to the requirements of the new PAS 2080 standard[25] and recent Government policy announcements and publications. The in-combination climate change impacts assessment and the climate change resilience assessments have been updated in response to further interpretation of EU and Institute of Environmental Management and Assessment (IEMA) guidance on undertaking and reporting the two assessments separately.
Community	In line with the increased emphasis on integration, this topic will be more closely integrated with related disciplines such as socio-economics and health. The formal EIA Report will be structured to enable the inter-relationships between these topics to be

[25] British Standard Institute, (2016), PAS 2080:2016, Carbon management in infrastructure

Environmental topic to be included in the EIA	Change in methodology
	made clear. Also the term 'amenity effects' will be replaced by 'in-combination effects' for the purposes of clarification of the scope of the assessment, although the methodology will remain the same.
Cultural heritage	Minor technical updates reflecting revised guidelines and standards - Historic England's guidance on The Historic Environment in Local Plans, Managing Significance in Decision-Taking in the Historic Environment, and The Setting of Heritage Assets (Good Practice Advice Notes 1, 2, and 3) – as well as comments from consultees, specifically with regard to assessing impacts on the historic landscape, the development of a model of archaeological potential and the significance criteria.
Ecology and biodiversity	In line with the emphasis in the 2014 Directive on integration of assessments required under different European Union (EU) Directives, this topic will incorporate assessments under the Birds Directive and the Habitats Directive where appropriate, and any monitoring procedures in the event of any significant residual effects remaining. The assessment methodology will be updated in line with new advice about protected species from Natural England, and guidance on bat surveys, and on Ecological Impact Assessment (EcIA) from the Chartered Institute of Ecology and Environmental Management (CIEEM). The use of eDNA[26] to determine presence, or absence, of great crested newts in waterbodies is added to the specialist surveys, and reference made to a new section on Climate Change.
Electromagnetic interference	Updated to reflect EU Directive on electromagnetic interference. (EU Directive 2013/35/EU Electromagnetic Fields (EMF) limits).
Health	New topic introduced as a result of Directive 2014/52/EU and in consideration of the development of Health Impact Assessment practice. Formerly reported separately. Minor updates to reflect recent guidance and publications. Addition of 'education' to list of health determinants. Expansion of proposed consultation and engagement in line with EIA. More detail on methodology for assessment including qualitative and quantitative assessment criteria.
Land quality	Minor technical updates in line with evolving assessment practice.
Landscape and visual	Updated in line with revised Landscape Institute Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3), primarily relating to the assessment scale for landscape sensitivity, and in response to consultation comments.
Major accidents and natural disasters	New topic introduced as a result of Directive 2014/52/EU.
Socio-economics	Minor technical updates reflecting development of methodology and policy aligned with lessons learned from Phase One and developments in good practice, together with the inclusion of updated policy documents such as the 3rd edition of the HCA Employment Density Guide[27] and DfT National Policy Statement for National Networks (17 December 2014). Terminology has also been changed by referring to 'in-combination' effects as opposed to 'amenity' to improve clarity concerning the operation of this methodology.

[26] eDNA, or environmental DNA, is DNA that is released into aquatic environments by plants and animals through shed skin cells, urine, faeces, saliva, hair, eggs and sperm, or when they die

[27] Homes and Communities Agency (HCA), November 2015, Employment Density Guide, 3rd edition

Environmental topic to be included in the EIA	Change in methodology
Sound, noise and vibration	Minor updates in line with HS2 Phase One Information Paper E20, updated standards such as BS4142: 2014 and integration with the health assessment.
Traffic and transport	Minor technical clarifications on the applications of methodology and policy.
Waste and material resources	Minor technical updates reflecting development of legislative and policy framework, such as the repeal of the Site Waste Management Plans Regulations 2008 and reference to relevant local waste planning policy.
Water resources and flood risk	Updated in response to revised legislation and guidance. The approach proposed to demonstrate compliance with the Water Framework Directive (WFD) is now more explicitly referenced within the SMR. For Phase One the approach to the WFD compliance assessment was agreed with the Environment Agency after publication of the SMR. The baseline flood risk assessment will align with the Environment Agency's current published flood maps. Also updated in response to the Government's non-statutory technical standards for sustainable drainage systems[28].

[28] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

3 Stakeholder engagement

3.1 Introduction

3.1.1 Stakeholder engagement activity will inform the assessment process for Phase 2a from inception. Engagement will be an ongoing and continuous process throughout the assessment, supported by distinct periods of consultation at key stages of the EIA and design development.

3.1.2 During preparation of the EIA, ongoing engagement on the scope, methodology and proposed mitigation and nature of resultant impacts within environmental and community topic areas will occur with the key consultees relevant to those topics.

3.2 General approach to stakeholder engagement

3.2.1 HS2 Ltd will organise and facilitate stakeholder engagement activity, working closely with its consultancy team. The general approach to stakeholder engagement for Phase 2a will comprise:

- engagement and consultation scheduled to support the key development stages in the design, engineering, assessment and communication of the Proposed Scheme;
- a proactive approach to engaging stakeholders and the general public, in particular, within community areas along the route of the Proposed Scheme;
- the use of varied engagement techniques to suit the specific and often varied needs of specific stakeholders, including groups who may be hard to reach or engage; and
- a focus on the particular issues which are of greatest relevance or importance to each stakeholder group, to enhance the ability of the Proposed Scheme to address stakeholder concerns in a timely and effective manner.

3.3 Stakeholder engagement for the integrated assessment

3.3.1 In line with the integrated assessment of environment and health, stakeholder engagement will be undertaken to collectively inform all aspects of the assessment of the Proposed Scheme.

3.3.2 Consultees for the process of undertaking an EIA will be engaged and formally consulted throughout the assessment process, including key stakeholders for the assessment of health and designated statutory consultees recognising these have an important influence on the integrated assessment. A list of consultees is provided in Annex B of this SMR.

3.3.3 A detailed mapping of stakeholders to support the assessment has been undertaken, and will continue to be updated through the development of the Proposed Scheme. This mapping has been used to inform the identification of the most appropriate mechanisms with which to engage both specific stakeholders and communities, but also key sections or groups within such communities.

3.3.4 The engagement process will seek to be accessible and inclusive in its approach and is informed by HS2 Ltd's Equality, diversity and inclusion policy[29].

3.3.5 It is important that engagement is used to provide a voice to those who may be affected by the Proposed Scheme generally, but also specifically to those who may be more vulnerable to impacts. Engagement will therefore be used to obtain local experience and knowledge that will allow for the identification of potential effects that might not otherwise have been considered.

3.3.6 Ultimately, Phase 2a engagement will focus on ensuring that local needs and considerations are taken into consideration when identifying appropriate mitigation and enhancement measures. This engagement will help to facilitate the early identification of such measures and their timely integration into the scheme design.

3.4 Key stages of engagement and consultation

3.4.1 The programme of ongoing stakeholder engagement will be structured around key milestones in the design development and assessment for the Proposed Scheme. This will provide the opportunity to update stakeholders and the public on the evolving Proposed Scheme design and assessment of environment and health.

3.4.2 As set out in Section 2, HS2 Ltd is consulting on the working draft EIA Report. This consultation is being carried out early in the development of the Phase 2a proposals. This is to allow for earlier engagement with those potentially affected by the Proposed Scheme and to help inform the scheme design and assessment.

3.4.3 Following consultation on the working draft EIA Report, HS2 Ltd will continue to engage with the public and other stakeholders prior to the deposit of the hybrid Bill and supporting documents. Parliament will consult on the formal EIA Report after deposit of the hybrid Bill where the public will have the opportunity to comment on that Report. Parliamentary officials will appoint an independent assessor who will summarise responses and provide a report to Parliament before the Second Reading of the hybrid Bill.

3.4.4 Engagement, and specifically the formal period of consultation, will adopt a 'design-led' approach which will present the Proposed Scheme from a multi-disciplinary perspective. This will focus on the inter-relationships between environment and communities, and demonstrate how the Proposed Scheme design has sought to provide optimal solutions for the benefit of both through the design development.

3.4.5 In doing so, it will enable stakeholders to be fully informed, understand what is proposed in their respective areas and identify predicted impacts arising from the Proposed Scheme. Through focus on the design, stakeholders will have the opportunity to assist in the identification of mitigation, where appropriate, as a result of a better understanding of the Proposed Scheme itself.

[29] HS2 Ltd's Equality, diversity and inclusion policy. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/437449/G5_-_Equality__Diversity_and_Inclusion_Policy_v1.2.pdf

3.4.6 During the EIA process, ongoing engagement on the scope, methodology and proposed mitigation and nature of resultant impacts within environmental topic areas will also occur with the key consultees relevant to those topics.

3.5 Forums for engagement and consultation

3.5.1 Engagement and consultation will be designed to meet the needs of a range of consultees and the public, recognising that there will be different requirements and expectations for each. This will allow for the Proposed Scheme to be developed in line with strategic and national aims as well as considering local issues and concerns. There will be four key forums as described below.

Directly affected individuals and land owners

3.5.2 The engagement and consultation will have a strong focus on directly affected individuals, particularly landowners. These are recognised as priority stakeholders and there will be a programme of catered and direct engagement throughout the design and assessment development. This stakeholder group will also form a key part of the baseline for the assessment of the Proposed Scheme, both in the consideration of agricultural land and as a component of the health baseline.

Communities

3.5.3 Communities which may be directly affected by the Proposed Scheme will be identified and be a key focus of the engagement and consultation processes.

3.5.4 During the design and assessment process, engagement with communities will be carried out to fulfil regulatory and best practice guideline requirements. Critically, consultation will be undertaken in a timely and appropriate manner to ensure communities have the opportunity to input to and influence the development of the Proposed Scheme.

3.5.5 The purpose of community engagement will be to consider local issues and discuss potential ways to avoid and mitigate impacts of the Proposed Scheme, such as screening views of the railway, managing noise and reinstating highways, and identifying possible community benefits.

3.5.6 Community engagement will require transparent communication of the nature of the Proposed Scheme and of the potential impacts and likely significant effects, in line with particular requirements set out in the amended EIA Directive.

Local authorities and parish councils

3.5.7 The role of the local authorities for the areas through which the Proposed Scheme will pass is two-fold:

- as the holder of data critical to informing the design and assessment; and
- providing access to wider stakeholders and communities within the area through local knowledge.

3.5.8 There will be ongoing engagement with local authorities and parish councils throughout the design and assessment processes to maximise the opportunity for local authorities and parish councils to positively inform the development of the

Proposed Scheme both in the context of technical input to the assessment and local knowledge and issues.

Technical and specialist groups

3.5.9 This group comprises stakeholders with specific technical knowledge or particular interest in the Proposed Scheme, many of whom will have a high level of influence on the design and assessment process, particularly in relation to technical feasibility and likely environmental and community impacts. This group includes national representatives of environmental statutory authorities and government departments, as well as non-statutory technical/specialist organisations. These stakeholders are likely to help influence project-wide mitigation strategies and principles.

3.6 Using engagement to inform scheme design and assessment

3.6.1 The feedback and data received from stakeholders through both ongoing engagement and formal periods of consultation will be recorded and used to influence the design and assessment of the Proposed Scheme where appropriate. Ongoing engagement will provide the opportunity to update stakeholders on the design evolution and assessment progress, identifying where feedback has helped inform both, up to hybrid Bill deposit.

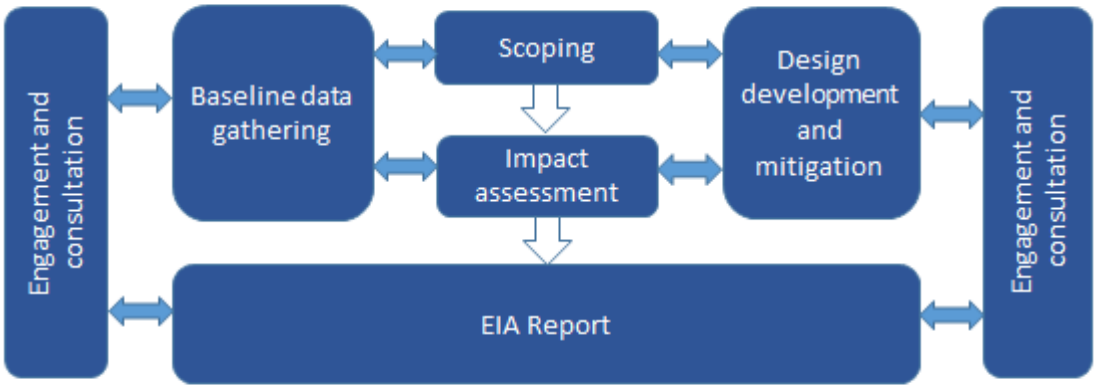
4 EIA methodology

4.1 Introduction

4.1.1 The EIA is the process that will lead to the production of the formal EIA Report which will be submitted in support of the Phase 2a hybrid Bill. It will be carried out in accordance with applicable legal requirements and with current best practice. The Phase 2a EIA will seek to adopt the principles of the EIA Directive 2014/52/EU and SO27A (as described in Section 2 of this SMR).

4.1.2 The EIA process will comprise a number of related and iterative activities, as illustrated in Figure 2.

Figure 2 - EIA process diagram



4.1.3 As Figure 2 shows, the main stages in the EIA process comprise:

- initial EIA scoping to establish the broad scope and methodology of environmental studies to be carried out for each topic and engage and consult with stakeholders to take account of their views;
- establishing current baseline conditions (i.e. the environmental conditions that currently exist in the vicinity of the Proposed Scheme). These will be determined from desk-top studies, previous environmental studies, publicly available information, environmental surveys of the area and consultation with groups that have specialist local knowledge;
- projecting future baseline conditions (i.e. the future conditions without the Proposed Scheme in place). The current baseline will be extrapolated to take account of predicted or anticipated change factors including, but not limited to, changes caused by changing climatic conditions, policy, legislation, proposed development, advances in technology and by other planned infrastructure projects;

- establishing the likelihood of other developments being under construction before or during the construction of the Proposed Scheme;
- consideration of policies, guidelines and legislation and best practice relevant to EIA;
- assessment of the design of the Proposed Scheme in accordance with the methodology outlined for each environmental topic within the SMR, to identify the local extent of potential impacts and the practicable design measures to avoid, reduce or otherwise mitigate significant adverse environmental effects;
- ongoing engagement with environmental, planning and community stakeholders throughout the engineering design and assessment process;
- preparation of the working draft EIA Report;
- public consultation on the working draft EIA Report;
- further assessment in the light of consultation responses and ongoing design development and baseline surveys;
- preparation of the formal EIA Report; and
- implementing mitigation and monitoring.

4.1.4 The formal EIA Report will be deposited with Parliament alongside the hybrid Bill for the Proposed Scheme and will allow Parliament to make an informed decision on whether the Proposed Scheme should proceed. Following First Reading of the hybrid Bill and the deposit of supporting documents, the Standing Orders (SO 224A) require a public consultation on the formal EIA Report. This consultation will be held over a period of at least 56 days (eight weeks). A summary of comments on the formal EIA Report will be provided by an independent assessor to inform Second Reading of the Bill.

4.1.5 The provision of further information to Parliament and further consultation may be required during this legislative process.

4.1.6 In addition to describing the reasonable alternatives considered, the EIA will broadly consider the following two scenarios:

- the likely significant environmental effects of the construction, existence and operation of the Proposed Scheme at various times (see Temporal scope in Section 4.2); and
- the likely significant environmental effects of the Proposed Scheme in addition to other schemes that are either consented or under construction at that time (but are not included in the projected future baseline) and are identified as having the potential to result in significant cumulative impacts and resultant effects (see Section 4.4 Cumulative effects).

4.1.7 The EIA will consider both the beneficial and adverse environmental and community effects of the Proposed Scheme in the short, medium and long term. It will consider

both temporary and permanent effects caused directly and indirectly by the Proposed Scheme. It will also address cumulative effects.

4.1.8 A description of the mitigation measures envisaged in order to prevent, reduce and where possible offset any significant adverse effects will be provided in the formal EIA Report.

4.1.9 The methodologies for the assessments provided in this SMR vary from topic to topic. In general however, all of the assessments will involve a process of interaction between engineering design, planning, environmental and community considerations with a view to avoiding or reducing significant adverse effects on the environment during construction and operation. Mitigation measures would be considered and incorporated within the Proposed Scheme wherever appropriate and practicable. The extent and scale of mitigation will be designed to control and minimise significant adverse environmental effects as well as identify opportunities to promote positive environmental effects.

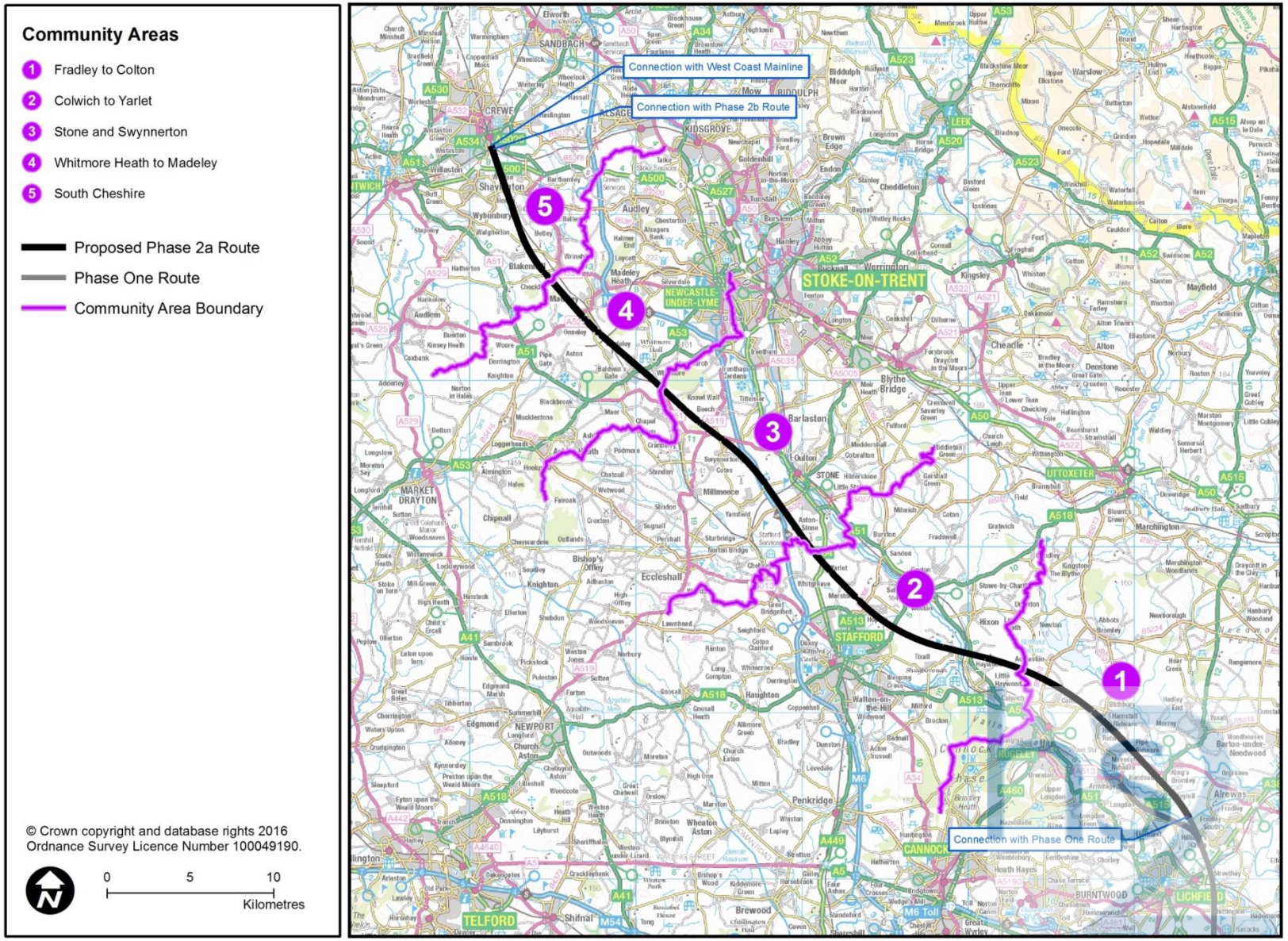
4.1.10 There will inevitably be some uncertainties in predicting future impacts and effects, especially given that operation would not be due to commence until 2027.

4.1.11 Where it is not possible or appropriate to quantify impacts or their consequential effects, qualitative assessments will be carried out, based on professional experience and judgement. Where uncertainty exists, this, together with any assumptions relied upon, will be noted in the relevant assessment and any limitations to the EIA work will be reported in the formal EIA Report.

4.1.12 The environmental assessment will be reported in relation to a series of geographical areas along the route, known as community areas. The community areas, as shown in Figure 3, are:

- community area 1: Fradley to Colton;
- community area 2: Colwich to Yarlet;
- community area 3: Stone and Swynnerton;
- community area 4: Whitmore Heath to Madeley; and
- community area 5: South Cheshire.

Figure 3 - Phase 2a community areas



4.1.13 Environmental impacts and effects will be reported in the community area where they are experienced, whether they arise from inside that area, or from an adjoining area. If effects arise on a receptor (for example an ancient woodland) which straddles the boundary between two areas, the effects will be reported in both community areas. Any environmental impacts and effects that are experienced outside of the community areas will be reported in an 'Off-route' volume to the formal EIA Report.

4.2 Scope of the assessment

4.2.1 The following section defines the temporal, geographic and technical scope of the assessment of the Proposed Scheme.

Temporal scope

4.2.2 The main construction works for the Proposed Scheme are expected to take place between 2020 and 2026 (including a period of testing and commissioning), with the intensity and scale of construction along the route varying over this period. The formal EIA Report will set out the proposed construction programme in order to establish the likely duration of works in each location. The assessment of construction effects will then relate to the programme described.

4.2.3 Trains are currently expected to start operating on the West Midlands to Crewe section in 2027, one year after the opening of the London-West Midlands section. The effects of services operating across Phase One and Phase 2a (in advance of the full Phase Two route opening) will be addressed in the formal EIA Report. It is expected that once the full Phase 2b route to Manchester is operational, the use of the combined Phase One / Phase 2a railway will intensify. The formal EIA Report will describe the predicted frequency, speed and length of trains and how that is estimated to change after 2027. The effects arising from the operational rail traffic on the Phase 2a section will however be assessed taking account of the worst-case scenario, anticipated to be up to 12 trains per hour in each direction on completion of the full Y network.

4.2.4 The formal EIA Report will describe those elements of Phase 2a such that the relationship between Phase One and Phase 2a is understood to enable the impacts on the Phase One receptors to be described and assessed.

4.2.5 Effects arising from longer term considerations after the opening of Phase One and Phase 2a, the progressive growth in background road traffic or the maturing of mitigation (e.g. growth of planting or habitat creation) will be considered. Where this applies, the topic sections in Part B of this SMR identify the appropriate temporal scope that would be adopted, taking account of these factors.

4.2.6 The EIA will establish the baseline environment as it exists at present, and then take account of likely changes to the baseline for the future scenarios defined within this section.

Geographic scope

4.2.7 The term geographic scope (also called spatial scope) means the area over which the EIA will consider effects. In general, this will take into account the distance from the Proposed Scheme over which changes to the environment are likely to occur as a result of the construction or operation of the Proposed Scheme. In addition to the

land required permanently it will also address land required for construction (both for short and long term periods) and then returned to an agreed condition afterwards. In addition to the physical extent of the works, the geographic scope is influenced by two principal factors:

- the nature of the baseline environment; and
- the manner in which the effects are likely to be propagated.

4.2.8 In addition, the EIA will consider any significant effects caused by activities such as:

- HS2 services on the 'classic network' north of Crewe;
- changes to HS2 passenger levels on Phase One as a result of Phase 2a and consequential effects; and
- consequential changes to rail traffic on other lines, especially on the WCML between Crewe and the north, and disruption at Crewe station during construction.

4.2.9 Transboundary effects are significant environmental effects caused in other countries (i.e. other than the UK). There are no direct connections between the HS2 scheme and other countries. Therefore, it is considered unlikely that the Proposed Scheme will result in any significant effects on the environment of another country and thus transboundary effects are not proposed to be considered further.

Technical scope

4.2.10 The environmental topic areas to be considered and the extent of the assessment work proposed for each is referred to as the technical scope. The technical scope of the EIA for the Proposed Scheme will seek to meet the requirements of EIA Directive 2014/52/EU, in the absence of new regulations, as described in Section 2 of this SMR. The EIA will assess the likely significant effects of the Proposed Scheme on the following environmental topics:

- agriculture, forestry and soils;
- air quality;
- climate change;
- community;
- cultural heritage;
- ecology and biodiversity;
- electromagnetic interference;
- health;
- land quality;
- landscape and visual;
- major accidents and natural disasters

- socio-economics;
- sound, noise and vibration;
- traffic and transport;
- waste and material resources; and
- water resources and flood risk.

4.2.11 These environmental topics have been evaluated as part of this scoping exercise in order to determine the extent to which they should be included in the EIA, having regard to whether there are likely to be significant effects that relate to them. Part B of this SMR provides further details for each environmental topic regarding the assessment approach to be applied during the EIA.

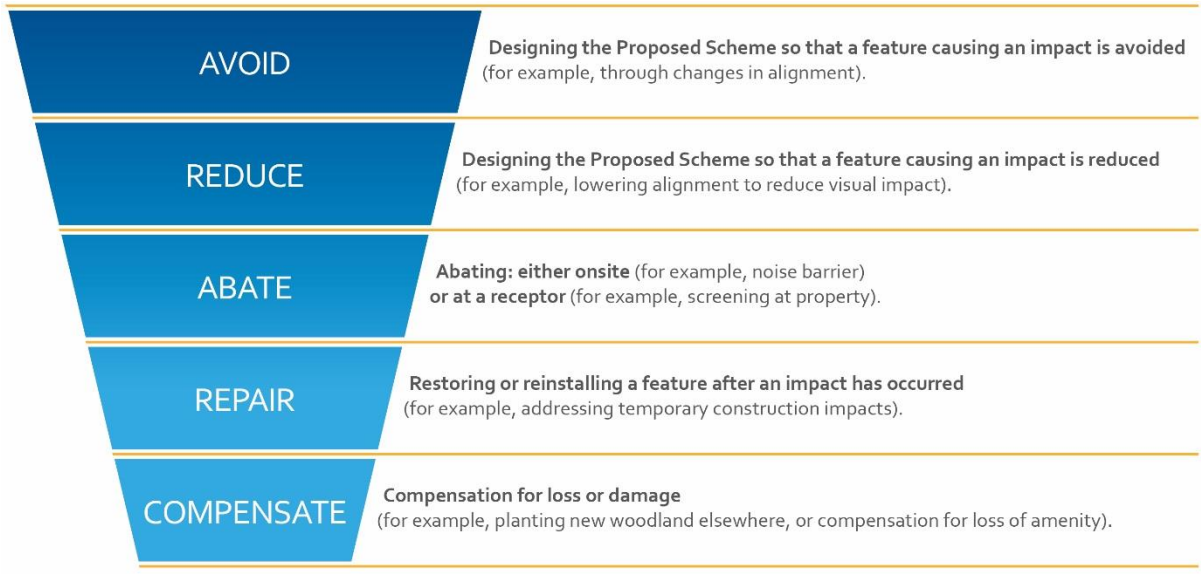
4.2.12 This SMR sets the overarching framework for the scope of the EIA for the Proposed Scheme and the methodology to be applied. Detailed methodologies for the topics will be developed in conjunction with environmental statutory authorities and government departments and presented in Technical Notes for each topic to be assessed. It is intended that these Technical Notes will be published alongside the formal EIA Report. The Technical Notes will take into account updates from the Phase One EIA methodology and include detailed approaches to the new topics required by application of the EIA Directive 2014/52/EU.

4.3 Approach to mitigation

4.3.1 The EIA will identify mitigation measures that would help to avoid, reduce, repair or, where appropriate, offset significant adverse effects.

4.3.2 Figure 4 illustrates the hierarchy that will continue to be used to consider mitigation and compensation measures.

Figure 4 - Mitigation hierarchy



4.3.3 Mitigation opportunities will continue to be identified during development of the Proposed Scheme prior to the submission of the hybrid Bill. The EIA process is iterative, which is likely to enable further refinement of the Proposed Scheme, with

the objective of avoiding or reducing significant adverse environmental effects. Mitigation measures will be identified by regularly reviewing the likely significant adverse environmental effects identified during the ongoing assessment process and considering these at design workshops within the HS2 project teams. Design modifications will be considered to avoid or reduce significant adverse effects.

4.3.4 During the EIA process, HS2 Ltd intends to develop the mitigation incorporated into the Proposed Scheme through:

- the HS2 Sustainability Policy - to set environmental standards which the Proposed Scheme should aim to achieve, thereby structuring and guiding the design;
- collaborative working between environmental assessment and engineering design teams - to achieve improved design outcomes;
- community engagement and consultation - to allow local people, environmental organisations and responsible authorities to raise issues and propose design and mitigation changes to be considered within the Proposed Scheme;
- recording proposed mitigation along the route to gauge the consistency of approach applied along the route; and
- Code of Construction Practice (CoCP) - an HS2 Ltd document to describe the approach to be taken during construction to reduce adverse effects on communities and the environment, including through the use of Local Environmental Management Plans.

4.3.5 The proposed mitigation measures will be described in the formal EIA Report, together with the significant effects remaining after mitigation (termed the residual effects). Where the Proposed Scheme is likely to improve environmental conditions (over and above the baseline), these effects will be identified as enhancements.

4.4 Cumulative effects

4.4.1 Cumulative effects are broadly defined as incremental effects that result from the accumulation of a number of individual effects, either caused by the Proposed Scheme (intra-project effects) or by other existing and/or approved projects which would be under construction at the same time as Phase 2a or built later (inter-project effects). Where it is identified that other schemes are expected to be complete before construction of Phase 2a, their effects will be considered through the extrapolation of the future baseline.

4.4.2 The assessment of cumulative effects will therefore consider the following:

- the combined effects on a single receptor of a number of individual environmental impacts, for example noise, dust and traffic;
- the effects of existing and/or approved projects in the vicinity of the Proposed Scheme which are under construction or have been consented, including Phase One, which when combined with the effects of the Proposed Scheme may have an incremental significant effect; and

- the cumulation of individual effects on a receptor which when summed (including in a regional context or over the length of the Proposed Scheme), result in an effect of greater significance than the sum of the individual effects (i.e. synergistic effects).

4.4.3 Other proposed schemes that should be considered as having a cumulative effect in combination with HS2 will be considered during the EIA. As an example, it is expected that the EIA would consider carefully the effects of the overlapping construction of Phase One and Phase 2a in the vicinity of receptors of impacts from the Proposed Scheme, particularly at the interface around Fradley. The EIA will also consider the cumulative impacts of subsequent Phase 2b development between Crewe and the north as far as reasonably practicable with the information available at the time of the assessment.

4.4.4 Network Rail is developing options for a Crewe Hub scheme, which is separate to the Phase 2a Proposed Scheme.

4.4.5 The Command paper High Speed Two: East and West can be taken as national policy support for Crewe Hub. It sets out, in paragraphs 6.14 and 6.15, the emerging options for a Crewe Hub station, noting that options work being undertaken by Network Rail and HS2 Ltd, with Cheshire East Council is now focused on two locations (the existing Crewe station and Basford sidings) and that the Government is 'working towards reaching a preferred approach in Autumn 2016'.

4.4.6 An appraisal of the cumulative effects of constructing and operating the Proposed Scheme and Crewe Hub, insofar as information is available at the time of the assessment, will be reported in the formal EIA Report.

4.4.7 The geographical scope of other schemes to be included in the cumulative assessment depends on the context (e.g. rural or urban) and on the characteristics of the topic concerned. This will be defined for each scheme and for each environmental topic in the course of the EIA process in engagement with appropriate stakeholders.

4.4.8 Where relevant, potential cumulative effects arising will be identified in each topic assessment, which will include details of the cumulative assessment methodology and results.

4.5 Defining significant effects

4.5.1 This SMR refers to both environmental impacts and environmental effects. The general approach taken is that the Proposed Scheme has the potential to cause an impact on the receiving environment or its neighbours either through physical change (such as the land used for the project, or change in land form) or through changes in sound or noise levels, air quality, or socio-economic factors. The extent to which an impact causes a significant environmental, socio-economic or community (including health) effect to occur will depend on a number of factors. In the main, it is significant effects that are reported in the formal EIA Report, but in the EIA process much of the attention is on assessing the level of impacts that give rise to the effects and determining how to avoid or reduce them.

4.5.2 The predicted effects will be classified according to whether they are considered to be major, moderate or minor; and beneficial or adverse. This will provide a consistent

approach to expressing the results of the assessments undertaken as part of the EIA. The terms used are defined as follows:

- beneficial - advantageous or positive change to an environmental resource or receptor;
- adverse - detrimental or negative change to an environmental resource or receptor;
- minor - slight, very short term or highly localised impact;
- moderate - limited impact (by extent, duration or magnitude); and
- major - considerable impact (by extent, duration or magnitude) of more than local importance or in breach of recognised standards, policy or legislation.

4.5.3 The duration of impacts will be categorised as short, medium or long term, where they are not permanent. There is no definition of these terms in EIA practice and it is recognised that the use of the terms would depend on the viewpoint of the user, especially where the user is subjected to the impact or effect. It is therefore important that in addition to using these descriptors, the EIA also gives an indication of the duration. In general, and given the length of the construction programme, the EIA will consider those impacts that last a matter of months to be 'short term' and those that continue through to the commencement of operations as 'long term'.

4.5.4 Some impacts would arise directly from construction or operation of the Proposed Scheme and others would arise more indirectly from activities associated with the Proposed Scheme or resulting as a consequence of it. Whether an impact arises directly or indirectly does not affect whether the resulting effects are considered to be significant or not.

4.5.5 Potential variants to the foregoing approach are described as appropriate in the environmental topic sections in Part B of this SMR.

4.5.6 Where it is not possible or appropriate to quantify impacts or their consequential effects, qualitative assessments will be carried out, based on professional experience and judgement. Where uncertainty exists this, together with any assumptions relied upon, will be noted in the relevant assessment and any limitations to the EIA work will be reported in the formal EIA Report.

4.5.7 The significance of effects will be evaluated with reference to recognised standards and accepted criteria for each assessment topic, where these are available. Where no recognised standards or criteria exist, professional judgement will be used to develop an appropriate approach to undertake a robust and appropriate assessment, as explained below. Each environmental topic section in this SMR describes the approach to be taken. In determining whether a resulting effect is significant due consideration will be given to:

- spatial extent (e.g. local, district, regional, national or international);
- magnitude;
- duration (whether short, medium or long term);

- frequency of occurrence;
- nature of the effect (whether direct or indirect, permanent or reversible);
- whether it occurs in isolation, is cumulative or interactive;
- sensitivity and number of receptors affected;
- value of a resource affected;
- performance against environmental quality standards; and
- compatibility with environmental policies.

4.5.8 Where effects are considered to be significant, the formal EIA Report will show the geographic (or spatial) level at which they are viewed as significant (for example, at a community level or a regional or national level).

4.5.9 The EIA is being undertaken by a number of consultancies who are considered to be amongst the leaders in their profession in the UK. The leads for each environmental topic, from the appointed consultancies, meet regularly to discuss the methodology being applied, the issues, impacts and effects arising, and the solutions available. National representatives of environmental statutory authorities and government departments are also involved in these discussions. This approach enables experienced EIA practitioners to apply expert professional judgement where appropriate on a consistent basis.

4.6 Assumptions

4.6.1 Each topic section of the formal EIA Report will include a section to explain key assumptions made in undertaking the assessments.

4.6.2 During the preparation of the EIA there could be some circumstances that result in factors that may limit the information available to inform the assessment process. Any limitations, and the consequences on the completeness or potential accuracy of conclusions, will be described in the relevant environmental topic section within the formal EIA Report.

5 Reporting of alternatives

5.1 Introduction

5.1.1 This section provides a summary of the approach that will be taken in relation to the consideration of alternatives and outlines the key alternatives to be reported.

5.2 The case

5.2.1 The case for taking action and for HS2 in particular revolves around four key elements: extra capacity, improved connectivity, local growth and direct opportunities for people and businesses.

5.2.2 The Government considers that a continuing increase in demand will create a need over the next 20 to 30 years for additional capacity to cater for inter-city journeys between London and the major conurbations in the Midlands and the North. It does not, however, believe transferring rail demand to road or domestic aviation to be an appropriate solution. If the increases in demand for inter-urban travel that would be expected as the UK economy returns to a pattern of long-term and sustainable growth are to be accommodated, then the Government considers that it is the rail network which needs to be in a position to play the lead role in delivering new capacity and that a clear case exists for this new capacity to be a new high speed rail network.

5.2.3 The Government does not consider that yet more rounds of incremental enhancements to existing lines will be sufficient to meet long-term capacity needs for passengers or freight. It is the Government's view that analysis by Network Rail has indicated that even very major enhancement packages simply cannot resolve the pressures on capacity anticipated on the WCML over the coming decades. The strong likelihood is that even by pushing the WCML to the absolute limit, as the alternatives that have been considered do, it would only delay rather than eliminate the need for new lines in the future. In the meantime, substantial disruption would have been imposed on passengers over a number of years as works were carried out and the additional strategic, economic and connectivity benefits that high speed rail is particularly capable of delivering, would have been foregone.

5.2.4 Given the opinion that upgrading the existing north-south lines is not a viable long-term solution, Government considers that the real choice, therefore, is not between high speed rail and further incremental upgrades; rather a new line capable of providing the capacity that is required. It is recognised that building new conventional rail lines would not be significantly cheaper, nor would their impacts on the environment and communities be significantly less than those of new high speed rail lines. Moreover, new conventional rail lines would deliver far fewer benefits in terms of enhanced connectivity and support for long-term economic growth. The additional benefits generated by designing a new line to accommodate high speed services, compared to a new conventional speed line, would outweigh the additional costs by a factor of more than four to one. These matters are described in more detail within the

report High Speed Rail Strategic Alternatives Study: Strategic Alternatives to the proposed 'Y' Network[30].

5.3 Acceleration

5.3.1 Building on the case for a 'Y' shaped high speed network, as further developed and refined under Phase Two of HS2, the Government also agrees that there is a clear case for accelerating the delivery of the Proposed Scheme. Accelerating this section of Phase Two of HS2 will improve journey times to northern cities sooner, support growth and jobs in the local areas, and help to create the conditions for both the Northern Powerhouse[31] and the Midlands Engine[32].

5.4 Reporting of alternatives

5.4.1 The Proposed Scheme is the product of some six years of work by HS2 Ltd to examine a substantial number of possible strategic, route-wide and local alternatives to the proposed route alignment. The main alternatives that have been considered for Phase One, Phase Two and the Proposed Scheme are set out in a number of reports[33]. This existing information will form the basis to describe the reasonable alternatives considered, which are relevant to the Proposed Scheme and its specific characteristics.

5.4.2 The reporting of alternatives will include content to:

- identify, describe and evaluate the likely significant effects on the environment of implementing the Proposed Scheme, and reasonable alternatives taking into account the objectives and the geographical scope of the Proposed Scheme;
- summarise the reasons for choosing the Proposed Scheme, in the light of the other reasonable alternatives dealt with; and
- outline the reasons for selecting the alternatives dealt with, including a description of how the assessment was undertaken including any difficulties encountered in compiling the required information.

5.4.3 The reporting of alternatives will also:

- describe the reasonable alternatives in terms of design, technology, location,

[30] Atkins, February 2011, High Speed Rail Strategic Alternatives Study: Strategic Alternatives to the proposed 'Y' Network

[31] The Northern Powerhouse is a proposal launched in a speech by the Chancellor of the Exchequer in Manchester in June 2014. Its aim is to boost economic growth in the north of England, especially the 'core cities' of Manchester, Liverpool, Leeds, Sheffield and Newcastle. Better transport connections between the northern cities and better links to London underpin the proposal. The transport strategy for the Northern Powerhouse which includes Phase Two of HS2 was set out in 'The Northern Powerhouse: One Agenda, One Economy, One North; Transport for the North, March 2015, HMSO

[32] The Midlands Engine is a proposal by Government to improve and grow the Midlands' economy by £34 billion by 2030 and create a further 300,000 jobs. The prospectus for the Midlands Engine for Growth which refers to the need to exploit and build on the connectivity provided by Phase One and Phase Two of HS2 was launched by the Secretary of State for Business, Innovation and Skills in December 2015

[33] High Speed Rail Strategic Alternatives Study: Strategic Alternatives to the proposed 'Y' Network (2011); Options for Phase Two of the high speed rail network, a report to Government by HS2 Ltd (March 2012); Options for Phase Two of the high speed rail network appraisal of sustainability (March 2012); Sustainability Statement, Volume 1: main report of the Appraisal of Sustainability, a report by Temple-ERM for HS2 Ltd (2013); HS2 Phase One Environmental Statement Volume 1: Introduction to the Environmental Statement; HS2 Phase One Environmental Statement Volume 5: Alternatives Report (November 2013); Rebalancing Britain: From HS2 towards a national transport strategy (October 2014); The Strategic Case for HS2 Phase 2a (October 2015); High Speed Two: East and West, The next steps to Crewe and beyond (November 2015); and, the Economic case for HS2 Phase 2a, House of Commons Briefing Paper (December 2015)

size and scale;

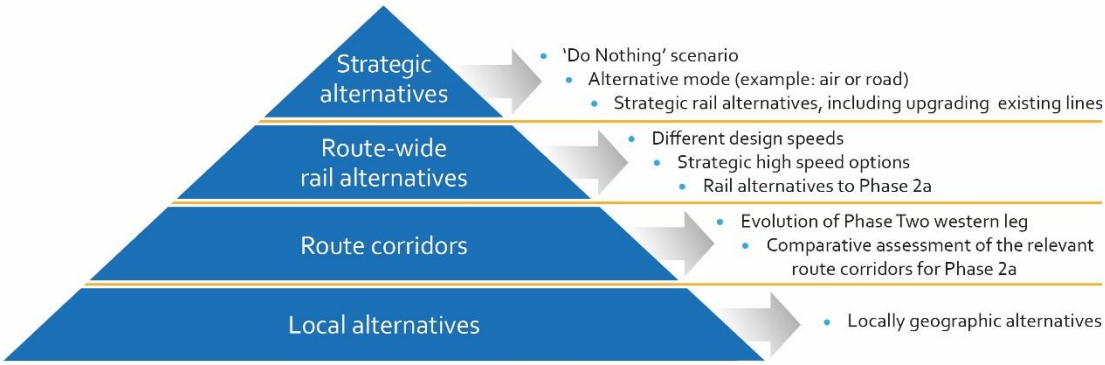
- include a comparison of the environmental effects of the relevant alternatives; and
- outline the likely evolution of the current state of the environment without implementation of the Proposed Scheme (baseline scenario) (refer to individual topics under Part B of this SMR).

5.4.4 In addition to the environmental analysis, a supporting narrative will be provided, where appropriate, on how the relevant alternatives considered have been valued, including from an engineering and operational perspective, with a clear justification for those options taken forward.

5.5 The alternatives

5.5.1 The reasonable alternatives to be described will be set out in accordance with the hierarchy in Figure 5. The geographic scope and level of detail for the alternatives will vary depending on which level of the hierarchy they form a part. For example, for Phase 2a the strategic alternatives will consider the scope of the whole 'Y' network and Phase Two, where environmental factors will be considered at a high level. Whereas, the route corridor alternatives will be confined to the geographic scope of Phase 2a with more assessment detail.

Figure 5 - Hierarchy of alternatives considered

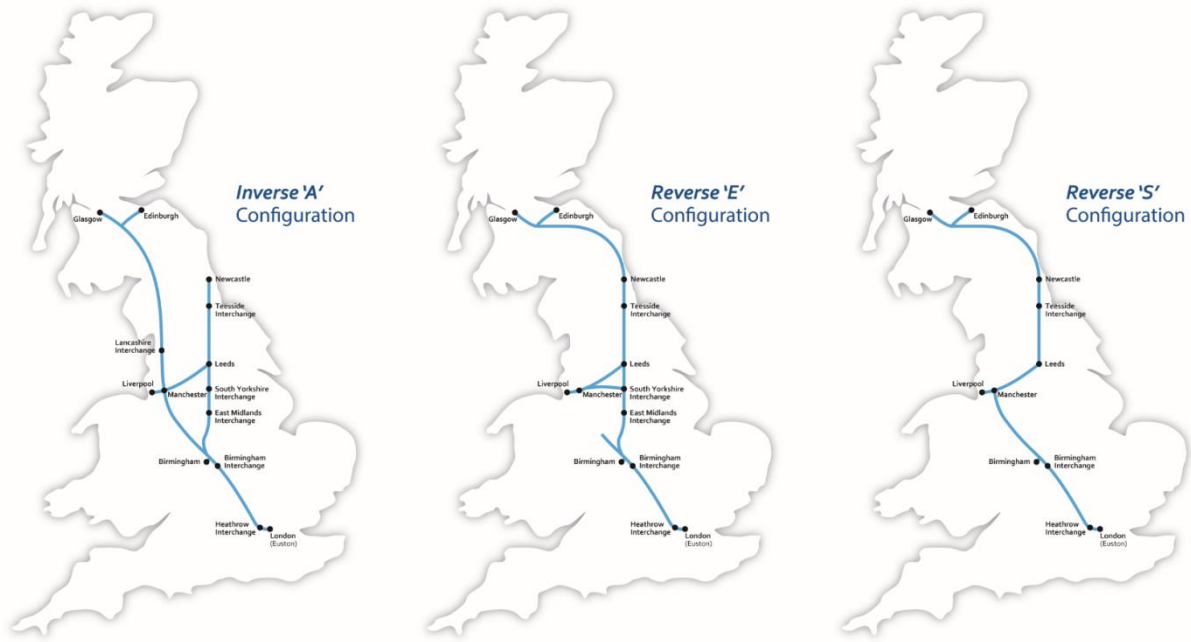


5.6 Strategic alternatives

5.6.1 The reporting of strategic alternatives will include content to describe, in outline, alternatives to Phase Two. These would include:

- a 'do nothing' scenario;
- alternative modes (air or road); and
- alternative high speed configurations to the 'Y' network (Figure 6).

Figure 6 - Alternative high speed configurations



5.7 Route wide rail alternatives

5.7.1 The reporting of route wide rail alternatives will include content to describe, in outline, alternatives to Phase Two. These would include:

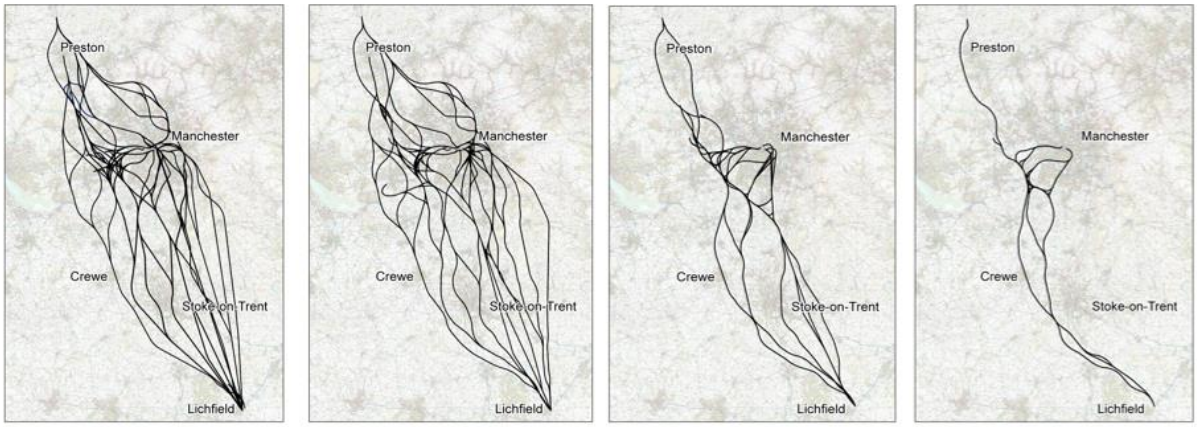
- strategic rail alternatives, including upgrading existing classic lines;
- consideration of alternative design speeds for new lines; and
- rail alternatives to Phase 2a.

5.8 Route corridor alternatives

5.8.1 A description of how route corridors have evolved for Phase 2a from the wider Phase Two western leg options will be reported (Figure 7).

5.8.2 This will concentrate on the relevant route corridor alternatives between the West Midlands and Crewe and the means of connecting to other rail networks including HS2 Phase One near Fradley and the WCML at or near Crewe that were considered in determining the alignment for the Proposed Scheme. An illustration of those corridors to be considered is shown in Figure 8.

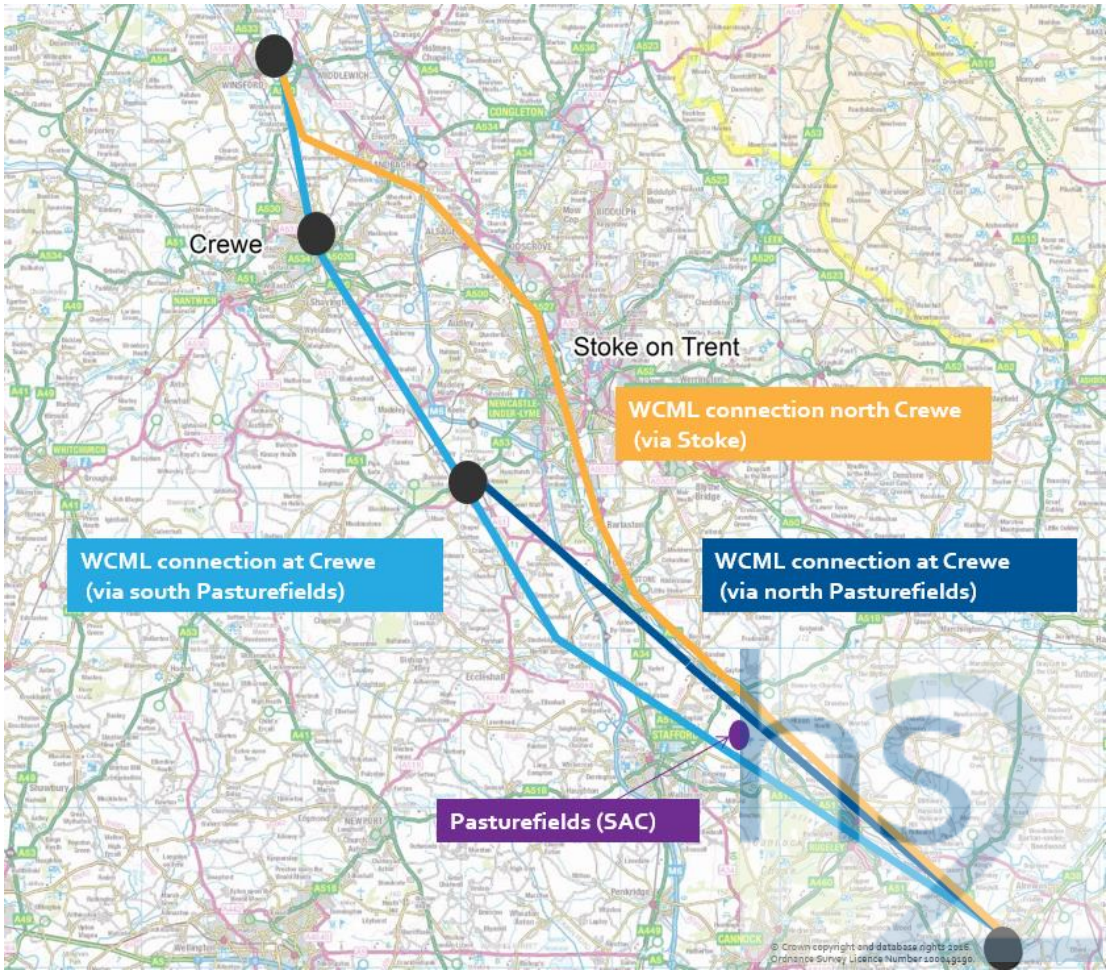
Figure 7 - HS2 Phase Two western leg evolution of alternatives over time



Source: Consultation on the route from the West Midlands to Manchester, Leeds and beyond Sustainability Statement, July 2013

5.8.3 A comparison of the environmental effects of the different route corridor alternatives presented above and the reasons for choosing the Proposed Scheme will be reported.

Figure 8 - Alternative Phase 2a route corridors



Ordnance Survey licence number: 100049190

5.9 Local alternatives

5.9.1 This section of the hierarchy will outline local geographic specific route alternatives considered in the development of the Proposed Scheme. The focus will be on those

alternatives considered following public consultation on the Proposed Scheme in 2013/14, where comparison between options is perhaps less distinct or more localised. The consideration of local alternatives will take into account factors such as construction feasibility and programme, cost and environment in determining the preferred option to be taken forward into the Proposed Scheme.

5.9.2 There will continue to be a refinement to the design in response to environmental assessment and the stakeholder engagement planned by HS2 Ltd, to address local environmental sensitivities and local issues raised through consultations and other factors such as engineering feasibility and cost. These would include, for example, the location of construction site compounds, the access routes to and from construction sites, and the location of environmental mitigation.

5.9.3 Where appropriate and feasible, localised alternatives for these types of features will be considered in order to determine their most suitable location. The outcomes of the engineering, cost and environmental comparative appraisal for local alternatives, with a clear justification of options taken forward, will be provided.

5.10 Mitigation

5.10.1 The process used to inform and evolve scheme design (i.e. how environmental considerations have been integrated into the Proposed Scheme to-date), including environmental mitigation appropriate to the level of environmental appraisal will be reported in outline. This will include those measures or features of the Proposed Scheme which were considered to avoid, prevent or reduce, compensate and as fully as possible, offset any likely significant adverse effects on the environment.

Part B

6 Agriculture, forestry and soils

6.1 Introduction

6.1.1 This section of the SMR covers agriculture, forestry and soils which includes the environmental topic areas of soil, agricultural and forestry land, and farm and farm-based enterprises. In particular, it considers the potential impacts of the requirements for land in terms of agricultural land quality, soil resources, local farm businesses and on-farm enterprises, and agri-environment schemes.

6.1.2 The approach that will be adopted to assess agricultural impacts is derived from national planning policy and the revised EIA Directive.

6.1.3 The principal feature of national policies regarding agricultural land use is the emphasis on safeguarding scarce natural resources in the long-term national interest. Consequently, policies for development in the countryside give a measure of protection to the best and most versatile agricultural land (defined as Grades 1, 2 and 3a in the Agricultural Land Classification (ALC) system).

6.1.4 Policy advises that the economic and other benefits of the best and most versatile agricultural land should be taken into account in decisions on development. Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be used in preference to higher quality land.

6.1.5 ALC is not the sole consideration in assessing how development proposals affect agriculture. Other factors to be considered include the conservation of displaced soil resources and the impacts on farm holdings.

6.2 Establishment of baseline and definition of survey

6.2.1 A high-level description of the baseline environment is contained in paragraph 4.9.1 of the Phase Two post-consultation Sustainability Report[34]. This indicates that the appraisal of sustainability process has sought to limit the loss of the highest quality Grades 1 and 2 agricultural land. High-level agricultural land classification maps show that, while no Grade 1 land is crossed, an estimated 6.2 miles (9.9km) of the route would be through land classified as Grade 2, notably between Chorlton and Basford, with the depot south of Crewe also shown on Grade 2 land.

6.2.2 There is a well-established methodology for classifying the quality of agricultural land, contained within guidance issued by the then Ministry of Agriculture, Fisheries and Food (MAFF) in 1988[35].

6.2.3 Agricultural land in England and Wales is graded between 1 and 5, depending on the extent to which physical or chemical characteristics impose long-term limitations on

[34] Temple/RSK, 2015, High Speed Rail: Preferred Route to Crewe, Sustainability Report Phase Two Post-Consultation Update: West Midlands to Crewe. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480667/Sustainability_Report_Phase_Two_Post-Consultation_Update_West_Midlands_Crewe.pdf

[35] Ministry of Agriculture, Fisheries and Food, 1988, Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land, MAFF

agricultural use. Grade 1 land is 'excellent quality' agricultural land with very minor or no limitations to agricultural use, and Grade 5 is 'very poor quality' land, with severe limitations due to adverse soil, relief, climate or a combination of these. Grade 3 land is subdivided into Subgrade 3a ('good quality' land) and Subgrade 3b ('moderate quality' land).

6.2.4 MAFF produced a Provisional ALC of England and Wales in the late 1960s/early 1970s at a scale of 1:63,360 (1 inch to 1 mile). This information is now shown on magic.gov.uk (at a scale of 1:250,000) and was used to inform the Phase Two Consultation Sustainability Statement 2013. However, this ALC information was based on reconnaissance field surveys and was intended to provide general strategic guidance on agricultural land quality. It is not, however, sufficiently accurate for use in the assessment of individual developments and should not be used other than as general guidance. In addition to limitations of scale, this classification was undertaken using a system that has since undergone two fundamental revisions and does not distinguish between the subgrades of Grade 3, which has important policy implications.

6.2.5 Since the publication of the Provisional ALC, certain areas of the country (usually those proposed for non-agricultural development) have been surveyed in greater detail. Those surveys carried out by MAFF and its successors are available from Natural England, and are also shown on magic.gov.uk.

6.2.6 The approach to the ALC survey of all land to be acquired or used for the Proposed Scheme will be undertaken in two parts. Firstly, an interpretation of published geological, topographical, soil and agro-climatic information will be undertaken in the light of the ALC guidelines. Then the predictive ALC will be augmented with the results of detailed ALC surveys undertaken by MAFF or Department for Environment, Food and Rural Affairs (Defra) and by other recognised sources within or adjacent to the route corridor of the Proposed Scheme. The predictive ALC survey will be augmented by field survey to validate its findings, where required and where practicable.

6.2.7 The site survey will involve the examination of soil profiles using hand-held augers and spades. Samples may be taken for laboratory analysis. The soil characteristics will then be described and analysed in terms of the MAFF guidelines to verify or inform the predicted grade of agricultural land.

6.2.8 In addition, the soil survey will collect data on soil physical properties within woodlands and other open land, where practicable, in order to inform the potential selection of compensation areas for displaced woodland, particularly ancient woodland, and will collect nutrient, pH and organic matter samples within all open areas in order to inform proposals for landscape mitigation planting and habitat creation and translocation.

6.2.9 A risk assessment will be prepared to ensure that health and safety hazards relating to the ALC and soil surveys are taken into account. Defra guidance on biosecurity for

visits to premises with farm animals will be followed[36]. Biosecurity guidance for visits to woodland habitat will also be followed[37].

6.2.10 Information on the existing agricultural use and circumstances of all land to be acquired or used will be obtained primarily from the owners and occupiers of the land. Where land is within a written tenancy, this information will be obtained mostly from the tenant. It should be noted that it is the effects of the Proposed Scheme on occupiers of holdings and the owners of the businesses affected that will be assessed for the EIA. This will involve face-to-face interviews based on a standard set of questions which will be agreed first with relevant consultees (i.e. National Farmers Union /Country Land and Business Association and Central Association of Agricultural Valuers) but will be likely to cover:

- a description of the existing size, location and use of farm holdings;
- a description of the existing scale and nature of agricultural and non-agricultural enterprises based on farm holdings and their associated capital and labour inputs;
- a discussion of the physical impacts on the structure and operation of the farm holding;
- a discussion about potential options to mitigate such impacts; and
- a discussion about potential options for mitigating significant environmental effects identified on an individual farm holding.

6.2.11 Where practicable, a representative of the HS2 Ltd stakeholder engagement team will attend the interviews alongside the agricultural surveyor. In order to minimise the number of visits to individual farm holdings, questions relating to other environmental matters may be raised within the interview as appropriate.

6.2.12 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. Non-agricultural, land-based enterprises will be those within the control of the main occupier of the farm holding.

6.2.13 Information on the presence of any agri-environment schemes (such as Environmental Stewardship and Countryside Stewardship) will be obtained from magic.gov.uk, the Natural England website[38] and from individual land owners and occupiers, who will also be asked for details of the nature, requirements and duration of such schemes on the whole farm.

[36] Department for Environment, Food and Rural Affairs (Defra), 2008, Biosecurity Guidance to Prevent the Spread of Animal Diseases, Defra

[37] Available online at http://www.forestry.gov.uk/pdf/FC_Biosecurity_Guidance.pdf/$file/FC_Biosecurity_Guidance.pdf

[38] Natural England, Our Work, Farming and Land Stewardship, Funding for Land Management, 2016. Available online at: http://www.naturalengland.org.uk/ourwork/farming/funding/default.aspx

6.2.14 In addition to data collected from land owners and occupiers, information on woodlands affected by the Proposed Scheme will be obtained from the National Forest Inventory[39].

6.3 Consultation and engagement

Consultation on the Sustainability Statement

6.3.1 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for agriculture, forestry and soils for the Proposed Scheme.

Consultation on the draft SMR

6.3.2 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

Engagement as part of the EIA process

6.3.3 It is intended to continue engagement with representative groups of farmers, landowners and other rural enterprises, and particularly (but not exclusively) with the following:

- the National Farmers' Union;
- the Country Land and Business Association; and
- the Central Association of Agricultural Valuers.

6.3.4 The owners and occupiers of land to be acquired or used for the construction and operation of the Proposed Scheme would form the basis of consultation in relation to the undertaking of the EIA.

6.3.5 A Farmers Pack will be developed for Phase 2a which will build on that established for Phase One[40]. The Pack will provide a bespoke Farmers Record, the scope and content of which will reflect the individual circumstances of each landowner. It will include maps of the construction works and the permanent works on each holding, and will set out assurances and commitments made by HS2 Ltd, together with agreements reached between HS2 Ltd and the landowner. The Pack will also set out a broad timeline of HS2 activities, including the estimated date of entry to the land for the commencement of construction, the construction programme and the opening of the railway. The third part of the Pack will comprise a Guide for Farmers and Growers, which sets out HS2 policies and guidance in relation to agricultural matters, including acquisition, compensation, land management during construction, land restoration and other matters.

[39] The National Forest Inventory, 2016 Available online at: http://www.forestry.gov.uk/inventory
[40] HS2 Guide for Farmers and Growers (2016). Available online at: https://www.gov.uk/government/publications/hs2-guide-for-farmers-andgrowers

6.4 Key aspects of the Proposed Scheme for the topic

6.4.1 The key aspects of the Proposed Scheme that will affect agricultural forestry and soil interests will involve:

- permanent and temporary requirements for all grades of agricultural land, permanent land requirements will affect the nation's stock of agricultural land, which may include areas of high quality land used for food and fibre production;
- permanent and temporary loss of soils in other land uses (e.g. woodland and land in agri-environment schemes); permanent loss of such soils will reduce the ability to support particular habitats (the biodiversity effects of such loss will be assessed within the ecology and biodiversity section of the formal EIA Report) and will affect their carbon storage properties (relevant to the climate section of the formal EIA Report);
- the sustainable re-use of soils displaced by the Proposed Scheme; soil is a finite resource which fulfils a number of functions and services including food and fibre production, environmental interaction with air and water (particularly marked with peats and highly organic soils), support of ecological habitats and biodiversity; support for the landscape; protection of cultural heritage and provision of raw materials. The temporary displacement of soils introduces the risk of downgrading the quality of land during soil handling, and introduces the need to ensure that where such land is restored, it is reinstated to its original quality;
- permanent and temporary severance of agricultural land and loss of agricultural access (the severance of land may affect the continued ability to farm or otherwise use the land to its potential);
- permanent and temporary severance of commercial woodlands affecting access for management and the continued viability of woodland management;
- loss of farm dwellings, farm buildings and other on-farm infrastructure; farm capital may support significant areas of land and the loss of this capital may affect the continued ability to farm or otherwise use this land to its potential;
- permanent and temporary disruption to drainage, irrigation and water supplies (such disruption will affect land quality (if permanent) and hence land use; or lead to short-term land use change); and
- construction effects (e.g. dust and pollution) on adjacent agricultural land which may affect the ability of that land to continue in its present land use; the likelihood of such effects will be assessed, in the first instance, under the relevant topics (e.g. the air quality section of the EIA Report).

6.5 Scope of assessment

Spatial scope

6.5.1 The study area will need to be defined for the agricultural assessment. For most of the key issues identified, the study area is likely to be restricted to the limits of the land to be acquired or used for the construction and operation of the Proposed Scheme, although there may be the potential for effects on neighbouring farmland during the construction and operational phases.

6.5.2 Baseline agricultural land quality and farm holding data will initially be collected for a 200m-wide corridor centred on the Proposed Scheme alignment, as the full extent of the study area (which equates to all agricultural land required for the construction of the Proposed Scheme) will be uncertain at the time of baseline work, although there will be a need for flexibility in the study area where off-site works are anticipated to extend beyond this limit.

6.5.3 The scope of the assessment will be guided by relevant legislation, planning policy and best practice guidelines.

Temporal scope

6.5.1 The temporal scope for this topic is outlined in Section 4.2 (Scope of the assessment) of this SMR. Agriculture and soil effects will be assessed for the construction period (2020 – 2026) and the year of opening in 2027. The temporal scope will be extended for areas of re-instated agricultural land; typically, agricultural aftercare on restored land lasts for five years following soil placement in order to ensure that soil structure has stabilised satisfactorily.

6.5.2 Projections of future climate change will be incorporated in the definition of the future baseline for the agricultural, forestry and soils assessment. The methodology and timeframes for assessing climate change impacts on sensitive receptors and significant effects assessed by the agriculture, forestry and soils topic are set out in Section 8.

Technical scope

6.5.3 The EIA Directive and national planning policy will form the basis of the assessment of effects of the Proposed Scheme on agriculture, forestry and soils, and will define the scope of the assessment, namely:

- the quantity and quality of agricultural and forestry land that would be affected, both temporarily and permanently;
- the nature and use of the agricultural and non-agricultural soil resource that would be affected (and displaced) by the Proposed Scheme;
- the physical impact of land loss and severance and other impacts on agricultural enterprises and farm-based non-agricultural enterprises; and
- the loss or degradation of features within agri-environment schemes.

6.6 Assessment methodology

Legislation

6.6.1 In 2006, the European Commission adopted a comprehensive 'Thematic Strategy for Soil Protection'[41] specifically dedicated to soil protection which included a proposal for a 'Soil Framework Directive'[42] to promote the sustainable use of soil and protect soil as a natural and non-renewable resource. However, the proposed Directive was withdrawn in April 2014 as it could not be agreed by a qualified majority. In taking its decision, the European Commission stated that it remains committed to the objective of the protection of soil and will examine options on how best to achieve this.

6.6.2 No direct replacement proposals have yet come forward from the Commission, although Directive 2014/52/EU emphasises that public and private projects should consider and limit their impact on land, particularly as regards land required, and on soil, including as regards organic matter, erosion, compaction and sealing (i.e. covering undisturbed natural soils with urban development and infrastructure construction).

6.6.3 Although there remains no specific UK legislation for the protection of soil and agricultural land, Defra issued the 'Soil Strategy for England – Safeguarding our Soils'[43] in 2009. The aims of the Strategy have been incorporated into the Natural Environment White Paper, The natural choice: securing the value of nature[44] and set out Defra's vision that by 2030 all England's soils will be managed sustainably and degradation threats tackled successfully in order to improve the quality of England's soils and safeguard their ability to provide essential services for future generations.

6.6.4 The Strategy sets out priorities for action in respect of:

- better protection of agricultural soils;
- protecting and enhancing stores of soil carbon;
- building the resilience of soils to a changing climate;
- preventing soil pollution;
- effective soil protection during construction and development; and
- dealing with the legacy of contaminated land.

Planning policy

6.6.5 The National Planning Policy Framework[45] (NPPF) advises at paragraph 109 that the planning system should contribute to and enhance the natural and local environment by, amongst other matters, protecting and enhancing soils.

[41] European Commission (EC), 2006, Soil Thematic Strategy (COM (2006) 231), EC
[42] European Commission (EC), 2006, Proposal for a Soil Framework Directive (COM (2006) 232), EC
[43] Department for Environment, Food and Rural Affairs (Defra), 2009, Safeguarding our Soils: A Strategy for England, Defra
[44] HM Government, 2011, The Natural Environment White Paper, The natural choice: securing the value of nature, The Stationery Office
[45] Department for Communities and Local Government (DCLG), 2012, National Planning Policy Framework, The Stationery Office

6.6.6 Paragraph 112 of the NPPF indicates that the economic and other benefits of the best and most versatile agricultural land should be taken into account in development decisions. Where significant development of agricultural land is demonstrated to be necessary, poorer quality land should be used in preference to higher quality land.

6.6.7 There is no guidance in policy with regard to the effects of development proposals on farm holdings although paragraph 28 of the NPPF emphasises the need to support economic growth in rural areas to create jobs and prosperity by, amongst other means, promoting the development and diversification of agricultural and other land-based rural businesses.

6.6.8 Although Natural England's Technical Information Note (TIN) 049 (2012) indicates that land quality is not the sole consideration in how development proposals affect agricultural land in the planning system, it no longer refers to other relevant factors such as the impact on farm size and structure, the use of buildings and other fixed equipment, or any stimulus a development might give to rural economic activity. Instead, the updated TIN 049 indicates that planning authorities are guided by the NPPF to protect and enhance soils more widely, including for example conserving soil resources during construction and preventing soil from being adversely affected by pollution

Guidance

6.6.9 The Planning Practice Guidance (PPG)[46] was issued in March 2014 and repeats policy in paragraph 112 of the NPPF in respect of the quality of agricultural land.

6.6.10 The guidance indicates that the ALC provides a method for assessing the quality of farmland to enable informed choices to be made about its future use within the planning system, with direction given to Natural England for further information on ALC. The guidance also confirms that Natural England has a statutory role in advising local planning authorities about agricultural land quality issues.

6.6.11 The guidance also repeats policy in the NPPF in respect of soils and states that the planning system should protect and enhance valued soils because they are an essential finite resource that provides important ecosystem services, such as a growing medium for food, timber and other crops, a store for carbon and water, a reservoir of biodiversity and a buffer against pollution.

6.6.12 Guidance on classifying agricultural land is contained in 'Agricultural Land Classification of England and Wales, Revised guidelines and criteria for grading the quality of agricultural land, prepared by MAFF in 1988 and summarised in Natural England's TIN 049.

6.6.13 Good practice guidance on soil handling and management during the construction phase, to minimise potential adverse impacts on the soil resource, is found in MAFF's 'Good Practice Guide for Handling Soils'[47], Defra's 'Construction Code of Practice for

[46] Department for Communities and Local Government. Planning Practice Guidance
[47] Ministry of Agriculture, Fisheries and Food (MAFF), 2000, Good Practice Guide for Handling Soils, MAFF

the Sustainable Use of Soils on Construction Sites'[48] and Defra's 'Guidance for Successful Reclamation of Mineral and Waste Sites'.[49]

6.6.14 Guidance on the sustainable management of forestry soils is provided in the United Kingdom Forestry Standard (UKFS) guidelines on Forests and Soil[50].

Significance criteria

6.6.15 In order to assess the effects of the Proposed Scheme on agricultural resources, significance criteria are adopted which relate to the effects on agricultural land and soils, on farming and other farm-based enterprises, and on commercially-managed forestry land.

6.6.16 The significance level attributed to each effect will be assessed based on the magnitude of change due to the Proposed Scheme, the sensitivity of the affected receptor/receiving environment to change, and the relative scarcity or abundance of the resource/receptor in the locality, as well as in a wider context, given that some receptors or features may group or converge in a particular locality.

6.6.17 The significance criteria are based on available guidance, and on good practice that has been developed in consultation with Defra and Natural England.

6.6.18 The ALC survey will provide a statement of the amount and quality of agricultural land within the land to be acquired or used for the construction and operation of the Proposed Scheme. The magnitude of change will be reflected in the land required permanently and temporarily for the Proposed Scheme and the sensitivity of the agricultural land resource will be reflected in its grading relative to the abundance of best and most versatile land within a 4km corridor in each community area.

6.6.19 This topic will consider the conservation and reinstatement of displaced soil resources, and the sustainable reuse of displaced agricultural and non-agricultural soil resources is also considered in the waste and material resources section of this SMR.

6.6.20 It is common practice for EIA significance criteria to set an absolute threshold for the loss of a certain area of best and most versatile agricultural land (typically 20 or 50 hectares). However, such an approach will be inappropriate for a project of this scale; instead the significance of loss of best and most versatile land will be related to the abundance or special value of such land in the relevant community area.

6.6.21 The assessment will set out the predicted physical impacts on individual farm holdings, including the land required in each holding during the construction phase, the area of land severed, the area to be restored to agriculture and the resulting permanent requirement for land from each holding, including the permanent requirement for land for landscape planting and habitat creation. The effects identified will be assessed in accordance with the significance criteria that have been developed in consultation with Defra and Natural England. The effects will be

[48] Defra, 2009, Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, Defra
[49] Defra, 2004, Guidance for Successful Reclamation of Mineral and Waste Sites, Defra
[50] Forestry Commission, Forests and soil, UK Forestry Standard Guidelines, 2011. Available online at: http://www.forestry.gov.uk/forestry/infd-8bvguk

expressed primarily in physical terms and will reflect the degree of operational change required following construction of the Proposed Scheme.

Agricultural receptors (farms and other rural land-based businesses)

6.6.22 The nature of impacts will comprise primarily the requirement of land from the farm holding (permanent and temporary), the severance of land (permanent and temporary), the loss of key farm infrastructure (dwellings, buildings and other structures such as irrigation reservoirs and slurry pits) and the imposition of disruptive effects (such as noise and dust) on land uses and the holding's operations.

6.6.23 Guideline criteria for assessing the magnitude of impacts are presented in Table 2 Where a farm holding experiences different levels of impact for different types of impact, the higher level will be assigned. Thus, for example, a farm holding that will lose 15% of its land (medium impact) but will retain access to severed land via a private means of access (low impact) will be assessed as incurring a medium impact.

Table 2 - Impact magnitude criteria for farm holdings

Impact magnitude	**Definitions**			
	Land required	Severance	Infrastructure	Disruptive effects
High	>20% of all land farmed	No access available to severed land	Direct loss of farm dwelling, building or structure	Disruption discontinues land use or enterprise
Medium	>10% - 20% of all land farmed	Access available to severed land via the public highway	Loss of or damage to infrastructure affecting land use	Disruption necessitates change to scale or nature of land use or enterprise
Low	> 5% - 10% of all land farmed	Access available to severed land via private way	Infrastructure loss/damage does not affect land use	Disruption does not affect land use or enterprise
Negligible	5% or less of all land farmed	No new severance	No impact on farm infrastructure	No disruption on land use or enterprise

6.6.24 The sensitivity of receptors will be determined by the extent to which they have the capacity to absorb or adapt to impacts, which will be determined primarily by their nature and scale.

6.6.25 In general terms, larger farm holdings will have a greater capacity to absorb impacts and will be less sensitive. However, the scale of the land holding is reflected in the magnitude of impact and the percentage of land required from the farm. For example, the loss of 100 hectares from a 400 hectare (1,000 acre) farm would be a high impact (25%) whereas the same area of land required from a 1,000 hectare farm would be low (10%). The sensitivity criteria therefore concentrate on the nature of the receptor in order to avoid giving undue weight to the scale of operations. They are presented in Table 3.

Table 3 - Agriculture receptor sensitivity criteria

Receptor sensitivity	Definition
High	Farm types in which the operation of the enterprise is dependent on the spatial relationship of land to key infrastructure, and where there is a requirement for frequent and regular access between the two, or dependent on the existence of the infrastructure itself, e.g.: • dairying, in which milking cows travel between fields and the parlour at least twice a day; • irrigated arable cropping and field-scale horticulture, which are dependent on irrigation water supplies; and • intensive livestock or horticultural production which is undertaken primarily within buildings, often in controlled environments.
Medium	Farm types in which there is a degree of flexibility in the normal course of operations, e.g.: • combinable arable farms; and • grazing livestock farms (other than dairying).
Low	Farm types and land uses undertaken on a non-commercial basis.

6.6.26 The significance of an effect will be a product of the magnitude of the impact and the sensitivity of the receptor, as summarised in Table 4.

Table 4 - Significance of effect criteria

Significance		Impact magnitude			
		High	**Medium**	**Low**	**Negligible**
Sensitivity of receptor	High	Major – significant	Major / Moderate – significant	Moderate –significant	Minor – not significant
	Medium	Major / Moderate – significant	Moderate – significant	Minor – not significant	Negligible – not significant
	Low	Moderate - significant	Minor – not significant	Negligible – not significant	Negligible – not significant

Agricultural land

6.6.27 Guideline criteria for assessing the magnitude of impacts are presented in Table 5. The magnitude of impact is assessed according to the proportion of best and most versatile agricultural land required by the Proposed Scheme within each community area.

Table 5 - Impact magnitude criteria for agricultural land

Impact magnitude	Definitions
High	More than 60% of agricultural land required for the construction or operation of the Proposed Scheme is best and most versatile land
Medium	20% - 60% of agricultural land required for the construction or operation of the Proposed Scheme is best and most versatile land
Low	Less than 20% or less than 10ha of agricultural land required for the construction or operation of the Proposed Scheme is best and most versatile land
Negligible	Less than 2% of agricultural land required for the construction or operation of the Proposed Scheme is best and most versatile agricultural land

6.6.28 The sensitivity of resources affected will be determined by their inherent value, as reflected in their ALC grade, within the context of the abundance of best and most versatile agricultural land in the locality, defined as a 4km corridor centred on the Proposed Scheme, as demonstrated in Table 6.

Table 6 - Agriculture resources sensitivity criteria

Resources sensitivity	Definition
High	Best and most versatile agricultural land where 'Low Likelihood of best and most versatile agricultural land' is the most extensive category in a 4km-wide corridor according to the Defra Likelihood maps
Medium	Best and most versatile agricultural land where 'Moderate Likelihood of best and most versatile agricultural land' is the most extensive category in a 4km-wide corridor according to the Defra Likelihood maps
Low	Best and most versatile agricultural land where 'High Likelihood of best and most versatile agricultural land' is the most extensive category in a 4km-wide corridor according to the Defra Likelihood maps

6.6.29 The Defra database and maps, 'Likelihood of Best and Most Versatile Agricultural Land' show:

- areas of High Likelihood, where more than 60% of the land is likely to be Best and Most Versatile;
- areas of Moderate Likelihood, where 20% to 60% of the land is likely to be Best and Most Versatile; and
- areas of Low Likelihood, where less than 20% of the land is likely to be Best and Most Versatile.

6.6.30 The significance of an effect will be a product of the magnitude of the impact and the sensitivity of the receptor, as summarised in Table 4. At the route-wide level, the proportion of each grade of agricultural land that would be required for the Proposed Scheme will be compared to national estimates of each grade of land as a measure of the significance of effect on the national resource of agricultural land.

Forestry land

6.6.31 Woodlands are an important natural resource as they offer soil protection, water regulation and carbon storage, and provide wood products and support forest industries.

6.6.32 This assessment will consider the impact on forestry land in a quantitative fashion, as a land use and management feature. It will not assess the qualitative impacts on woodland, for which reference needs to be made principally to the ecology and biodiversity and landscape and visual assessments; see sections 11 and 15 respectively. The ecology and biodiversity and cultural heritage assessments consider the effects and impacts on veteran trees; see sections 11 and 10 respectively.

6.6.33 The nature of the impact will comprise the direct requirement for forestry land. The areas of forestry land that will be affected by the Proposed Scheme will be measured and also expressed as a percentage of the total land requirements within the community area, as shown in Table 7.

Table 7 - Impact magnitude criteria for forestry land

Impact magnitude	Definitions
High	More than 10% of land required for the construction or operation of the Proposed Scheme is forestry land
Medium	6% - 10% of land required for the construction or operation of the Proposed Scheme is forestry land
Low	Less than 6% of land required for the construction or operation of the Proposed Scheme is forestry land
Negligible	Less than 1% of land required for the construction or operation of the Proposed Scheme is forestry land

6.6.34 The sensitivity of forestry, as a land use, will be determined within the context of the abundance of forestry land in the locality, as measured within a 4km-wide corridor, following the approach taken with agricultural land. The abundance will be related to the average woodland coverage in England of 10%, as demonstrated in Table 8.

Table 8 - Forestry land sensitivity criteria

Resources sensitivity	Definition
High	Forestry land where there is less than the national average forestry cover (<6%)
Medium	Forestry land where there is the national average forestry cover (6-10%)
Low	Forestry land where there is above the national average forestry cover (>10%)

6.6.35 The significance of an effect will be a product of the magnitude of the impact and the sensitivity of the receptor, as summarised in Table 4.

Soil resources

6.6.36 The impact on the soil resource will reflect the degree to which disturbed soil resources are reused on and, if necessary, off the Proposed Scheme in a manner that enables the resource to continue to fulfil one or more of the primary soil functions of:

- the production of food and biomass, and the provision of raw materials;
- the storage, filtration and cycling of water, carbon and nitrogen in the biosphere;
- the support of ecological habitats and biodiversity;
- the support for the landscape;
- the protection of cultural heritage; and
- the provision of a platform for human activities, particularly construction and recreation.

6.6.37 The assessment will consider the key functions identified for a soil in a particular location and use the criteria for assessing the magnitude of impact are shown in Table 9.

Table 9 - Impact magnitude criteria for soils

Impact magnitude	Definitions
High	The soil displaced from the Proposed Scheme is unable to fulfil one or more of the primary soil functions.
Medium	The soil displaced from the Proposed Scheme mostly fulfils the primary soil functions off-site or has a reduced capacity to fulfil the primary functions on site.
Low	The soil displaced from the Proposed Scheme mostly fulfils the primary soil functions on-site.
Negligible	The soil retains its pre-existing functions on-site.

6.6.38 The sensitivity of displaced soil will reflect its textural characteristics, in the light of local rainfall conditions, and its susceptibility to the effects of handling during construction and the re-instatement of land, as shown in Table 10.

Table 10 - Soil sensitivity criteria

Resources sensitivity	Definition
High	Soils with high clay and silt fractions (clays, silty clays, sandy clays, heavy silty clay loams and heavy clay loams) and organic and peaty soils where average annual rainfall is 700mm or greater; and silty loams, medium silty clay loams, medium clay loams and sandy clay loams where average annual rainfall is 1,000mm or greater. Soils in Wetness Classes V and VI.
Medium	Clays, silty clays, sandy clays, heavy silty clay loams and heavy clay loams where average annual rainfall is lower than 700mm; silty loams, medium silty clay loams, medium clay loams and sandy clay loams where average annual rainfall is less than 1,000mm; sands, loamy sands, sandy loams and sandy silt loams where average annual rainfall is 1,000mm or greater. Soils in Wetness Classes III and IV.
Low	Soils with a high sand fraction (sands, loamy sands, sandy loams and sandy silt loams where average annual rainfall is less than 1,000mm. Soils in Wetness Classes I and II.

6.6.40 The significance of an effect will be a product of the magnitude of the impact and the sensitivity of the receptor, as summarised in Table 4.

Construction effects

6.6.41 Construction effects on agricultural and forestry land and farm and land-based enterprises will include land requirements; severance of agricultural and forestry land and farm holdings; the loss of, or disruption to, buildings and operational infrastructure such as drainage; and the use of the soil resource displaced by the construction of the Proposed Scheme.

6.6.42 Other construction effects will include the deposition of dust on sensitive crops, land uses or buildings; disruption to drainage, irrigation and water supply systems; unintentional pollution of soil and water courses or bodies (used for crop irrigation or livestock drinking water supplies); spread of injurious weeds to adjacent agricultural land from soil and material stockpiles; and construction noise on farm and farm-based enterprises.

6.6.43 Construction effects will be distinguished between temporary and permanent effects. Temporary construction effects will comprise the land required to construct the Proposed Scheme which will include the land returned to agricultural or forestry use after construction; the temporary severance of land during the construction period; and the effects of disruption, principally from construction noise and dust, on land uses and enterprises.

6.6.44 Permanent construction effects will comprise the net area of agricultural and forestry land required to operate the Proposed Scheme, following the construction period and the restoration of land required temporarily to agricultural and forestry uses; the permanent severance of land; and the permanent loss of or effect on farm infrastructure such as property, buildings and structures, and the consequential effects on land uses and enterprises.

Operational effects

6.6.45 Operational effects on agricultural and forestry land and farm and farm-based enterprises may include sound emanating from moving trains and warning signals and the propensity of operational land to harbour noxious weeds.

6.6.46 The approach to the assessment of effects of operational sound of the Proposed Scheme on agricultural livestock receptors will be made in liaison with sound, noise and vibration specialists, and will concentrate on sound from operational trains ('passby' sound) rather than construction sound where effects are likely to be temporary and reversible.

6.6.47 An interim criterion of sound exposure level of 100dB(A) will be used to identify potential significant adverse effects upon agricultural livestock. In the absence of natural or man-made wayside barriers, this would include receptors within a distance of up to 25m from the nearside track for trains travelling at a maximum speed of 360kph; at lower speeds this distance may be reduced.

6.6.48 However, as it is assumed that grazing livestock will be able to move freely away from the sound source, the assessment will concentrate on identifying fixed livestock buildings or other enclosures close to the track. It is proposed to identify potential receptors within 40m rather than 25m of the track, as livestock buildings within 25m of the nearside track could be demolished as part of the construction works. Once identified, the sound, noise and vibration specialists will advise on the operational sound level at the identified receptor locations given the likely train speeds and known scheme design (including cuttings and other features that would attenuate sound). The significance of effect will be determined in liaison with the sound, noise and vibration specialists.

Cumulative effects

6.6.49 The construction of the Proposed Scheme, combined with the construction of Phase One of HS2 and developments that are already taking place or anticipated within the route of the Proposed Scheme, may result in increased pressure on agricultural and forestry land and farm businesses. Cumulative effects will be assessed in relation to other significant projects that have received consent at the time of the assessment.

6.7 Assumptions

6.7.1 The assessment within this topic area considers soils as a medium for food and fibre production, and excludes an assessment of soil quality from the perspective of contamination, which is detailed in Section 14 (Land quality) of this SMR. Soil also fulfils a number of functions, such as environmental interaction with air and water; support for ecological habitats and biodiversity; support for the landscape; and protection of cultural heritage. These aspects will be assessed under the relevant environmental topics within the formal EIA Report.

6.7.2 This assessment also considers the effects on all farms (including horticulture), equestrian units, farm woodland and forestry enterprises, farm-based recreational and tourist uses and farm diversification projects that are either ancillary to the main agricultural use or within the control of the farm business. Other rural enterprises are assessed in Sections 9 (Community) and 17 (Socio-economics) of this SMR.

7 Air quality

7.1 Introduction

7.1.1 This section of this SMR sets out the scope and methodology for assessing the impacts and effects of the Proposed Scheme on air quality during its construction and operation. These activities could result in changes in air quality and therefore need to be assessed in the formal EIA Report.

7.1.2 Air quality changes would occur during construction as a result of the construction activities, associated traffic movements and highway interventions. During operation, the main changes in air quality would arise as a result of changes to road layouts and traffic flows.

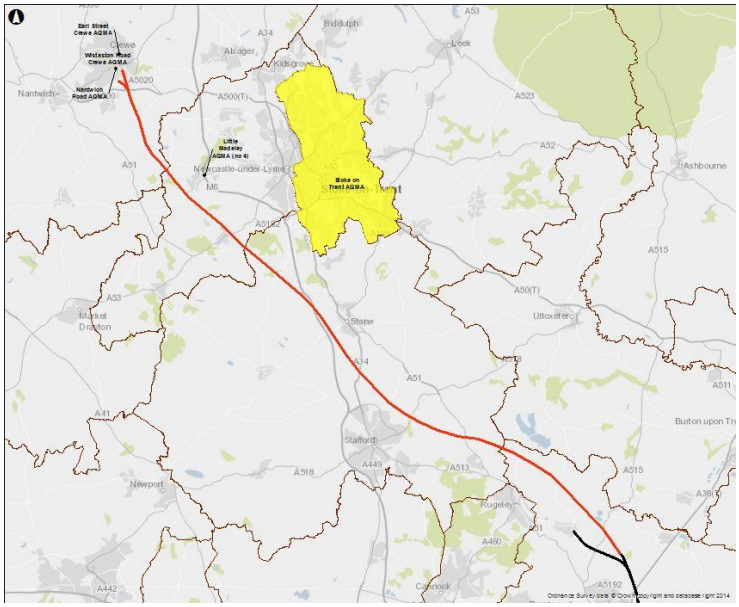
7.1.3 The assessment will focus on air pollutants that are likely to arise from the construction and operation of the Proposed Scheme. These pollutants are oxides of nitrogen (NOx), nitrogen dioxide (NO_2), particulate matter (PM_{10}, $PM_{2.5}$) and dust.

7.2 Establishment of baseline and definition of survey

7.2.1 The majority of the Proposed Scheme runs through a predominantly rural setting where air quality is generally good and is not located within air quality management areas (AQMA). Figure 9 shows the Proposed Scheme route map in relation to existing AQMAs.

7.2.2 The vast majority of AQMAs in the UK are designated where NO_2 and PM_{10} concentrations are elevated. This is mostly related to vehicle emissions from heavily trafficked roads. Historically, several areas close to the route (e.g. in Staffordshire) have declared AQMAs but these have been revoked as air quality has improved. New AQMAs may be declared, or extensions made to existing AQMAs; therefore this will be reviewed throughout the air quality assessment.

Figure 9 - HS2 Phase 2a route map showing the designated Air Quality Management Areas (AQMAs) in the Phase 2a community areas



7.3 Consultation and engagement

Consultation on the Sustainability Statement

7.3.1 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for air quality for the Proposed Scheme.

Consultation on the draft SMR

7.3.2 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for air quality.

Engagement as part of the EIA process

7.3.3 The key stakeholders to be engaged with in relation to air quality assessment methodology are environmental health departments at local authorities where:

- the Proposed Scheme infrastructure maintenance depot would be located;
- the Proposed Scheme would pass through;
- significant changes in operational or construction traffic would occur; and
- there are construction activities in general.

7.4 Key aspects of the Proposed Scheme for the topic

7.4.1 The main air quality effects from the Proposed Scheme during its construction would arise from:

- emissions associated with site plant and vehicles;
- emissions from construction traffic;
- changes in emissions arising from local diversions; and

- dust arising from activities such as use of haul roads, wind erosion of temporary stockpiles, earth moving operations, and demolition activities.

7.4.2 The above aspects would have the potential to cause changes in NO2 and PM10/PM2.5 concentrations and may cause dust deposition at sensitive human receptor locations. In addition, some have the potential to cause changes in NOx concentrations at ecologically sensitive habitats. Ozone will not be considered in this assessment as it is formed at a regional level and the expected changes in pollutant emissions are unlikely to have a significant effect on its formation in the atmosphere.

7.4.3 Air quality effects from the operation of the Proposed Scheme can be categorised into direct and indirect effects. Direct effects would arise from the changes in traffic flows on the highway network, as well as emissions from buildings. Indirect effects would arise from changes in emissions brought about by a modal shift from car to rail services, which may have a beneficial effect on air quality.

7.5 Scope of assessment

Spatial scope

7.5.1 Assessment of the effects of emissions arising from local traffic diversions and construction traffic around worksites would be limited to receptors located along roads that meet any of the criteria specified in the Design Manual for Roads and Bridges (DMRB)[51]. These criteria will be applied along the length of the route of the Proposed Scheme to identify where further assessment is required, and comprise:

- road alignment change by 5m or more;
- daily traffic flows change by 1,000 annual average daily traffic (AADT) or more;
- heavy duty vehicle (HDV) flows change by 200 AADT or more;
- daily average traffic speed change by 10kph or more; or
- peak hour traffic speed change by 20kph or more.

7.5.2 The assessment of dust emissions arising from construction sites associated with the Proposed Scheme will be carried out in accordance with the Institute of Air Quality Management (IAQM) Guidance[52]. These include areas around worksites where there are sensitive receptors within 350m from the construction site boundary and/or within 50m of the routes used by construction vehicles on the public highway and up to 500m from construction site entrances.

7.5.3 Assessment of nitrogen deposition will be required if there are significant changes in traffic flows within 200m of ecologically sensitive sites. The assessment will follow the methodology set out in the DMRB guidance. Ecological resources and other ecological issues are described in Section 11 (Ecology and biodiversity), of this SMR.

[51] Highways Agency, 2007, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 Air Quality, HA207/07, The Stationery Office
[52] Institute of Air Quality Management (IAQM), 2014, Guidance on the assessment of dust from demolition and construction, IAQM

7.5.4 Assessment of health effects from air pollution will be undertaken for NO2 and PM2.5 concentrations for the population within 200m of the affected road network. The scope and methodology for assessing health effects in relation to air quality are described in Section 13 (Health), of this SMR.

Temporal scope

7.5.5 The assessment of air quality effects due to changes in traffic during construction of the Proposed Scheme will be undertaken for the following scenarios:

- future 'without the scheme' traffic emissions for key years during the construction period; and
- future 'with the scheme' traffic emissions for key years during the construction period.

7.5.6 The assessment of air quality effects due to changes in traffic during operation of the Proposed Scheme will be undertaken for the following scenarios:

- future 'without the scheme' traffic emissions during the opening year of operation; and
- future 'with the scheme' traffic emissions during the opening year of operation.

Technical scope

7.5.7 The assessment will not include the transboundary effects of the Proposed Scheme on air quality, as the likely changes in atmospheric emissions would be negligible in this context.

7.6 Assessment methodology

Legislation

7.6.1 The assessment will take into account the following legislation, and any subsequent changes to the legislation:

- Part 4 of the Environment Act 1995;
- The Air Quality (England) (Amendment) Regulations 2002[53] and the Air Quality Standards Regulations 2010[54];
- Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe[55]; and
- National Planning Policy Framework (NPPF) 2012[56] and National Planning Practice Guidance (NPPG) 2014[57].

[53]Department for Environment, Food and Rural Affairs, 2002, The Air Quality (England) (Amendment) Regulations 2002, The Station ery Office
[54] Department for Environment, Food and Rural Affairs, 2010, The Air Quality Standards Regulations 2010, The Stationery Office
[55] Official Journal of the European Union, 2008, Directive 2008/50/EC of the European Parliament and of the Council of the 21 May 2008 on ambient air quality and cleaner air for Europe, EU
[56] Department for Communities and Local Government, 2012, National Planning Policy Framework
[57] Department for Communities and Local Government, 2014, National Planning Practice Guidance - Air Quality

Guidance

7.6.2 The assessment will take into account the following guidance:

- LAQM Technical Guidance (2016)[58] or subsequent document;
- DMRB Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 Air Quality, HA207/07;
- Environmental Protection UK (EPUK)/IAQM guidance on land-use planning and development control[59];
- IAQM guidance on the assessment of dust from demolition and construction[52]; and
- The Control of Dust and Emissions during Construction and Demolition, Supplementary Planning Guidance, July 2014[60].

Air quality standards

7.6.3 Air quality limit values and objectives are quality standards for clean air and to protect human health. These limit values and objectives will be used as assessment criteria for determining the significance of any potential changes in local air quality resulting from the Proposed Scheme. Some pollutants have standards expressed as annual average concentrations and others have standards expressed as 24-hour, 1-hour or 15-minute average concentrations. Some pollutants have standards expressed in terms of both long-term and short-term concentrations.

7.6.4 Table 11 sets out the EU air quality limit values and UK national air quality objectives for the pollutants relevant to this study (NO2 and PM10/PM2.5). Within the community area reports, the term 'air quality standards' refers to both the English air quality objectives and the air quality limit values introduced in the UK based on EU Directives.

Table 11 - UK and EU air quality standards

Pollutant	Averaging period	Limit value / Objective
NOx	Annual mean	30µg/m3
NO2	Annual mean	40µg/m3
	1 hour mean	200µg/m3 not to be exceeded more than 18 times a year (99.8th percentile)
PM10	Annual mean	40µg/m3

[58] Defra, 2009, Local Air Quality Management Technical Guidance , Defra
[59] Moorcroft and Barrowcliffe et al., 2015, Land-use Planning & Development Control: Planning for Air Quality, Institute of Air Quality Management, London
[60] Greater London Authority, 2014, The Control of Dust and Emissions during Construction and Demolition, Supplementary Planning Guidance, Greater London Authority

Pollutant	Averaging period	Limit value / Objective
	24 hour mean	50µg/m3 not to be exceeded more than 35 times a year (90.4th percentile)
PM2.5	Annual mean	25µg/m3

Construction effects

Dust emissions

7.6.5 The construction effects will be assessed through an investigation of potential sources of air pollutant emissions from construction activities and through the formulation of appropriate mitigation and control measures. An environmental risk assessment of construction effects will be carried out using the risk-based approach from the IAQM guidance, as described in the Air Quality Technical Note 'Guidance on assessment methodology'.

7.6.6 The assessment will identify where particular mitigation measures are required to address local issues. These mitigation measures will be detailed in the Local Environmental Management Plans being developed for each local authority area.

Traffic emissions

7.6.7 With regard to assessment of the effects of emissions arising from changes in traffic flows during construction, traffic data will be screened using the DMRB criteria described in paragraph 7.5.1. Following this screening exercise, roads meeting any of these criteria would be subject to a detailed assessment using the atmospheric dispersion model ADMS-Roads to investigate the effects of changes in traffic flows. Dispersion modelling would use the latest vehicle emission data from Defra and take into account information in the National Emissions Inventory and London Atmospheric Emissions Inventory, as appropriate. Comparison of the results with and without the construction traffic and local diversions in the future years would allow the effect to be determined.

7.6.8 This assessment would comply with the requirements of LAQM Technical Guidance and would address the issues related to model verification and sensitivity analysis. This will only be considered in relation to areas where detailed air dispersion modelling is required and it will not be necessary elsewhere on the route of the Proposed Scheme. The approach for assessing traffic emissions is further described in the Phase One Air Quality Technical Note 'Guidance on assessment methodology'.

7.6.9 Defra has published technical guidance for local authorities on when and how emissions from moving and stationary diesel trains should be considered in relation to LAQM duties[61]. In the absence of any other specific guidance, this will be used to inform the assessment of potential air quality impacts from construction related train operations. Defra's guidance addresses locations with relevant exposure where there is risk of exceedance of the annual mean air quality standard for NO2. Such locations are within 30m of railway tracks but only where the background annual mean NO2

[61] Defra, Guidance on Assessing Emissions from Railway Locomotives, 2009. Available online at: http://laqm.defra.gov.uk/laqm-faqs/faq37.html

concentration is above 25µg/m3. In the context of the Proposed Scheme these locations may occur in the vicinity of temporary railheads where diesel locomotives are used for construction related activities.

Operational effects

7.6.10 Operational effects due to changes in traffic flows and diversion of traffic along the route of the Proposed Scheme and at off-route locations would be assessed using the methodology described in paragraph 7.6.7. The assessment of emissions from other sources, such as emissions from buildings, will be assessed using ADMS dispersion model if a significant impact is expected. This is further described in the Air Quality Technical Note 'Guidance on assessment methodology'. An initial appraisal will be undertaken that will examine the magnitude and location of the emissions to determine whether dispersion modelling is required.

7.6.11 Where there is a need to carry out an assessment of nitrogen deposition near to sensitive sites, this will follow the methodology detailed in Volume 11 of the DMRB. Any changes in nitrogen deposition will also be reported in terms of the percentage change relative to the critical load and level for ecosystem protection. Any potential impacts on ecological systems relating to air quality changes will be addressed in the ecological assessment (see Section 11, Ecology and biodiversity).

Cumulative effects

7.6.12 Cumulative effects will be largely taken into account in the traffic data used for the assessment which will incorporate likely change brought about by other proposed and committed developments both during and following construction. Where there is planned development that includes significant emissions to the atmosphere then these emissions would be included within the air quality modelling undertaken for the Proposed Scheme if these are likely to result in cumulative effects.

7.7 Assumptions

7.7.1 The air quality assessment assumes that an adequate level of detail of construction activities would be available for the construction sites.

8 Climate change

8.1 Introduction

8.1.1 This section of the SMR addresses the scope and methodology for the three route-wide assessments to be undertaken within the climate change topic:

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

8.1.2 The GHG assessment relates to the effects of the Proposed Scheme on GHG emissions contributing to climate change. The in-combination climate change impacts assessment relates to the combined effect of the impacts of the Proposed Scheme and potential climate change impacts on the receiving environment. In line with IEMA guidance[62], the combined effect of the impacts of the Proposed Scheme and potential climate change impacts on the receiving environment are referred to as 'in-combination impacts' and 'in-combination effects'. This is distinct from uses of the terms 'combined effects' and 'cumulative effects' used elsewhere in the SMR. The climate change resilience assessment relates to the resilience of the Proposed Scheme to climate change impacts.

8.1.3 For purposes of clarity, this section addresses the three climate change topic assessments separately, except for the sub-section on stakeholder engagement and consultation processes.

8.1.4 As stated in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Synthesis Report[63], mitigation (i.e. reducing GHG emissions) and adaptation (i.e. responding to climate change impacts) are complementary approaches to reducing risks of climate change impacts over different timescales. 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 GHG emissions and enhance resilience to climate change.

8.2 Consultation and engagement

Consultation on the Sustainability Statement

8.2.1 Consultation responses to the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for climate change for the Proposed Scheme.

[62] IEMA, 2015: IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. Available online at: http://oldsite.iema.net/eia-climate-change. Accessed: 4 August 2016

[63] IPCC, 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. Accessed: 4 August 2016

Consultation on the draft SMR

8.2.2 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

8.2.3 In addition, the GHG section of this chapter has been updated to reflect the requirements of PAS 2080[64]. The in-combination climate change impacts assessment and the climate change resilience assessments have been updated in response to further interpretation of EU and IEMA guidance[65] on undertaking and reporting the two assessments separately.

Engagement as part of the EIA process

8.2.4 Key stakeholder groups are to be included during the engagement and consultation process for the GHG assessment, the in-combination climate change impacts assessment and the climate change resilience assessment. The consultees will be identified according to the geographic scope and nature of the issues. The key stakeholder groups include:

- central government departments and agencies;
- non-governmental organisations;
- construction industry stakeholders; and
- rail industry stakeholders.

8.3 Greenhouse gases

Introduction

8.3.1 The Proposed Scheme will be assessed within the context of the UK's evolving carbon agenda. The Climate Change Act 2008[66] committed the UK to its first statutory carbon-reduction target to reduce GHG emissions by at least 80% from 1990 levels by 2050. To ensure that regular progress is made towards the target the Climate Change Act also established a systems of carbon budgets. The first four carbon budgets, leading to 2027, have been set in law. Meeting the fourth carbon budget (2023-27) will require that GHG emissions are reduced by 50% on 1990 levels in 2025. The Carbon Plan (2011)[67] sets out the Government's plans for achieving the GHG emissions reductions committed to in the Climate Change Act and the first four carbon budgets. Low carbon transport is an essential part of the Carbon Plan.

[64] British Standard Institute, (2016), PAS 2080:2016, Carbon management in infrastructure
[65] IEMA, 2015: IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. Available online at: http://www.iema.net/policy/impact-assessment/eia-cc. Accessed: 4 August 2016
[66 & 67] Department of Energy & Climate Change, The Carbon Plan – reducing greenhouse gas emissions, 2011. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47621/1358-the-carbon-plan.pdf. Accessed: 4 August 2016

8.3.2 In November 2015, the Committee on Climate Change (CCC) advised Government to set the fifth carbon budget (2028-32) to reduce UK GHG emissions in 2030 by 57% relative to 1990 levels. The Government announced in June 2016 that they will adopt the recommendation. The Government is expected to propose draft legislation for the fifth carbon budget and publish a plan setting out how it expects to meet the fourth and fifth carbon budgets by the end of 2016.

8.3.3 The Government's Construction Industry Strategy[68] presents the UK's low carbon construction aspirations. It includes the aspiration to decrease construction GHG emissions by 50% by 2025 based on 1990 levels, as reported in the Green Construction Board's Low Carbon Routemap for the Built Environment[69].

8.3.4 The GHG assessment will quantify and report the GHG emissions associated with the construction and operation of the Proposed Scheme in the form of the 'carbon footprint'. The carbon footprint will be presented as a range and will be reported in tonnes of carbon dioxide equivalent (tCO_2e). The Proposed Scheme's carbon footprint will be compared to UK national and transport sector GHG emissions in order to provide context for the scale of the carbon footprint.

Establishment of baseline and definition of survey

8.3.5 Scenarios of current and future baselines will be built on the work of the Sustainability Statement. The baseline GHG assessment will cover the following aspects:

- changing travel patterns and modal shift; and
- projected UK grid power GHG emissions.

8.3.6 Baseline transport data will be based on the latest PLANET Framework Model (PFM). The PFM transport model reports on travel patterns by mode (road and rail) on the route of the Proposed Scheme, and will also consider air travel. Transport efficiency improvements over time will also be considered. The impact that the Proposed Scheme has on freight will be assessed separately.

8.3.7 Given that the Proposed Scheme will be electrically powered, the assessment will consider various UK grid mix projections.

Key aspects of the Proposed Scheme for the topic

8.3.8 Key aspects of the Proposed Scheme for this topic include:

- earthworks – includes all excavated material, backfill volumes and any soil treated throughout the construction process. GHG emissions will arise from the energy used by plant equipment in the extraction of material, as well as from logistical operations transporting material along the route of the Proposed Scheme;
- land use, land use change and forestry (LULUCF) – includes GHG emissions

[68] HM Government (2013) Industrial Strategy: government and industry in partnership. HM Government, London

[69] The Green Construction Board, Low Carbon Routemap for the UK Built Environment, 2013. Available online at: http://www.greenconstructionboard.org/otherdocs/Routemap%20final%20report%2005032013.pdf. Accessed: 4 August 2016

that are either captured or released, resulting from direct human-induced changes in land use during construction and operation;

- demolition – to accommodate the Proposed Scheme, demolition and re-development of sites (e.g. local businesses and residential properties) will be required. GHG emissions associated with the transport of demolition waste will be included in the GHG assessment;
- construction – covers the embedded carbon of construction materials used in structures such as tunnels, bridges, viaducts, rail lines and supporting infrastructure. This will include the logistical impact of delivering materials to site and removal of waste from site. Depending on data availability, fuel used by plant equipment during construction (such as tunnel boring machines) will also be included;
- operation – covers energy consumption of infrastructure such as the infrastructure maintenance depot (IMD) and tunnel fans;
- rolling stock - energy use, and consequential GHG emissions, from the running of the trains will depend on, but not be limited to, the following factors: train weight, acceleration, traction efficiency, braking performance, regenerative breaking, train resistance, tunnel resistance aerodynamic factors, passenger loads and speed. The embedded impact of the rolling stock will also be included in the GHG assessment;
- maintenance – covers the day-to-day upkeep of the railway (track, bridges, tunnels etc.) as well as the trains. Maintenance activities, similar to construction, involve plant equipment, materials and transport;
- energy supply - the construction and operational assessment will take account of grid decarbonisation projections and will be based on evidence from sources such as the UK's Low Carbon Transition Plan[70], the CCC reports[71] [72], and DECC; and
- modal shift - this assessment will consider road, rail and air efficiency improvements likely to have occurred by the time the Proposed Scheme is in operation, as well as the likely impact on road, conventional rail and domestic air travel GHG emissions.

Scope of GHG assessment

8.3.9 The assessment will cover all life cycle emissions of the Proposed Scheme irrespective of where they occur. These include: the pre-construction and construction stage, the use stage, the end of life stage and any additional emissions or benefits beyond the Proposed Scheme's boundary.

[70] Department of Energy and Climate Change, The UK Low Carbon Transition Plan: national strategy for climate and energy, 2009. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228752/9780108508394.pdf. Accessed: 11 August 2016

[71] Committee on Climate Change (2008) Building a low-carbon economy – the UK's response to tackling climate change. CCC, London [72] Committee on Climate Change (2009) Meeting Carbon Budgets – the need for a step change. CCC, London

8.3.10 The scope of the GHG assessment is summarised in Table 12.

Table 12 - Scope of GHG assessment broken down by life cycle stages, consistent with the principles set out in BS EN 15804:2012

Life cycle assessment boundary stages	**Description**
Pre-construction stage (module A0)	Represents preliminary studies and works such as strategy and brief development, architecture, design efforts, EIA and cost planning. Most if not all these functions will be largely office based. For example, this will include GHG emissions associated with office energy use and consultants travel.
Product stage (modules A1 – A3)	Represents the embedded GHG emissions associated with the extraction, processing and manufacturing of the Proposed Scheme's construction material for permanent assets. This includes all energy and GHG emissions from manufacturing plants, primary and secondary manufacturing stages as well as any transport emission between these stages. For example, concrete manufacturing includes energy and GHG emissions linked to all key stages: quarrying, aggregate crushing, transport of aggregates to ready-mix concrete plants and asphalt plants. This final stage includes emissions associated with the adding of water and cement mixes.
Construction process - transport stage (module A4)	Represents transport related GHG emissions associated with the delivery of construction material, such as concrete and steel, and construction equipment to construction sites along the Proposed Scheme from the point of production (or point of storage in the case of plant and machinery).
Construction process – on-site stage (module A5)	Represents GHG emissions from construction site works activities including: 1. temporary works, ground works, and landscaping 2. materials storage and any energy or otherwise need to maintain necessary environmental conditions 3. transport of materials and equipment on site 4. installation of materials and products into the infrastructure asset 5. emissions associated with site water demand 6. waste management activities (transport, processing, final disposal) associated with waste arising from the construction site 7. production, transportation, and waste management of materials/products lost during works.
Use stage – installed products and materials (module B1)	Represents the GHG emitted directly from the fabric of products and materials once they have been installed as part of the Proposed Scheme.
Use stage (modules B2 – B5)	Represents the GHG emissions resulting from activities of works and new materials for the maintenance, repair, replacement and refurbishment of the Proposed Scheme during the use stage/operation.
Use stage - operational	Represents the GHG emissions resulting from the energy used by the Proposed Scheme's infrastructure and building-integrated systems (e.g. fans, pumps, lights) and

Life cycle assessment boundary stages	Description
energy (modules B6)	energy consumption, and GHG emissions associated with the operation of the rolling stock, minus any electricity generated through on-site low carbon energy sources not exported to the grid.
Use stage - operational water (modules B7)	Represents the GHG emissions resulting from the provision of water required by the Proposed Scheme to enable it to operate and deliver its service. It will include all water used and its treatment (pre- and post-use) during the normal operation of the Proposed Scheme. For example this includes water used in the maintenance and cleaning of the rolling stock.
Use stage - other operational processes (module B8)	Represents other process GHG emissions arising from the Proposed Scheme to enable it to operate and deliver its service including management of operational waste.
Use stage – users utilisation (module B9)	Represents the activities associated with users utilisation of the infrastructure during the use stage, for example users plugging in their laptops or phones to charge whilst on the train.
End of life stage (module C1)	Represents the GHG emissions resulting from activities of deconstructing, demolishing and decommissioning the Proposed Scheme. Essentially these are on-site GHG emissions from plant equipment.
End of life stage (modules C2 – C4)	Represents the activities associated with transport, waste management and final disposal of materials associated with the site and materials of the Proposed Scheme.
Benefits and loads beyond the infrastructure life cycle (module D)	Includes: 1. avoided GHG emission impacts associated with the Proposed Scheme including potential for re-use, recovery and recycling of materials and/or energy beyond the system boundary. 2. savings in GHG emissions from modal shift of passenger and freight journeys associated with the Proposed Scheme; 3. carbon sequestration from trees planted as part of the Proposed Scheme. 4. GHG emissions from transport of construction workers to site.

Assessment methodology

8.3.11 Although there is no specific standard for reporting infrastructure GHG emissions in EIA, a variety of existing standards will be used to guide this assessment:

- the European Commission (EC) guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment[73];
- the Publically Available Specification (PAS) 2080[74] on carbon management in infrastructure;

[73] European Commission, (2013), Integrating Climate Change and Biodiversity into Strategic Environmental Assessment. Available online at: http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf. Accessed: 20 April 2016

[74] British Standard Institute, (2016), PAS 2080:2016, Carbon management in infrastructure

- BS EN 15804[75] which outlines the requirement for quantifying and reporting emissions at a product level; and
- BS EN 15978[76] which outlines the calculation method to assess performance at the buildings level, based on life cycle assessment (LCA).

8.3.12 The GHG assessment will use the guiding principles of existing standards and guidance. This will be supported by a combination of carbon modelling tools, lifecycle software, publicly available information including the University of Bath's Inventory of Carbon and Energy[77] on construction materials, and specific figures from environmental product declarations (EPDs).

8.3.13 Depending on data availability the reporting unit will be in tonnes of carbon dioxide equivalents (tCO_2e) covering the seven main GHGs[78] listed by the Greenhouse Gas Protocol accounting standard[79].

8.3.14 The approach used will be to:

- define GHG emission sources;
- gather information and appropriate GHG coefficients; and
- calculate GHG emissions.

8.3.15 The GHG assessment will report the carbon footprint from construction and 60 years of operation to align with the economic case, and 120 years to align with the assumed design life. In addition, assessments will be carried out for the following time periods:

- 2020 – start of construction;
- 2027 – Proposed Scheme opening;
- 2041 – full technical capacity and operation of HS2 as a whole; and
- 2087 – 60 years of operation after opening.

8.3.16 Construction related emissions will be based on the construction and logistics information for the Proposed Scheme. This includes information relating to specific design elements (such as viaducts or bridges) across the entire route in terms of:

- volume (m^3) of construction materials;
- type of construction material (e.g. concrete, imported fill, steel, gravel);
- transport distances (km) of construction material; and

[75] British Standard Institute, (2013), BS EN 15804+A1:2013. Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products
[76] British Standard Institute, (2012), BS EN 15978:2011. Sustainability of construction works – assessment of environmental performance of buildings – Calculation method
[77] Hammond, G.P. and Jones, C.I, 2008, Inventory of Carbon & Energy (ICE) Version 1.6a, University of Bath, UK
[78] Direct GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N20), perfluorocarbons (PFCs), hydroflurocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3)
[79] Greenhouse Gas Protocol (2013), Required Greenhouse Gases in Inventories – Accounting and reporting standard amendment. WRI and WBCSD, USA; http://www.ghgprotocol.org/files/ghgp/NF3-Amendment_052213.pdf; Accessed: 4 August 2016

- volume (m^3) of waste generated (both construction and demolition).

8.3.17 The excavation and movement of excavated materials along the Proposed Scheme will be modelled separately. This assessment will provide volumes of materials along with distances travelled and modes of transport.

8.3.18 Bespoke data collection templates will be developed to capture construction related data for the Proposed Scheme. These templates will capture the following information for design elements such as a viaduct or bridge:

- volume of materials;
- life span of design element;
- GHG coefficients;
- overall GHG emissions of each design element; and
- functional units (e.g. tonnes of carbon dioxide CO_2 per metre and year of design element).

8.3.19 Construction site GHG emissions relating to fuel and energy use by plant equipment will be calculated using appropriate assumptions. These assumptions will consider GHG emissions associated with machinery and plant used as well as travel by construction workers based on the scheme's construction programme.

8.3.20 Transport related GHG emissions will be based on the latest PFM transport model, and will include:

- classic rail network: change in train movements on the classic network as a result of uptake of services on the Proposed Scheme;
- modal shift: transfers from domestic air trips to the Proposed Scheme; and
- modal shift: transfer from road onto the Proposed Scheme.

8.3.21 The carbon benefits associated with the released capacity on the classic network for freight transport will also be assessed.

Assumptions

8.3.22 Predictions of future GHG emissions from the Proposed Scheme and for the baseline will need to make assumptions, for example in relation to the future carbon footprints of power generation and vehicle efficiencies. As such, the assessment will cover a range of predictions which will be set out in the formal EIA Report.

8.4 In-combination climate change impacts

Introduction

8.4.1 These sections address the in-combination climate change impacts assessment which assesses the combined effects of the impacts of the Proposed Scheme and potential climate change impacts on the receiving environment.

8.4.2 At present, no international legislation or policy framework exists that specifies the scope and methodology to be used as part of the in-combination climate change

impacts assessment within the EIA process. However, there are several guidance reports that provide relevant background (see for example guidance by the Food and Agriculture Organisation[80,81,82] and the World Health Organisation[83]).

8.4.3 At the European level, the EIA Directive 2011/92/EU[84] places a requirement upon projects anticipated to have significant effects on the surrounding environment and communities to make a formal assessment of these effects. The amended EIA Directive 2014/52/EU[85] identifies the important role that the EIA process can play in assessing climate change impacts. It states that EIAs shall identify, describe and assess the direct and indirect significant effects of climate, and the risk of major accidents and/or disasters that are relevant to the project, including those caused by climate change. The Directive 2014/52/EU entered into force on 15 May 2015 and contains the amendments to the 2011 Directive in full. The regulations reflecting this directive are due to be transposed into UK legislation by 2017.

8.4.4 The EC guidance on Integrating Climate Change and Biodiversity into EIAs[86] carried out under the amended EIA Directive 2014/52/EU[87], includes climate change and biodiversity related guidance for screening and scoping, analysing evolving baseline trends, identifying alternative and baseline measures, monitoring and adaptive management. There are also several publications by the EC addressing climate change impacts for EIA topics, such as agriculture, ecology, health, landscape and water. The publications provide background information on climate change impacts in Europe and suggest potential mitigation measures[88,89,90,91].

8.4.5 At a national level, the UK Climate Change Risk Assessment report, which supports UK climate change policy as set out in the Climate Change Act 2008, includes summary reports for different sectors including agriculture, biodiversity and ecosystem services, forestry, health and water[92]. The reports summarise the main climate change impacts for these sectors and lists potential mitigation measures. Similarly, the reports submitted under the UK Adaptation Reporting Power (ARP) in the first and second rounds of reporting[93] include the identification and examination

[80] The Food and Agriculture Organisation of the United Nations guidance report on climate change impacts for agriculture; http://www.fao.org/docrep/018/i3325e/i3325e.pdf Accessed: 9 June 2016

[81] The Food and Agriculture Organisation of the United Nations guidance report on climate change impacts on soils; http://www.fao.org/docrep/w5183e/w5183e05.htm Accessed: 9 June 2016

[82] The Food and Agriculture Organisation of the United Nations guidance report on climate change impacts on forests; http://www.fao.org/3/i3383e.pdf Accessed: 9 June 2016

[83] The World Health Organisation fact sheet on climate change and health; http://www.who.int/mediacentre/factsheets/fs266/en/ Accessed: 9 June 2016

[84] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment. European Council

[85] 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; http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052. Accessed: 10 June 2016

[86] European Commission, (2013), Integrating Climate Change and Biodiversity into Environmental Impact Assessment; http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf. Accessed: 20 April 2016

[87] http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf. Accessed: 10 June 2016

[88] http://ec.europa.eu/health/climate_change/policy/index_en.htm. Accessed: 10 June 2016

[89] http://ec.europa.eu/agriculture/climate-change/factsheet_en.pdf. Accessed: 10 June 2016

[90] http://ec.europa.eu/environment/water/adaptation/index_en.htm. Accessed: 10 June 2016

[91] http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2008.01569.x/pdf. Accessed: 10 June 2016

[92] http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=15747. Accessed: 9 June 2016

[93] https://www.gov.uk/government/collections/climate-change-adaptation-reporting-second-round-reports. Accessed: 9 June 2016

of risks and impacts relevant to water, agriculture and forestry, health and wellbeing, and the natural environment.

8.4.6 IEMA has published guidance on climate change resilience and adaptation[94] in response to the requirements specified in the amended EU EIA Directive 2014/52/EU. This guidance provides an approach to undertaking assessments of in-combination climate change impacts and climate change resilience within the EIA process in the UK.

8.4.7 The Environment Agency has recently published updated guidance on climate change allowances to be used in flood risk assessments as set out in the NPPF[95]. This advice includes climate change allowances for peak river flow and peak rainfall intensity for flood risk assessments for different UK river basin districts, flood zones and land use sensitivities. The assessments made of the implications of climate change for future flood risks associated with the Proposed Scheme will take account of the content of this guidance. These assessments will be reported in the formal EIA Report within the water resources and flood risk sections of the community area reports with separate stand-alone flood risk assessments prepared for each community area. A route-wide assessment demonstrating alignment with NPPF policies will also be included in the water resources and flood risk section of the formal EIA Report. These assessments will inform the in-combination assessments made in the climate topic.

8.4.8 The approach and findings of the HS2 Phase One ES are a relevant starting point for defining the scope and methodology for the Phase 2a in-combination climate change impacts assessment.

Establishment of baseline

8.4.9 The term 'baseline' in this section refers to the description of current and future climate conditions which will inform the assessments of in-combination climate change impacts and climate change resilience. The term 'future climate conditions' is not to be confused with the EIA term 'future predicted baseline'. Future climate conditions refers to the description of the climate in a future time period using climate change projections for weather variables.

8.4.10 The impacts of climate change occur over a broader region than the five community areas within the route of the Proposed Scheme. As such, the in-combination climate change impacts assessment will be route-wide and current climate data and climate change projection data will be sourced for locations at either end of the route – namely Fradley at the southern end and Crewe at the northern end. These locations are considered generally representative of the climate within which the Proposed Scheme would be located.

8.4.11 The description of the baseline for the Proposed Scheme will be based upon current climate data available for the Fradley and Crewe areas. It will include gridded observational data and climate change projection data from the United Kingdom

[94] Institute of Environmental Impact Assessment (IEMA); IEMA guide to climate change resilience and adaptation, 2015; https://www.iema.net/.../climate%20change%20adaptation%20and%20eia_0.pdf Accessed: 9 June 2016
[95] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances Accessed: 9 June 2016

Climate Projections 2009[96] (UKCP09) as well as additional relevant information from the sources listed earlier in this section. The UKCP09 climate change projection data is the most widely used data for the UK and the most appropriate data to be used as recommended in the IEMA guidance on climate change resilience and adaptation.

8.4.12 The time period covered by the gridded observational data is 1961 – 2011. The UKCP09 climate change projection data are available for different future time periods, emission scenarios and probability levels.

8.4.13 The emissions scenarios in UKCP09 are plausible representations of the future development of emissions of substances (e.g. GHGs and aerosols) that can influence global climate. The medium and high emissions scenarios available from UKCP09 will be included in the description of climate change projections. Data for the low emissions scenario has not been considered as, given historical GHG emissions, it is not regarded a realistic scenario[97].

8.4.14 UKCP09 is based on probabilistic projections that assign a likelihood to different possible climate change outcomes. For each emissions scenario there are a range of modelling assumptions that can lead to different climate change projections.

8.4.15 The probability levels of 10%, 50% and 90% for the medium and high emissions scenarios will be used to assess the likelihood of changes in climate variables and to describe climate change trends. The terminology used to define likelihood will be based on the terminology adopted in UKCP09[98], which is based on the terminology used by the IPCC Fourth Assessment Report[99].

8.4.16 For practical reasons, the 50% probability level for the medium emissions scenario will be used for the final assessment in-combination climate change impacts. This selection of probability levels is in agreement with the recommendations in UKCP09, i.e. the use of the 10% and 90% probability levels are used to represent low and high changes in climate[100]. It is also in agreement with the climate change projections used in Phase One and in line with reports submitted under the NAP[101].

8.4.17 For in-combination climate change impacts relating to flood risk, climate change projections based on current Environment Agency guidance will be used.

8.4.18 The assessment of potential climate change impacts on the effects associated with the Proposed Scheme will be undertaken in accordance with timeframes outlined in the methodologies for each topic. Table 13 provides a comparison of these timeframes and the corresponding timeframes for UK climate change projections.

[96] UK Climate Projections; About UKCP09; http://ukclimateprojections.metoffice.gov.uk/21684. Accessed: 9 June 2016

[97] The Copenhagen Diagnosis; Updating the World on the Latest Climate Science; 2009; http://www.ccrc.unsw.edu.au/sites/default/files/Copenhagen_Diagnosis_HIGH.pdf. Accessed August 2016

[98] UK Climate Projections; Definition of unlikely; 2016; http://ukclimateprojections.metoffice.gov.uk/23192. Accessed August 2016

[99] IPCC Fourth Assessment Report; Climate Change 2007; Working Group I: The Physical Science Basis; The IPCC Assessments of Climate Change and Uncertainties; https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-6.html. Accessed August 2016

[100] UK Climate Projections; Before you start using UKCP09; http://ukclimateprojections.metoffice.gov.uk/21679. Accessed August 2016 [101]Climate change adaptation reporting; Second round reports; https://www.gov.uk/government/collections/climate-change-adaptation-reporting-second-round-reports. Accessed August 2016

Table 13 - Temporal scope for the in-combination climate change impacts assessment

	Design	Construction (including testing and commissioning)	Operation (start)	Operation of Proposed Scheme
In-combination climate change impacts assessment Topic assessment timeframes	n/a	2020-2026	2027	2027 onwards
UKCP09 time period[102]	2020s (2010-2039)	2020s (2010-2039)	2020s (2010-2039)	2080s (2070-2099)[103]

8.4.19 During the construction phase of the Proposed Scheme (2020 – 2026), the trends within the UKCP09 climate change projections suggest the following changes to long-term, seasonal averages:

- warmer, drier summers, particularly in parts of central and southern England; and milder, wetter winters[104]; and
- an increase in annual average temperature[105] and fewer days with snow and frost[106].

8.4.20 Extreme weather during the construction phase will:

- very likely[107] include more very hot days[108];
- likely include more intense downpours of rain[109] (particularly in summer); and
- very likely include an increase in dry spells[110].

8.4.21 In addition, it is likely, although with a higher level of uncertainty, that the probability of the following extreme weather events will increase as a consequence of climate change[111]:

[102] UKCP09 uses 30-year time periods for both the baseline climate and for all future climate projections. The projections are reported for seven overlapping 30-year time periods from 2010 - 2099. Each future time period is named based on the decade upon which it is centred. The 2020s, 2050s and the 2080s are most commonly used time periods

[103] For timescales outside the standard UKCP09 time periods the Climate change topic will engage with relevant government agencies (e.g. the Met Office and Environment Agency) for additional advice and guidance. In the case of flood risk only, climate change allowances up to and beyond 2115 will be used as indicated in Guidance - Flood risk assessments: climate change allowances (NPPF). This is because the NPPF defines the 2080s as covering the period 2070-2115 for the purposes of flood risk assessment, and HS2 can be considered as a development with a lifespan of at least 120 years

[104] UK Climate Projections, 2009; Climate Change Projections Table 4.1, 4.2, 4.4 and 4.5; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87894&filetype=pdf; Accessed August 2016

[105] UK Climate Projections; Climate Change Projections Section 4.3.5 2009; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87894&filetype=pdf ;Accessed August 2016

[106] UK Climate Projections; Climate Change Projections Table 3 2009; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87894&filetype=pdf;Accessed August 2016

[107] UK Climate Projections; Definition of unlikely; 2016; http://ukclimateprojections.metoffice.gov.uk/23192; Accessed August 2016

[108] UK Climate Projections; Climate Change Briefing Report Table 3 2009; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87868&filetype=pdf; Accessed August 2016

[109] UK Climate Projections; Climate Change Projections, Table 4.2 2009; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87894&filetype=pdf; Accessed August 2016

[110] UK Climate Projections; Climate Change Briefing Report Table 4. 2009. Available online at http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87868&filetype=pdf; Accessed August 2016

- short periods of intense cold weather (still expected as a result of natural variability[112]); and
- an increase in the frequency and intensity of storms and high winds (widely accepted as difficult to predict with any certainty[113]).

8.4.22 During the operation of the Proposed Scheme (2027 onwards), these changes in climatic averages and extreme weather events are projected to become more pronounced.

8.4.23 Climate change projections for extreme weather events will be obtained using the Weather Generator (WG)[114] in UKCP09. However, it should be noted that the WG is subject to a number of limitations, these are described on the UKCP09 website[115]. The main limitations of the WG relate to the representation of extreme weather events, especially in the representation of short duration (hourly) extreme rainfall and long-term events such as droughts.

Scope of in-combination climate change impacts assessment

Technical scope

8.4.24 An initial assessment of potential climate change impacts during construction and operation will be undertaken for all EIA topics in collaboration with topic specialists. This process will determine the requirement for undertaking a more detailed assessment of significant in-combination climate change impacts and effects for relevant topics or community areas.

8.4.25 Potential climate change impacts may be greater or more numerous for some topics than others due to the varying sensitivity of topic receptors and resources to projected changes and trends in the characteristics of climate variables. These topics will remain scoped in for a more detailed assessment of in-combination climate change impacts for topic specific effects. This more detailed assessment will determine whether there are any significant in-combination effects to report.

8.4.26 In addition to this section of the SMR, climate change may also be discussed within other individual topic sections of the SMR where relevant.

Spatial scope

8.4.27 Potential climate change impacts will initially be assessed at the route-wide level across all five of the community areas within Phase 2a, with any significant in-combination climate change effects reported at the community area level if appropriate for relevant topics.

[111] Met Office; Climate Jigsaw Puzzle; 2012; http://www.metoffice.gov.uk/barometer/science/2012-04/climate-jigsaw-puzzle; Accessed: February 2016
[112] UK Climate Projections; Climate Change Briefing Report Table 3, 2009; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87868&filetype=pdf; Accessed: February 2016
[113] UK Climate Projections; Climate Change Projections Section 1.4, 2009; http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87894&filetype=pdf; Accessed: February 2016
[114] UK Climate Projections, 2009; About the Weather Generator; http://ukclimateprojections.metoffice.gov.uk/22540; Accessed: February 2016.
[115] UK Climate Projections, 2009; Limitations of Weather Generator 2.0;http://ukclimateprojections.metoffice.gov.uk/22653; Accessed: February 2016

8.4.28 The assessment will take into account the distances either side of the Proposed Scheme within which other topics are undertaking their own assessment of effects. For example the landscape topic is considering landscape character effects beyond the route corridor to the extent of the character area boundaries which have been defined. The width of the survey corridor for the ecology topic will be defined by the potential area of ecological impact. This will vary depending on a number of factors, including the engineering of the route, the topography and ecological connectivity of the landscape, and the ecological receptor. In rural sections, the survey corridor for some species could extend up to 500m either side of the land required for construction; in urban sections, the survey corridor will, in general, be much narrower as the zone of impact will be more restricted.

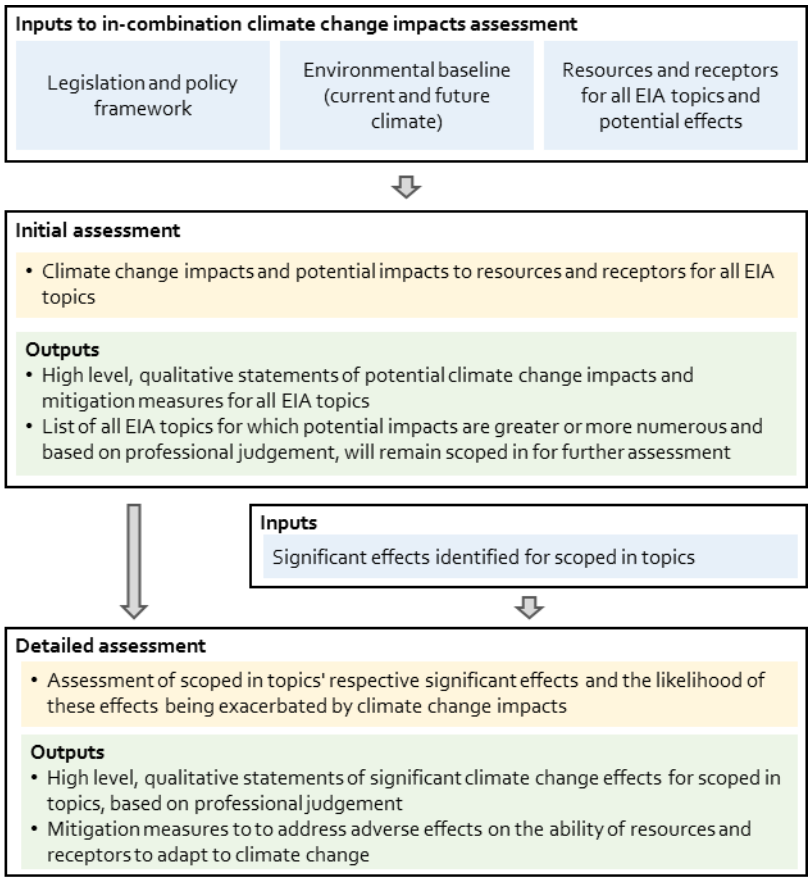
Temporal scope

8.4.29 Potential climate change impacts will be assessed for all topics for the 2020s (to cover the effects of construction which is estimated to commence in 2020 until 2026 including commissioning). Potential climate change impacts relevant to the effects of operation (which commences in 2027) will be assessed for the 2080s (to cover as much of the operational life of the Proposed Scheme as possible).

Assessment methodology

8.4.30 Potential climate change impacts will be considered at the route-wide level for all topics and community areas. This will form the basis for an initial in-combination climate change impacts assessment, the scope of which will include all EIA topics, and will be carried out by the climate change topic with input from topic specialists. The initial in-combination climate change impacts assessment will identify EIA topics to remain scoped in for a more detailed assessment. See Figure 10 for an illustration of this approach.

Figure 10 - Approach to the in-combination climate change impacts assessment



8.4.31 The methodology described in this section of the SMR is based on the sources of information described in the introduction section and in the establishment of baseline (Section 8.4) of the in-combination climate change impacts assessment.

8.4.32 In addition to these documents, a review will be undertaken as part of the initial assessment of the most recent, publicly available research, evidence and technical knowledge as well as existing legislation and guidance. Relevant European, national and local policies and guidance on climate change impacts, adaptation and resilience will be identified and referenced for each EIA topic, where applicable. For example, topic specific guidance published by the Food and Agriculture Organisation, the Woodland Trust[116], the Forestry Commission[117], the Landscape Institute[118], Public Health England (formerly the Health Protection Agency)[119] and Defra[120] will be considered.

[116] Woodland Trust; Climate change - the Woodland Trust's position. Available online at: https://www.woodlandtrust.org.uk/publications/2015/06/climate-change
[117] Forestry Commission; Forests and climate change, 2016. Available online at: http://www.forestry.gov.uk/climatechange .
[118] Landscape Institute; Landscape architecture and the challenge of climate change. Available online at: http://www.landscapeinstitute.org/PDF/Contribute/LIClimateChangePositionStatement.pdf
[119] Health Protection Agency; Health Effects of Climate Change in the UK, 2012. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/371103/Health_Effects_of_Climate_Change_in_the_UK_2012_V13_with_cover_accessible.pdf
[120] Defra; The England Biodiversity Strategy, 2011. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf

8.4.33 Climate change science is an evolving field of enquiry, and the integration of potential climate change impacts into the EIA process is still a relatively new approach. For many EIA topics, the evidence base is growing but not definitive, or there is insufficiently detailed evidence available at the local level. Conversely, for some EIA topics such as water resources and flood risk there is a relative abundance of evidence and guidance. This means it may be difficult to draw consistent conclusions about the potential impacts of climate change for all topics in line with the established EIA methodologies.

8.4.34 Following consideration of potential climate change impacts, informed professional judgement will be used by topic experts to produce high level, qualitative statements about potential topic specific impacts resulting from projected climate change (i.e. changes and trends in climate averages and extreme weather events) for receptors and resources in the area surrounding the Proposed Scheme.

8.4.35 These high level, qualitative statements will also include consideration of any mitigation measures to address adverse effects on the ability of resources and receptors to adapt to climate change that may be required beyond those already suggested by the other EIA topics, as well as allowances for future measures and monitoring to ensure the continued resilience of receptors and resources.

8.4.36 Example criteria that will be used to complete the initial in-combination climate change impacts assessment are set out in the bullet points below. The assessment will also include any topic specific references identified in addition to those listed in the legal and policy framework section above. These will be considered together with the climate change projections and informed professional judgement for each topic to complete the assessment. The results of the initial in-combination climate change impacts assessment will be presented in a summary table for each EIA topic in the route-wide assessment with the following general headings:

- resources / receptors potentially impacted by the Proposed Scheme;
- effects of Proposed Scheme on receptors / resources identified by topic;
- existing mitigation measures for these effects;
- potential climate change impacts on resources / receptors and identified effects;
- likelihood[121] and significance of in-combination climate change impacts given existing mitigation measures;
- mitigation measures to address adverse effects on the ability of resources / receptors to adapt to climate change; and
- allowances for future measures and monitoring.

[121] N.B. The assessment of likelihood of in-combination climate change impacts will be based on professional judgement and is distinct from the definitions of likelihood used to describe probability levels in the UK CP09 climate change projection data

8.4.37 Following the initial assessment, EIA topics for which potential climate change impacts are considered greater or more numerous will remain scoped in for a more detailed assessment. The scoping decision will be reviewed by the EIA topic specialists in collaboration with the climate change topic specialists.

8.4.38 The potential significance of the in-combination climate change impacts identified will then be assessed qualitatively, based upon the professional judgement of EIA topic specialists working closely with the climate change topic specialists. This assessment process will also consider other significant topic specific effects previously identified by each topic, and whether they could potentially be exacerbated or ameliorated by climate change impacts.

8.4.39 An exception to the approach outlined above is the assessment of water resources and flood risk which will be undertaken taking into account current Environment Agency climate change allowances for increases in peak river flow and rainfall intensity.

Construction effects

8.4.40 The effects of the Proposed Scheme will be assessed for the construction phase, including an assessment of potential in-combination climate change impacts.

Operational effects

8.4.41 The effects of the Proposed Scheme will be assessed for the operational phase, including an assessment of potential in-combination climate change impacts.

Mitigation measures

8.4.42 Suitable mitigation measures to address adverse effects on the ability of resources and receptors to adapt to climate change will be developed by topics working with the climate change topic specialists.

8.5 Climate change resilience

Introduction

8.5.1 These sections address the climate change resilience assessment of the Proposed Scheme to climate change impacts.

8.5.2 As for the in-combination climate change impact assessment, no international legislation or policy framework exist that specify the approach to be used for the climate change resilience assessment. Several guidance reports provide relevant background information, for example the UN and the United States have explored the impact of climate change on transport infrastructure and railways[122,123].

8.5.3 Similarly, at European and national level most legislation and policy framework relevant for the in-combination climate change impacts assessment is also relevant for the climate change resilience assessment.

[122] National Climate Assessment (2014) Climate Change Impacts in the United States - Chapter 5: Transportation
[123] United Nationals Economic Commission for Europe (2013) Climate Change Impacts and Adaptation for International Transport Networks

8.5.4 The amended EIA Directive 2014/52/EU states that the vulnerability of projects to climate change needs to be assessed within the EIA process. The EC guidance on Integrating Climate Change and Biodiversity into EIA[124] recommends that alternatives and measures are considered at the planning stage to ensure, amongst other things, that projects are resilient to the impacts of climate change. It highlights a shift in thinking to account for possible long term risks within environmental assessments, and the role of resilience in this shift. The EIA process is well placed to aid this progression, showing how a changing baseline can affect a project over time.

8.5.5 The EC has also released sector specific guidance[125] on the interface between climate change and infrastructure, including projected impacts, and resilience levels. This document accompanies the Communication 'An EU strategy for adaptation to climate change'[126] and provides further background material supportive of the narrative and arguments put forward in the Communication. This working document also presents, for some areas, an outline of actions that the Commission will be undertaking, as announced in the Communication.

8.5.6 As for the in-combination climate change impacts assessment, the following sources provide relevant background information and context at the national level:

- the IEMA guidance on climate change resilience and adaptation[127] provides an approach to undertaking climate change resilience assessments into the EIA process in the UK;
- relevant reports submitted under the UK ARP in the first and second rounds of reporting[128] (for example, NR, National Grid, Highways Agency and Transport for London); and
- the guidance on climate change allowances published by the Environment Agency[129] which will be used in the flood risk assessment for the Proposed Scheme.

8.5.7 The 'Resilience to impacts from climatic conditions report' [130] published as part of the HS2 Phase One ES includes a list of potential climate change risks and mitigation measures. It provides a relevant starting point for the climate change resilience assessment of the Proposed Scheme. Further work on the design of Phase One of the Proposed Scheme also provides useful additional information for the Phase 2a climate change resilience assessment.

[124] http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf; Accessed 10 June 2016

[125] European Commission, (2013), Adapting Infrastructure to Climate Change- Communication from the commission to the European Parliament, the council, the European economic and social committee and the committee of the regions: An EU Strategy on Adaptation to Climate Change, http://ec.europa.eu/clima/policies/adaptation/what/docs/swd_2013_137_en.pdf; Accessed 10 June 2016

[126] European Commission, (2013), An EU strategy for adaptation to climate change, http://ec.europa.eu/clima/publications/docs/eu_strategy_en.pdf; Accessed 10 June 2016

[127] Institute of Environmental Impact Assessment (IEMA); IEMA guide to climate change resilience and adaptation, 2015 https://www.iema.net/.../climate20change20adaptation20and20eia_0.pdf; Accessed 9 June 2016

[128] https://www.gov.uk/government/collections/climate-change-adaptation-reporting-second-round-reports; Accessed 9 June 2016

[129] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances; Accessed 9 June 2016

[130] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/259614/volume5_Climate_Change_Resilience_Report_CL-003_000.pdf; Accessed 9 June 2016

Establishment of baseline

8.5.8 The environmental baseline for the climate change resilience assessment will be the same as the baseline defined for the in-combination climate change assessment. It will be based upon current and future climate data available for the areas around Fradley and Crewe.

8.5.9 The resilience of the Proposed Scheme will be based on the potential risks during the timeframes for the interim preliminary design stage, and the future design, construction, operation and maintenance stages over the 120 year design life of the Proposed Scheme. Table 14 provides a comparison of these timeframes and the corresponding timeframes for UK climate change projections. It should be noted that some of the infrastructure and assets associated with the Proposed Scheme have shorter or longer design lives than others.

Table 14 - Temporal scope for the climate change resilience assessment

	Design	**Construction (including testing and commissioning)**	**Operation (start)**	**Operation of Proposed Scheme**
Climate change resilience assessment Proposed Scheme activities / stages	2016-2020	2020-2026	2027	2027 onwards
UKCP09 time period[131]	2020s (2010-2039)	2020s (2010-2039)	2020s (2010-2039)	2080s (2070-2099)[132]

8.5.10 Sections 8.4.11 – 8.4.13 summarise the UKCP09 climate change projections for mean climatic conditions and extreme weather events for the construction and operation phases of the Proposed Scheme.

Scope of climate change resilience assessment

Technical scope

8.5.11 The technical scope of the climate change resilience assessment incorporates:

- an initial climate change resilience assessment of all potential climate hazards for all infrastructure and assets associated with the Proposed Scheme to the end of their design life; and
- a further climate change resilience assessment of significant climate hazards for relevant infrastructure and assets associated with the Proposed Scheme to

[131] UKCP09 uses 30-year time periods for both the baseline climate and for all future climate projections. The projections are reported for seven overlapping 30-year time periods from 2010 - 2099. Each future time period is named based on the decade upon which it is centred. The 2020s, 2050s and the 2080s are most commonly used time periods

[132] For timescales outside the standard UKCP09 time periods the Climate change topic will engage with relevant government agencies (e.g. the Met Office and Environment Agency) for additional advice and guidance. In the case of flood risk only, climate change allowances up to and beyond 2115 will be used as indicated in Guidance - Flood risk assessments: climate change allowances (NPPF). This is because the NPPF defines the 2080s as covering the period 2070-2115 for the purposes of flood risk assessment, and HS2 can be considered as a development with a lifespan of at least 120 years

the end of their design life.

Spatial scope

8.5.12 The spatial scope of the climate change resilience assessment comprises all five of the community areas within Phase 2a.

Temporal scope

8.5.13 The temporal scope of the risk assessment will include consideration of risks relevant to the design and construction stages and operation of the Proposed Scheme as described in Table 14. It is anticipated that the review of these potential climate change related risks will be an on-going process as the design progresses, and that related resilience measures will also be reviewed accordingly.

Assessment methodology

8.5.14 The climate change resilience assessment will initially be considered at a route-wide level and will include all infrastructure and assets associated with the Proposed Scheme. The assessment will identify infrastructure and assets which may require a more detailed assessment. See Figure 11 for an illustration of this approach.

8.5.15 The methodology described in this section of the SMR is based on the sources of information described in the introduction section (Section 8.1) and in the establishment of baseline (Section 8.5) of the climate change resilience assessment.

8.5.16 As part of the assessment a review will be undertaken of the most recent climate legislation, policy, best practice guidance and previous climate change risk assessments for high-speed rail and major infrastructure projects (e.g. Phase One) and of relevant research projects (e.g. Tomorrow's Railway and Climate Change Adaptation (T1009)[133,134,135,136]).

8.5.17 The assessment of climate change resilience will be based upon the most recent, publicly available research, evidence and technical knowledge identified as part of the literature review. For example, infrastructure and other asset specific guidance including that published by RSSB[137], NR[138] and the Cabinet Office[139] will be considered.

8.5.18 As for the in-combination climate change impacts assessments, the integration of potential climate change impacts into the climate change resilience assessment in the EIA process is still a relatively new approach. For transport infrastructure and assets, the evidence base is growing but not definitive, or there is insufficiently detailed

[133] RSSB; Tomorrow's railway and climate change adaptation (T1009), 2010. Phase 1 report

[134] RSSB; Tomorrow's railway and climate change adaptation (T1009), 2011. Phase 3 report

[135] RSSB; Tomorrow's railway and climate change adaptation (T1009), 2015. Phase 1 summary report. Available online at: http://www.rssb.co.uk/improving-industry-performance/climate-change-adaptation.

[136] RSSB; Tomorrow's Railway and Climate Change Adaptation: Final Report, 2016. Available online at: http://www.rssb.co.uk/Library/research-development-and-innovation/2016-05-T1009-final-report.pdf.

[137] RSSB; Tomorrow's Railway and Climate Change Adaptation: Final Report, 2016. Available online at: http://www.rssb.co.uk/Library/research-development-and-innovation/2016-05-T1009-final-report.pdf.

[138] Network Rail; Climate change adaptation report, 2015. Available online at: http://www.networkrail.co.uk/Climate-Change-Adaptation-Report.pdf.

[139] Cabinet Office; Keeping the country running: natural hazards and infrastructure, 2011. Available online at: https://www.gov.uk/government/publications/keeping-the-country-running-natural-hazards-and-infrastructure.

evidence available at the asset specific level. Conversely, for some engineering and design disciplines, such as flood risk engineering, there is a relative abundance of evidence and guidance. A notable exception to the approach outlined above is the assessment of flood risk, which will be undertaken using climate change projections as specified in the latest guidance.

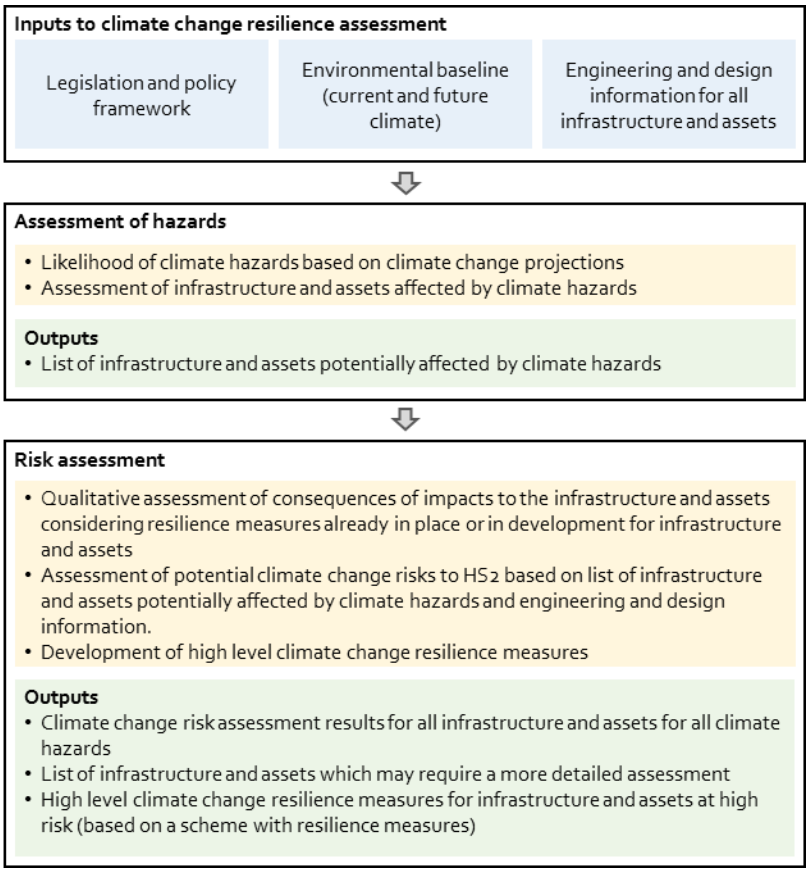
8.5.19 The initial route-wide climate change resilience assessment will use the descriptions of changes in climate averages and extreme weather events provided in UKCP09 to qualitatively assess the impacts of climate change on the Proposed Scheme using professional expertise and judgement. It will take into account current weather events and climatic conditions, and consider how these might worsen or improve during construction and the operational life of the infrastructure and assets associated with the Proposed Scheme due to projected climate change. A more detailed and quantitative assessment may then be carried out during future design stages.

8.5.20 In the case of flood risk, more detailed planning requirements and design guidance relating to climate change exists. Therefore, an assessment of climate change impacts on flood risk will be carried out within the water resources and flood risk topic assessment at the route-wide and site-specific levels taking into account current Environment Agency climate change allowances for increases in peak river flow and rainfall intensity.

8.5.21 The assessment will assume that the Proposed Scheme will be designed to be resilient to impacts arising from current weather events and climatic conditions, and designed in accordance with current planning, design and engineering practice and codes. The assessment will also identify the resilience measures for each risk either already in place or in development for infrastructure and assets.

8.5.22 The climate change resilience assessment will be composed of two main parts: the assessment of hazards and the risk assessment, see Figure 11.

Figure 11 - Approach to the climate change resilience assessment



8.5.23 For the purposes of this assessment a hazard is defined as one of the effects of a changed climate which has the potential to do harm to the infrastructure and assets associated with the Proposed Scheme. A climate hazard may result in an impact on the Proposed Scheme. The impact may be direct, for example flooding of the infrastructure or assets, or indirect, for example heat exhaustion of workers. The consequence in either of these cases would be disruption of the service.

8.5.24 The risk assessment will be based on the likelihood of a hazard, the consequence of impact, and the vulnerability of the infrastructure or asset itself. The definitions of these terms can be summarised as follows:

- likelihood of a hazard is the probability of occurrence of the hazard and will be based on UKCP09 projections as described in the establishment of baseline section;
- consequence of impact refers to the magnitude of the impact on the Proposed Scheme once the hazard occurs;
- risk is the likelihood of a hazard occurring multiplied by consequence of impact of hazard; and
- vulnerability is the degree to which infrastructure or assets are susceptible to adverse impacts and is influenced by sensitivity, adaptive capacity and magnitude of impact.

Assessment of hazards, infrastructure and assets

8.5.25 The following climate hazards will be considered in this risk assessment[140]:

- high and low temperatures;
- diurnal temperature range;
- high precipitation;
- soil moisture deficit;
- drought;
- humidity;
- ice and snow/cold;
- insolation (solar irradiation);
- river, surface water and groundwater flooding;
- storms/lightning strikes; and
- wind.

8.5.26 The degree to which the frequency and intensity of these potential hazards may change as a result of climate change is explained in the UKCP09 climate change projections. The level of uncertainty in these projections is also described in the UKCP09 reports and the Tomorrow's Railway and Climate Change Adaptation (T1009) reports. For example, there are large uncertainties on the direction of change in storms and high winds. It should be noted that the route-wide and site-specific flood risk assessments cover all sources of potential flooding hazards (river, surface water and groundwater flooding).

Risk assessment

8.5.27 The risk assessment will consider the likelihood of a hazard occurring that could result in an impact on the infrastructure and assets associated with the Proposed Scheme (major accidents and natural disasters are considered further in Section 16). The risk to the Proposed Scheme will depend on the severity of the consequence of the impact, and the vulnerability of the infrastructure or asset itself.

8.5.28 The potential likelihood and consequence of impacts to the infrastructure and assets associated with the Proposed Scheme will be scored using a qualitative five point scale for the medium emissions scenario:

- likelihood – very likely, likely, possible, unlikely, very unlikely[141] (as described in the establishment of the baseline section); and
- consequence of impact – very high, high, medium, low, very low.

[140] Source: Adapted from UKCP09, T1009, 2011, 2015 and Phase One
[141] UK Climate Projections; Definition of unlikely, 2016, Available online at: http://ukclimateprojections.metoffice.gov.uk/23192

8.5.29 The assessment of consequence of impact will consider resilience measures already in place or in development for infrastructure and assets. Following consideration of potential climate change impacts, informed professional judgement will be used by engineering and design experts to produce high level, qualitative statements about potential infrastructure and asset specific climate change impacts.

8.5.30 The risk assessment will identify the need for additional resilience measures to protect against the effects of climate change. High level resilience measures will be designed as part of workshops and focus groups with key stakeholders.

8.5.31 This level of risk assessment is considered appropriate for the interim preliminary design stage, and may be developed further during future design, construction and operation stages.

9 Community

9.1 Introduction

9.1.1 This section of the SMR sets out the scope and methodology to be adopted for the assessment of community impacts and effects.

9.1.2 Impacts relevant to the community assessment fall broadly within the following categories:

- demolition/construction, direct land required and impacts on property; and
- intrusion/disturbance to communities and community facilities caused by other environmental impacts.

9.1.3 Community resources and receptors are set out below against the themes of residential property and community infrastructure.

Residential property

9.1.4 This will include private, rented and shared ownership residential dwellings and their surrounding grounds/gardens, student accommodation, extra care/retirement housing, mobile homes (where there are established and recognised locations) and homes used in conjunction with a business or other function.

9.1.5 Receptors include the residents or tenants of properties. They also include employees who permanently reside in a residential property, for example, care givers and janitors.

9.1.6 Impacts on commercial and industrial property will be addressed as part of the socio-economic assessment within the formal EIA Report. Impacts on farms and farm-based enterprises will be addressed as part of the agriculture, forestry and soils assessment within the formal EIA Report.

Community infrastructure/organisations

9.1.7 This will include community facilities and infrastructure such as education, health, emergency services, places of worship, sports and recreational facilities, open spaces and public rights of way (PRoW).

9.1.8 Receptors include users and beneficiaries of resources which can include local residents, organised (community) groups, pupils, patients, congregations and employees who use community infrastructure. Receptors also include owners and organisations running the resources.

9.2 Establishment of baseline and definition of survey

Characteristics of communities

9.2.1 The potential for adverse impacts on communities has influenced the development of the Proposed Scheme, for example by aligning the proposed route to avoid the majority of communities between the West Midlands and Crewe.

9.2.2 The proposed route alignment nevertheless passes through and potentially affects, a diverse range of communities and people. The main centres of population include Stafford and Crewe, but the route will pass close to a variety of settlements, including villages, hamlets and isolated farmsteads in the countryside. Some of these communities are more dispersed and rural/agricultural and potentially face issues such as ageing populations and social exclusion.

9.2.3 The key community characteristics of relevance include:

- their physical layout and scale (e.g. in relation to land required, demolitions and severance);
- the location, type and importance of community facilities, and
- their social vulnerability (i.e. whether they contain or serve a high proportion of vulnerable individuals).

Baseline data and methods

9.2.4 The baseline will include collecting information on both resources and receptors.

9.2.5 Potential resources include:

- community infrastructure, including education, health, emergency services, community halls and places of worship;
- recreation infrastructure, including entertainment facilities, sports facilities, and other leisure activities;
- open space;
- residential properties (in terms of their occupation and amenity); and
- PRoW (and other access routes of local importance).

9.2.6 Receptors include:

- individuals using community resources;
- residents;
- local workers;
- community groups;
- owners and organisations with interests in the community resources; and
- local communities as a whole.

9.2.7 Information on resources and receptors will draw on a variety of sources that include:

- data collected during the preparation of the Sustainability Statement, supplemented and updated as appropriate;
- relevant national datasets such as: Index of Multiple Deprivation Access Domain; Ofsted reports and data; Census data; Office of National Statistics Neighbourhood Statistics; Sport England's participation dataset; Land

Registry information; Valuation Office Agency information; and Yellow Pages and/or similar data sets on local facilities;

- existing local studies and information such as: open space surveys; land-use surveys; housing needs surveys; user surveys; membership lists; registered users;
- analysis and data from relevant topics such as: sound, noise and vibration (Section 18); air quality (Section 7); health (Section 13); socio-economics (Section 17); landscape and visual (Section 15); and traffic and transport (Section 19); and
- new studies and/or field surveys where appropriate, for example, relating to open spaces, PRoW, and effects on community organisations.

9.2.8 The community profiles that will be established through drawing on the above sources will be limited by the extent of publicly available data and data obtained through consultation and engagement with communities.

9.3 Consultation and engagement

Consultation on the Sustainability Statement

9.3.1 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for community for the Proposed Scheme.

Consultation on the draft SMR

9.3.2 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for community.

Engagement as part of the EIA process

9.3.3 In accordance with the consultation and engagement process set out in Section 3, further engagement with relevant organisations and communities will be carried out as part of the assessment. Engagement will be appropriate to each organisation.

9.3.4 Relevant organisations include:

- national government departments and statutory organisations;
- local and regional government including Local Enterprise Partnerships and local authorities (including parish councils) on the line of route of the Proposed Scheme;
- other relevant local non-governmental organisations including, for example, tourism boards; and
- relevant voluntary and community sector organisations and other special interest groups.

9.3.5 Stakeholders will also be able to respond to consultation as part of a coordinated EIA approach.

9.4 Key aspects of the Proposed Scheme for the topic

9.4.1 The assessment of community effects will consider impacts and effects during both construction and operation of the Proposed Scheme. Impacts can generate the following broadly defined effects on receptors and resources:

- loss or gain: A loss or gain to a resource or receptor. For example, a decrease in housing stock as a result of demolitions;
- displacement: The re-location of receptors and resources from one location to another within the study area. For example, people moved from their homes to replacement homes permanently or temporarily;
- in-combination effects: Amenity value relates to the enjoyment of a resource by a receptor. The amenity value that resources offer receptors may be affected by a combination of factors including: noise and vibration; HGV traffic; air quality; and visual impacts. The assessment of in-combination effects on community receptors will draw on the conclusions from these other assessment topics taking into account professional judgement about the sensitivity of the individual resource or receptors to the predicted effects; and
- isolation: In the context of this assessment isolation is to be measured by the barriers local communities face in making their usual journeys. This includes physical, psychological and social barriers (i.e. non-economic) and the effects of this on local communities. Isolation of commercial and industrial buildings and land, and agricultural property and land, are addressed within the scope of assessments presented in Section 17 (socio-economics) and Section 6 (agriculture, forestry and soils).

9.4.2 This assessment will form part of an integrated assessment with health (Section 13) which will consider the impacts on human health arising from the Proposed Scheme.

9.4.3 Integrated working between the community and health assessments will ensure that the assessment methodologies are aligned through:

- establishment of a common baseline for the community areas that will meet the requirements for all disciplines;
- ensuring that the community assessment takes account, where relevant and where information is available, of the health characteristics of community facilities; and
- ensuring significant community effects are taken into account as part of the health assessment.

9.5 Scope of assessment

9.5.1 The scope for the community assessment draws on the experience and good practice from similar infrastructure projects elsewhere (including Phase One) and professional judgment of a suitably qualified EIA practitioner.

Spatial and technical scope

9.5.2 The proposed spatial scope is summarised in Table 15. This scope will be refined as the assessment proceeds (e.g. to ensure consistency with other environmental topics).

Table 15 - Impacts and effects on resources and receptors and spatial scope

Resource	Impacts	Effects:		Spatial scope
		Resources	Receptors	
Residential property	Residential property (including gardens) lost to land requirement	Reduction in housing stock available for people	Displacement of home owners/tenants, inconvenience and loss of their assets	Direct land required by HS2 either for the Proposed Scheme itself or for construction
	In-combination effects of noise and vibration, HGV traffic, air quality and visual impacting on residents[142]	Character or quality of residential properties change as a result, for example due to noise and vibration; HGV traffic; reduction in air quality; visual impacts	Receptors' enjoyment of resource is changed	Relevant impact area from the edge of the route of the Proposed Scheme is a minimum of 250m in both urban and rural areas unless subsequent analysis from other topic areas suggests a greater or lesser extent at specific locations
	Isolation of residential properties from other properties and infrastructure	Physical e.g. islanding or isolation of resource	Social and community functioning/integrity is damaged	Anticipated to cover some households up to 1km from the route and construction sites and depending upon specific context and proposals[143]
Community organisations, recreation infrastructure and open/play space	Infrastructure lost to land requirement	Decline in facilities available for community use or temporary impairment of use	Loss of facilities and benefits for users, workers owners, and groups/organisations	Direct land required by the Proposed Scheme
	Presence of construction workers with consequent requirements	Increased demand from construction workers	Reduced availability for users, workers, owners, and groups/organisations	Distance to relevant infrastructure likely to be significantly used by construction workers
	In-combination effects of noise and vibration, HGV traffic, air quality and visual impacting on community	Character or quality of cities/towns/ neighbourhoods changes as a result of noise and vibration; HGV traffic;	Receptors' enjoyment of resource is changed	Relevant impact area from the edge of the route of the Proposed Scheme is a minimum of 250m in urban and rural

[142] Noise and vibration; HGV traffic, vibration, pollution, air quality and visuals significant effects have been identified for the in-combination assessment as it is those effects which are most likely to potentially contribute to a change of amenity value of residential property and community infrastructure operations

[143] The distance of the diversion and duration are factors in determining whether or not there is an impact

Resource	Impacts	Effects:		Spatial scope
		Resources	Receptors	
	infrastructure operations[144]	reduction in air quality; visual impacts		areas unless subsequent analysis from other topic areas suggests a greater or lesser extent at specific locations
	Severance of infrastructure from receptors	Physical e.g. islanding or isolation of resource	Social and psychological e.g. community ties/integrity is damaged	Catchment area of affected resource where it is subject to severance[145]

Temporal scope

9.5.3 The temporal scope for this topic is outlined in Section 4.2 (Scope of the assessment). Community effects will be assessed for the construction period (including a period of commissioning) (2020 - 2026) and for the year of opening in 2027. However, the assessment will also need to reflect the temporal scope of other topic assessments such as sound, noise and vibration (Section 17), air quality (Section 7), landscape and visual (section 15) and traffic and transport (Section 19).

9.6 Assessment methodology

9.6.1 There are no industry-wide accepted methods for assessing community effects for projects of this nature. Methods have been developed for predicting and assessing effects which draw on existing guidance, analysis and methods established for other railway and large infrastructure projects including Phase One of HS2.

Legislation and guidance

9.6.2 Relevant guidance includes:

- Highways Agency Interim Advice Notes[146] and DfT's Transport Analysis Guidance Website (WebTAG)[147]; and
- industry accepted practice from other major infrastructure project EIAs, for example Phase One, Crossrail and Thames Tideway Tunnel.

Significance criteria

9.6.3 The significance of a community effect will be determined by assessing both the:

- magnitude of the impact; and
- the sensitivity of the community resources or receptors.

[144] Noise and vibration, HGV traffic, air quality and visuals significant effects have been identified for the in-combination assessment as it is those effects which are most likely to potentially contribute to a change of amenity value of residential property and community infrastructure operations

[145] The distance of the diversion and duration are factors in determining whether or not there is an impact

[146] Department for Transport (DfT) and the Highway's Agency, various dates, Interim Advice Notes, 2016. Available online at: http://www.dft.gov.uk/ha/standards/ians/index.htm

[147] Department for Transport (DfT), WebTAG Home, Transport Analysis Guidance, 2016. Available online at: http://www.dft.gov.uk/webtag and www.webtag.org.uk

Determining magnitude of impacts

9.6.4 To determine the magnitude of impact, the nature of the impact (beneficial or adverse) and characteristics (i.e. whether direct or indirect, secondary, cumulative, short or long-term, permanent or temporary, reversible or irreversible) will be assessed and classified as high, medium, low or negligible.

9.6.5 The magnitude of an impact is its severity or scale. The magnitude of an impact on a resource or receptor reflects consideration of information and analysis relating to the spatial extent (localised/isolated versus widespread with potential secondary effects); the extent (number of groups and/or people or households affected); and the duration (short, medium and long-term).

9.6.6 Guideline criteria have been established based on professional judgment and are presented in Table 16. Specific magnitude criteria are included in the Phase One Technical Note 'Community and socio-economics – Further assessment guidance' (see Annex A for reference) which will be included in the updated Technical Notes to be issued with the formal EIA Report.

Table 16 - Community impact magnitude criteria

Impact magnitude	Definition
High	An impact that will be very adverse/beneficial, and very likely to affect large numbers of groups and/or people (with number depending on the local context and nature of the impact), and that will usually continue and effectively constitute long-term impact on the baseline conditions
Medium	An impact that is likely to affect a moderate number of groups and/or people (with the number depending on the local context and nature of the impact)
Low	An impact that is likely to affect a small number of groups and/or people (with number depending on the local context and nature of the impact) and/or the base case is not affected beyond a short or medium-term duration
Negligible	An impact that is temporary in nature and/or is anticipated to have a slight or no effect on the well-being of groups and/or people

Determining receptor sensitivity

9.6.7 The sensitivity of receptors will be defined by their importance, scarcity and size. The sensitivity of receptors will be determined by the extent to which individuals have the capacity to experience the effect without a significant loss or gain. Sensitivity will be classified as high, medium or low.

9.6.8 Guideline criteria have been established using professional judgment to determine the sensitivity of the receptors. These are presented in Table 17. Specific sensitivity criteria are included in the Phase One Technical Note, which will be included in the updated Technical Notes to be issued with the formal EIA Report.

Table 17 - Community receptor value/sensitivity criteria

Receptor value and/or sensitivity	Definition
High	Individuals or groups who are at risk and that have little or no capacity to experience the impact without incurring a significant effect
Medium	Individuals or groups that have a limited or average capacity to experience the impact without incurring a significant effect
Low	Individuals or groups that generally have adequate capacity to experience impacts without incurring a significant effect

Determining the significance of effects

9.6.9 The significance of a community effect is a product of the magnitude of the impact and the sensitivity of the receptor and will be determined based on professional judgement.

9.6.10 The approach to determining the significance of community effects is summarised in Table 18.

Table 18 - Community - significance of effect criteria

Significance		Impact magnitude			
		High	**Medium**	**Low**	**Negligible**
Sensitivity of receptor	High	Major adverse /beneficial - significant	Major adverse /beneficial - significant	Moderate adverse /beneficial – significant	Minor adverse /beneficial - not significant
	Medium	Major adverse /beneficial - significant	Moderate adverse /beneficial - significant	Minor adverse /beneficial - not significant	Negligible - not significant
	Low	Moderate adverse/ beneficial - significant	Minor adverse/ beneficial - not significant	Negligible - not significant	Negligible - not significant

9.6.11 Effects are considered to be major and significant if both impact magnitude and receptor sensitivity is high or medium. Effects are considered to be moderate and significant if impact magnitude is high and receptor sensitivity is low, or alternatively if receptor sensitivity is high and impact magnitude is low.

9.6.12 Other effects, equating to minor adverse/beneficial and negligible effects, are not considered to be significant.

Construction effects

9.6.13 Construction effects will be assessed following the general EIA assessment process including:

- establishment of the baseline with definition and collection of relevant data and information as outlined in Section 9.2 (establishment of baseline and definition of survey);

- consultations including those outlined in Section 9.3 (consultation); and
- assessment of impacts and effects against key aspects of the Proposed Scheme as outlined in Section 9.4 (key aspects of the Proposed Scheme for the topic), covering the scope outlined in Section 9.5 (scope of assessment) and using the significance criteria outlined in this section.

Operational effects

9.6.14 The same process will be used for the assessment of operational effects as outlined for construction effects above.

Cumulative effects

9.6.15 The community assessment will report three types of cumulative effect as outlined in Section 4.4 (cumulative effects) of this SMR:

- inter-project effects – the EIA will consider the interaction between the Proposed Scheme, Phase One and other consented or completed developments which may give rise to significant cumulative effects;
- intra-project (in-combination) effects – where two or more residual significant effects from other EIA topics (air quality, noise and vibration, HGV traffic or visual impact) coincide on a community resource / receptors; and
- synergistic – termed 'community-wide effects' these occur where a combination of effects on individual resources have a wider impact on a community, such that they change the experience of a significant proportion of people within that community in terms of their day to day functions (live, work, leisure, travel).

9.7 Assumptions

9.7.1 For assessment purposes it will be necessary to assume that the baseline characteristics established during the EIA process will remain largely unchanged. However, where it is possible to predict change, or to identify planned community facilities, these will be incorporated into the future baseline.

10 Cultural heritage

10.1 Introduction

10.1.1 This section describes the methodology to be used in the assessment of the likely significant impacts and effects upon heritage assets and the historic environment affected by the construction and operation of the Proposed Scheme.

10.1.2 Heritage assets are defined by the Government in the NPPF Annex 2 Glossary as: *"A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions. Heritage asset includes designated heritage assets and assets identified by the local planning authority (including local listing)"*.

10.1.3 Heritage assets include those that are designated under legislation (refer to the NPPF Annex 2 Glossary Designated heritage assets) as well as those that are non-designated. Non-designated assets include heritage assets identified as such by local authorities through their inclusion within the local Historic Environment Record (HER) and those that are identified from other sources during the course of research and survey.

10.1.4 The NPPF Annex 2 Glossary defines the historic environment as: *"All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora."*

10.1.5 Cultural heritage is generally and most easily divided into three key areas as follows:

- archaeological and palaeo-environmental remains including geological deposits that may contain evidence of the human past;
- historic landscapes; and
- historic buildings and the historic built environment.

10.2 Establishment of baseline

10.2.1 The baseline to be assessed is that which is current at the time of the publication of the formal EIA Report.

10.2.2 The Proposed Scheme passes through a largely rural environment of varied historical characteristics. In the process of data gathering, it is recognised that there are interfaces with other disciplines, for example ecology and biodiversity, water resources and flood risk, sound, noise and vibration, landscape and visual and community. These interfaces will be actively addressed as part of the EIA process to ensure that an integrated assessment is undertaken.

10.2.3 Data in respect of heritage assets will be collected for the following designated and non-designated assets:

- designated assets:
  - World Heritage Sites;

- Listed Buildings, Grade I, II* and Grade II;
- Scheduled Monuments;
- Registered Parks and Gardens;
- Conservation Areas; and
- Registered Historic Battlefields;

- non-designated assets:
  - non-designated historic buildings, structures and built monuments including:

a. locally listed buildings; and

b. buildings, structures and monuments included in the HER which are of heritage significance.

- non-designated archaeological or historic landscape sites including:

a. archaeological sites recorded in the HER and/or the Historic England Archives dataset;

b. archaeological and other heritage assets predicted or known from desk based research or fieldwork;

c. palaeo-environmental remains and geological deposits predicted or known to contain evidence for the human past;

d. known historic settlements including those identified as being of archaeological interest; and

e. non-designated historic parks, gardens and battlefields.

10.2.4 Baseline data sources will include:

- details of designated sites held by Historic England;
- local authority conservation area appraisal documents and statements and their mapping;
- records of Ancient Woodland maintained by Natural England, Defra and the Forestry Commission;
- historic landscape character (HLC) mapping held by local planning authorities;
- HER data, held by local planning authorities;
- National Record of the Historic Environment held by Historic England;
- aerial photographs held by Historic England, local authorities, and other appropriate repositories;
- geological mapping and borehole information as held by British Geological Survey;

- documentary, cartographic and other resources as deposited within local studies libraries, county and national records libraries and archives, including historic Ordnance Survey maps, tithe, estate and other maps, and other relevant sources;
- readily available published material, building surveys and gazetteers;
- data sets held by other bodies, such as Canal & River Trust and the National Trust who have specific data on the assets for which they have a responsibility; and
- local authority or ecclesiastic sources, historic maps and documentary sources for burial grounds.

10.2.5 Data collected during the EIA process:

- data from preliminary works such as boreholes or test pits;
- data from a programme of non-intrusive survey;
- data from light detection and ranging (LiDAR) aerial survey;
- data from intrusive techniques, for example coring, trial trenching and building survey;
- data in respect of the zone of theoretical visibility (ZTV) as identified by the landscape and visual assessment, where this is available (see Section 15 landscape and visual); and
- data obtained through site visit and walkover survey from PRoW, or from private land where access has been previously arranged and approved.

10.2.6 The scope of non-intrusive, and potentially intrusive survey (subject to land access), is to be developed and agreed in consultation with Historic England and other appropriate bodies including Local Authority Archaeological and Conservation Officers. HS2 Ltd has prepared a Technical Note 'Cultural heritage – Risk based approach to archaeological assessment' setting out a risk based methodology required to prioritise areas of the Proposed Scheme for additional archaeological survey beyond walkover/field visits for the formal EIA Report. This will be included in the formal EIA Report and is based on the equivalent Phase One Technical Note (see Annex A for reference). In addition to this approach to archaeological survey, a pragmatic approach to surveys, where land access is forthcoming, will be considered. This will be outlined in the formal EIA Report.

Study area

10.2.7 The Phase 2a proposed study area for data gathering to identify impacts upon non-designated assets will encompass the entire land requirement plus 500m either side.

10.2.8 The study area for data gathering to identify impacts upon designated heritage assets, and to understand the historic landscape, will be 2km either side of the land required. Data for designated assets that lie beyond 2km of the land required but fall within the ZTV will also be collected.

10.3 Consultation and engagement

Consultation on the Sustainability Statement

10.3.1 A number of consultation responses were received regarding the Phase Two Consultation Sustainability Statement 2013 in respect of heritage assets. These included those from Historic England, the National Trust, and local planning authorities. Other responses received included those from local amenity societies and specialist interest groups.

10.3.2 The response from Historic England focused on matters affecting the setting of heritage assets, including experience of place and understanding of the history of assets. Historic England were concerned over the use of gradiated 'buffer zones' in assessing direct and indirect impacts upon different types of designated heritage assets. Within this EIA process, all designated assets within the ZTV defined for the area of assessment of visual impact (see Section 15 landscape and visual) will be assessed where the ZTV is available and an area covering 2km either side of the land required for construction and operation of the Proposed Scheme if not available. It is however, acknowledged that other factors such as noise and light impacts may extend beyond the ZTV, and these will be assessed within the respective sections of the Phase 2a formal EIA Report.

10.3.3 Historic England was also concerned over the omission from the Sustainability Statement of known but non-designated archaeological assets. They were concerned that the assessment did not therefore take into account those non-designated archaeological assets of schedulable quality or other non-designated archaeological assets. Their response identified areas in Phase 2a where there may be potential impacts upon non-designated heritage assets. The analysis of impact undertaken during the EIA will therefore assess these areas, and will include consideration of non-designated assets potentially of schedulable quality.

10.3.4 Responses were received from the National Trust, Staffordshire Gardens and Parks Trust and Cheshire Gardens Trust as well as the Ridware Historical Society. Concerns were noted over the archaeologically rich Trent Valley, while setting and experience effects were noted where the Proposed Scheme passes near Shugborough Park and Hall and gardens, and at Ingestre Park and Swynnerton Hall. These assets are to be assessed for impacts as part of the EIA process.

Consultation responses on the Phase One SMR

10.3.5 A number of consultation responses were received regarding the Phase One SMR in respect of heritage assets affected by Phase 2a. Responses included those from statutory consultees including Historic England and local planning authorities. The points below address issues raised in these responses. Further engagement will take place through the production of this SMR.

10.3.6 Historic England identified the potential to improve assessment of the impact on the historic landscape. In response, a Technical Note setting out the historic landscape assessment methodology is being developed by HS2 Ltd in discussion with Historic England's landscape specialists. This will form the basis of historic landscape assessment during Phase 2a and will be issued with the formal EIA Report.

10.3.7 Historic England identified a need to include a model that identified how understanding of risk/archaeological potential has driven the programme of survey. HS2 Ltd will revise the existing Technical Note on this topic. This will be issued with the formal EIA Report. Historic England identified that the potential impact of noise on the significance of heritage assets needed to be considered. Consideration will be given to the sound environment of a heritage asset and the contribution of this to its setting. A combination of professional judgement and information from the sound, noise and vibration assessment will be used, taking into account the intended function of the asset. This will be carried out in line with Historic England guidance on the setting of heritage assets.

10.3.8 Historic England identified the need to address the effect of the proposals on the viability of heritage assets. The Phase One ES (November 2013) outlined HS2 Ltd's approach as: *"Where there may be an effect on the viability of an asset, potentially leading to dereliction or changes in managements affecting heritage assets, mitigation will be addressed on a case by case basis with the community and any other relevant stakeholders. Mitigation measures will take account of the range of effects that have been identified in the ES."*

10.3.9 Significant effects on the viability of a heritage asset may occur where it is no longer possible for the asset to be maintained in its present use and no suitable alternative use can be secured. The risk of unviability of heritage assets will be assessed using professional judgement, taking account of impacts identified from other disciplines (e.g. community, agriculture and socio-economics). This will refer to existing national policy and guidance including the NPPF[148], NPPG[149] and Historic England's Conservation Principles[150].

10.3.10 Historic England identified inconsistency with the grouping of heritage assets within the Phase One ES. While grouping of assets will still take place on Phase 2a, effects on the settings of groups of heritage assets will be assessed where such groups are likely to experience the same or similar effects owing to their location in the landscape and distance from the Proposed Scheme. In such cases key high value assets within the group will be specifically identified.

Consultation on the draft SMR

10.3.11 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

Engagement as part of the EIA process

10.3.12 Historic England is the Government's advisor on heritage, and will be consulted throughout the course of the project.

[148] Department for Communities and Local Government, 2012, National Planning Policy Framework, paras 126 & 131
[149] Department for Communities and Local Government (DCLG), National Planning Practice Guidance (NPPG), 2014, para 15
[150] Historic England, 2008, Conservation Principles – Policies and Guidance for the Sustainable Management of the Historic Environment

10.3.13 Consultation will continue throughout the EIA. Consultees for the topic include the Local Authority Archaeological Officers and Conservation Officers or their equivalents for Staffordshire and East Cheshire.

10.3.14 In addition, the National Trust, Battlefields Trust, the Canal & River Trust and the Gardens Trust are proposed as additional consultees. Engagement will take place with these organisations and other relevant parties that make representations to HS2 Ltd with reference to Phase 2a during the EIA process.

10.4 Key aspects of the Proposed Scheme for the topic

10.4.1 Key aspects of the Proposed Scheme for this topic include:

- construction works which require the physical excavation of, demolition or removal of, or alteration to heritage assets;
- settlement of heritage assets resulting from tunnelling, deep excavations or construction of retaining walls;
- protection of heritage assets during construction activities;
- temporary setting effects on designated or other heritage assets during construction;
- permanent setting effects on designated and other heritage assets arising from construction or operation;
- ground disturbance caused through the implementation of ecological and other mitigation measures;
- vibration effects upon heritage assets during both construction and operation;
- increased noise effects upon heritage assets at some locations where tranquillity may be a consideration during both construction and operation;
- damage to waterlogged deposits through changes in groundwater regimes following construction; and
- impacts on the long-term viability of heritage assets as a result of changes in access and/or use.

10.5 Scope of assessment

10.5.1 Effects to be assessed are direct and indirect, temporary, permanent and cumulative. Each of these is examined below in the context of the cultural heritage assessment to be presented in the formal EIA Report.

10.5.2 A direct effect is one that will occur to the physical fabric or land of an asset and its curtilage, and any effect upon the setting of that asset arising directly from the Proposed Scheme.

10.5.3 An indirect effect is one that might arise as a consequence of the construction or operation of the railway by, for example, affecting viability of land leading to dereliction of buildings and land leading to changes in the management or land use of archaeological or historic landscape features. These can also affect the availability of

land for future research in cases where archaeological sites may be buried by earth bunding.

10.5.4 A permanent effect will occur, for example, as a result of the construction and operation of the railway including the permanent works for the railway. A permanent effect is not reversible and may (by definition) result in the permanent loss of, or harm to a heritage asset including its setting.

10.5.5 Temporary activities such as soil storage, contractor's site compounds and access routes, as well as the activities associated with the erection of other facilities and structures, where the site will be returned to its former condition, may have temporary effects (for example on setting) or permanent effects (for example where sub surface deposits are affected).

10.5.6 A cumulative effect is one arising from the incremental effects of multiple developments on heritage assets.

Spatial scope

10.5.7 The effects of the scheme on all heritage assets within 500m of the footprint of the Proposed Scheme will be assessed. The assessment will address the significance of the heritage assets (archaeological, architectural, artistic or historic) to be affected, to ensure that this impact is captured and articulated sufficiently.

10.5.8 The setting effect of the scheme on heritage assets will be assessed where the ZTV is available and an area covering 2km either side of the land required for construction and operation of the Proposed Scheme if not available. Within this area of survey, designated and non-designated heritage assets will be identified in accordance with the methodology defined in this document. High value assets which lie outside of the ZTV, with a heritage significance which professional judgement suggests is likely to be significantly affected by factors such as changes to noise or light will also be considered.

Temporal scope

10.5.9 In addition to considering the effects of construction resulting from the Proposed Scheme, the cultural heritage assessment will consider effects relating to the operational phases. Construction works for the Proposed Scheme are anticipated to take place between 2020 and 2026 (including commissioning). Effects arising from the operation of the Proposed Scheme will be assessed taking into account the services to be expected when HS2 reaches maximum capacity.

10.5.10 The temporal scope of the assessment assumes a baseline with current conditions as of the commencement of assessment in 2016.

Technical scope

10.5.11 All cultural heritage assets with the potential to be directly or indirectly affected by the Proposed Scheme will be considered. The significance/value of all heritage assets within the study area will also be considered. Where the Proposed Scheme is determined to have an impact upon the setting or fabric of an asset, such that its significance/value (archaeological, architectural, artistic, or historic) would be affected, the magnitude of this impact will be assessed in line with the methodology

below. Similarly, the resulting effect will be assessed in line with the methodology below.

10.5.12 The ecological significance of veteran trees and ancient woodland along with the wider landscape is addressed in the ecology and biodiversity section (Section 11) and the landscape and visual section (Section 15). These aspects are considered within the cultural heritage section as components of the broader historic landscape, rather than as individual heritage assets.

10.6 Assessment methodology

Legislation and guidance

10.6.1 Policy in respect of heritage assets is set out in the NPPF (Section 12: Conserving and enhancing the historic environment).

10.6.2 There is no specific national guidance on the methodology for the preparation of impact assessments for heritage assets. However, DMRB (Volume 11: Environmental Assessment) provides an approach for the assessment of impacts arising from highway schemes; and Section 3, Part 2 (HA 2008/07) covers cultural heritage including historic landscape (Annex 7).

10.6.3 In January 2011, the International Council on Monuments and Sites (ICOMOS) issued guidance on Heritage Impact Assessments for Cultural World Heritage Properties[151]. Though specifically addressing World Heritage Sites and development impact on their Outstanding Universal Value, the document provides an approach to assessment and evaluation of impact.

10.6.4 In May 2011, Historic England published its guidance 'Seeing History in the View' (2011a)[152]. This guidance, which deals specifically with assessing impact upon heritage views and multiple assets, contains an approach to baseline analysis and the assessment of impact; with a series of tables to assist the process. More recently, in March 2015, Historic England published its guidance on the assessment of setting, in Good Planning Advice Note 3[153] which sets out an approach to the analysis and assessment of setting and its relationship to the heritage significance of an asset (2015a). In addition, in December 2015, Historic England published guidance on 'Tall Buildings' in Good Planning Advice Note 4[154] to assist those involved in planning for and designing tall buildings in making sustainable decisions.

10.6.5 The NPPF's Planning Practice Guidance contains a section on 'Conserving and Enhancing the historic environment'[155]. Additional guidance in respect of the Historic Environment is set out in the Historic England Good Practice Advice Notes 1[156] and

[151] ICOMOS January 2011. Heritage Impact Assessments for Cultural World Heritage Properties
[152] English Heritage May 2011 Seeing History in the View
[153] Historic England March 2015a Good Practice Advice Note 3: The Setting of Heritage Assets
[154] Historic England December 2015d Good Practice Advice Note 4: Tall Buildings
[155] DCMS April 2014 Planning Practice Guidance
[156] Historic England March 2015b Good Practice Advice Note 1: The Historic Environment in Local Plans

2[157] which support the NPPF which replaced Planning Policy Statement 5 (PPS5): Planning for the Historic Environment in March 2012.

Field visits

10.6.6 Field visits within the study area will comprise field inspection to identify heritage assets and their setting and to examine the character and form of the historic landscape. The purpose of the survey will be to verify the baseline research, assess the setting, nature and condition of known heritage assets and identify previously unidentified assets which may be affected by the Proposed Scheme. These activities will provide an understanding of the characteristics of the landscape and the assets that are contained within it and their contribution to the overall historic landscape within the study area.

Approach

10.6.7 The methodology set out in the above legislation and guidance is summarised as follows:

- identify the baseline heritage assets (defined as all data collected from a range of desk based sources and, as appropriate, surveys) and their setting;
- assess the significance of the baseline assets and the contribution of their settings to this significance;
- identify and define the magnitude of impact and the severity of the effects;
- if possible, identify mitigation required and its methodology in terms of spatial extent and techniques to be deployed; and
- assess the development impact and its effect on the significance of the asset taking into consideration any mitigation proposed.

Significance criteria

10.6.8 The significance of a heritage asset is defined as *"The value of a heritage asset to this and future generations because of its heritage interest; that interest may be archaeological, architectural, artistic or historic"* (the NPPF Annex 2, Glossary). Historic England define 'significance' and 'heritage values' as being a collective term for the sum of all the heritage values attached to a place, be it a building an archaeological site or a larger historic area such as a whole village or landscape[158].

10.6.9 Assets can be designated or non-designated. Designated assets are so designated in accordance with national or international criteria (conservation areas are a local authority designation, though determined through legislation) and have statutory protection. In assessing the significance of an asset, Historic England has outlined a number of values which contribute to overall significance. These include evidential,

[157] Historic England March 2015c Good Practice Advice Note 2: Managing Significance in Decision-Taking in the Historic Environment
[158] Historic England, 2008, Conservation Principles – Policies and Guidance for the Sustainable Management of the Historic Environment

historical, aesthetic and communal value[159]. Non-designated heritage assets may exhibit equivalent values to those which have been granted statutory protection.

10.6.10 Setting can also contribute to significance. Setting is not simply a visual consideration and specific guidance on the analysis of setting is set out by Historic England (2015a)[160]. It is acknowledged that setting could be affected by other scheme factors including noise; where relevant, the contribution of the existing sound environment to the heritage value of the asset will be identified and the potential change to this will be considered as part of the impact assessment process.

10.6.11 Taking these criteria into account, each identified baseline heritage asset will be assigned a level of significance (value) in accordance with a three-point scale as shown in Table 19. This table provides guidance as to significance (value) but professional judgment will be applied in all cases and may sometimes lead to individual heritage assets being placed in a different category where this is justified.

Table 19 - Factors for assessing the significance/value of heritage assets

Significance (value)	Asset categories
High	World Heritage Sites Grade I and Grade II* Listed Buildings Grade I and Grade II* Registered Parks and Gardens Scheduled Monuments Registered battlefields Conservation Areas (as appropriate) Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to have high significance (value) Burial Grounds and Cemeteries
Moderate	Grade II listed Buildings Conservation Areas (as appropriate) Grade II Registered Parks and Gardens Locally listed buildings as recorded on a local authority list Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to have moderate significance (value) Historic Townscapes with historic integrity in that the assets that constitute their make-up are clearly legible
Low	Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to have low significance (value) Assets whose values are compromised by poor preservation or survival or of contextual associations

[159] Historic England, 2008, Conservation Principles – Policies and Guidance for the Sustainable Management of the Historic Environment
[160] Historic England March 2015a Good Practice Advice Note 3: The Setting of Heritage Assets

Significance (value)	Asset categories
	to justify inclusion into a higher grade
Not significant	Assets identified as being of no historic, evidential, aesthetic or communal interest Assets whose values are compromised by poor preservation or survival or of contextual associations to justify inclusion into a higher grade

Magnitude of impact

10.6.12 Impacts can be direct or indirect, and can be characterised in terms of timing, scale, duration, reversibility and the likelihood of the impact occurring. Impacts can be permanent or temporary and can be positive or negative.

10.6.13 The magnitude of an impact can vary from 'high' to 'no change' as set out in Table 20, and can be beneficial or adverse.

Table 20 - Factors influencing the assessment of magnitude of impacts

Impact rating	Description of impact
High	Change such that the significance of the asset is totally altered or destroyed. Comprehensive change to setting affecting significance, resulting in changes in our ability to understand and appreciate the resource and its historical context and setting
Medium	Change such that the significance of the asset is affected. Changes such that the setting of the asset is noticeably different, affecting significance resulting in changes in our ability to understand and appreciate the resource and its historical context and setting
Low	Change such that the significance of the asset is slightly affected. Changes to the setting that have a slight impact on significance resulting in changes in our ability to understand and appreciate the resource and its historical context and setting
Minimal	Changes to the asset that hardly affect significance. Changes to the setting of an asset that have little effect on significance and no real change in our ability to understand and appreciate the resource and its historical context and setting
No change	The Proposed Scheme does not affect the significance of the asset. Changes to the setting that do not affect the significance of the asset or our appreciation of it

Significance of effects

10.6.14 Assessment of the significance of effects will take into consideration mitigation associated with the Proposed Scheme, for example landscape planting, ecological compensation and noise barriers. It should be recognised that some mitigation measures can themselves be a source of impact on heritage assets.

10.6.15 The assessment of the level of overall significance of the effect, taking into consideration mitigation, is determined by cross referencing the significance value of the asset (Table 19) and the magnitude of impact (Table 20) as shown in Table 21.

10.6.16 Major and moderate impacts may be considered to be significant effects. The assessment of overall effect can be either adverse or beneficial.

Table 21 - Matrix for establishing overall significance of effect

	Magnitude of impact				
Significance (value) of asset	**No change**	**Minimal**	**Low**	**Medium**	**High**
High	Neutral	Minor	Moderate	Major	Major
Moderate	Neutral	Minor	Minor	Moderate	Major
Low	Neutral	Negligible	Minor/ Negligible	Minor	Moderate
Not significant	Neutral	Negligible	Negligible	Negligible	Negligible

Construction effects

10.6.17 Construction effects will be assessed following the general EIA assessment process including the establishment of the baseline, consultations, assessment of impacts and effects against key aspects of the Proposed Scheme, the scope of the assessment and using the significance criteria outlined in this section. Further assessment of impacts identified through other EIA work, for example for water resources and flood risk , sound, noise and vibration, landscape and visual, and ecology and biodiversity will be undertaken.

10.6.18 Effects upon the significance of assets (such as due to a change in their setting) which are identified during the assessment of construction and continue to apply during operation will be identified as a construction effect.

Operational effects

10.6.19 The same process will be used for the assessment of operational effects as outlined for construction effects above.

Cumulative effects

10.6.20 The construction of the Proposed Scheme will generate economic stimulus for development within its corridor and particularly at off-route stations and interchanges to take advantage of the economic benefits such a location will bring. This, combined with developments that are already taking place or anticipated along the route of the Proposed Scheme, will result in increased pressure on heritage assets through total or partial loss, impacts on significance value or increased urbanisation resulting in adverse impacts on the setting of heritage assets. The criteria for the selection of developments included in the cumulative impact assessment are provided in Section 4.4 (Cumulative effects) of this SMR.

10.7 Assumptions

10.7.1 Key assumptions for this topic are that relevant data will be available from the various archive and record holding bodies consulted (i.e. HERs, Historic England, the National Record of the Historic Environment), records of designated sites (including the National Heritage list for England); and that collections of historic maps and other sources held by external record offices (such as local studies libraries, county and national archives) will be available.

10.7.2 It is assumed that all heritage assets within the proposed land required will be removed unless expressively excluded as a result of the mitigation process.

10.7.3 It is recognised that, within certain areas, access for heritage surveys will be restricted (e.g. to PRoW) or will be denied. Surveys will, therefore, necessarily be constrained to those areas where landowner access is granted.

10.7.4 The assessment within this section considers heritage assets from the perspective of the historic environment. The value of heritage assets from the perspective of other disciplines is covered in discipline specific sections.

10.7.5 This includes assessing the value of heritage assets from a social, recreational, ecological and landscape points of view in Section 9 (community), Section 11 (ecology and biodiversity) and Section 15 (landscape and visual) of this SMR, respectively.

11 Ecology and biodiversity

11.1 Introduction

11.1.1 This section of the SMR sets out the scope for the ecology and biodiversity component of the EIA of the Proposed Scheme.

11.1.2 It describes the methodologies that will be used to identify the potential for impacts and effects upon species and habitats, including sites recognised or designated for their significance for nature conservation that are found along the route of the Proposed Scheme.

11.2 Establishment of baseline and definition of survey

11.2.1 The baseline conditions for the EIA will be established through a combination of desk study, field survey and consultation.

11.2.2 Existing biological data for the route of the Proposed Scheme will be obtained from relevant Biological Records Centres and from national and local specialist data sources, such as Bat Groups. The data to be collated will include:

- statutory designated sites within 10km of the route[161];
- non-statutory designated sites and ancient woodlands within 5km of the route;
- records of protected, priority or otherwise notable species within 5km of the route (in some locations and for some species including bats, the corridor of search will be extended up to 10km from the route to ensure that a complete baseline for the assessment is gathered); and
- priority, or otherwise notable habitats, or features within 500m of the route.

11.2.3 Other relevant sources of ecological data such as national and local Biodiversity Action Plans, existing Phase 1 habitat surveys and Habitat Biodiversity Audits, Biodiversity Opportunity Mapping and Green Infrastructure studies will be consulted.

11.2.4 In addition, existing ecological data available from other sources, such as Environmental Statements associated with other relevant developments or nature reserve monitoring records, will be consulted where available. A desk study will also be undertaken to identify any additional woodlands within the land required for construction of the Proposed Scheme and a 500m radius around it that have the potential to be ancient woodland (based on a review of historical mapping), and merit inclusion on the Ancient Woodland Inventory, and further ecological survey and assessment.

11.2.5 The width of the survey corridor will be defined by the potential area of ecological impact. This will vary depending on a number of factors, including the engineering of the route, the topography and ecological connectivity of the landscape, and the

[161] Desk study searches encompass corridors either side of the centreline of the proposed route

ecological receptor. In rural sections, the survey corridor for some species, such as great crested newt, could extend up to 500m either side of the land required for construction; in urban sections, the survey corridor will, in general, be much narrower as the zone of impact will be more restricted.

11.2.6 Phase 1 habitat surveys will be carried out and will include the identification of woodland, ancient woodland and veteran trees. On the basis of the habitats present, and on the basis of professional judgement by an ecologist as to the potential for the presence of protected or otherwise notable species, further detailed specialist surveys will be undertaken where possible.

11.2.7 Specialist surveys will include:

- detailed botanical surveys (including National Vegetation Classification);
- surveys of invasive non-native species;
- river and watercourse surveys, as appropriate;
- hedgerow surveys;
- ditch surveys;
- pond surveys;
- amphibian Habitat Suitability Index (HSI) surveys of water bodies;
- amphibian and eDNA surveys of water bodies;
- reptile surveys;
- breeding bird surveys;
- wintering and passage bird surveys;
- badger surveys;
- hazel dormouse surveys;
- bat surveys of suitable features, to determine suitability as bat roosts, and emergence and activity surveys to determine presence and patterns of use by bats (where Habitats Directive Annex II[162] species are thought to be present, additional surveys will be agreed with Natural England);
- otter surveys;
- water vole surveys;
- terrestrial invertebrate surveys;
- aquatic macro-invertebrate surveys;

[162] Council Directive 92/43/EEC On the conservation of natural habitats and of wild fauna and flora. Annex II – species requiring designation of Special Areas of Conservation

- white-clawed crayfish surveys; and
- fish surveys.

11.2.8 Further details on the survey methodologies will be set out in the Field Surveys Methods and Standards (FSMS) Technical Note (refer to Annex A). The methods set out in this SMR follow recognised methodologies (deviating only where considered appropriate); and have been determined in consultation with Natural England.

11.2.9 The desk study and field surveys, aided by consultation, will support the identification of sites and features of value. In addition, the assessment will identify landscape-scale ecological features, such as linear features (e.g. hedgerows, watercourses, and disused railway lines) that have additional value in providing habitat connectivity and potential migration corridors.

11.2.10 As a general rule desk study records dated prior to 1 October 2001 will be considered as historic and unlikely to provide relevant information to inform the baseline for the assessment. Different cut-off dates will be applied for the following receptors:

- habitats and higher/lower plant records - all records prior to 1 October 1990 considered as historic (a longer period than the standard due to their less mobile nature); and
- white-clawed crayfish - all records prior to 1 October 2006 considered as historic (a shorter period than the standard due to the on-going rapid decline in numbers resulting from the spread of non-native crayfish).

11.2.11 Data from prior to the above dates will only be included in the formal EIA Report where no more recent survey data are available, or where the data are of contextual value in relation to considering evidence of longer term species declines/advances and/or to identifying potential targets for habitat creation or species re-introductions.

11.2.12 Survey methodologies and basic extents for common ecological surveys required on a widespread basis across the route are provided in the FSMS. The methods incorporate feedback from engagement with Natural England and the Environment Agency.

11.2.13 The FSMS Technical Note is not intended to cover all survey methodologies utilised. Where specific locations will require the use of additional survey methods or deviations from the methodologies identified in the FSMS these are to be reported within the relevant community area reports within the formal EIA Report.

11.3 Consultation and engagement

Consultation on the Sustainability Statement

11.3.1 A number of organisations raised ecology and biodiversity matters in their response to the Sustainability Statement consultation. These included:

- Natural England;
- Environment Agency;
- Woodland Trust;
- Forestry Commission;

- Royal Society for the Protection of Birds;
- The Wildlife Trusts;
- Staffordshire Wildlife Trust;
- Cheshire Wildlife Trust; and
- National Trust.

11.3.2 Relevant consultation responses on the Phase Two Sustainability Statement were taken into account in the development of the scope and methodology for ecology and biodiversity.

Consultation on the draft SMR

11.3.3 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

Engagement as part of the EIA process

11.3.4 During the EIA, the above organisations will remain key consultees for ecology and biodiversity and other national bodies will be consulted as appropriate.

11.3.5 In addition, at a local level, other organisations and individuals will be consulted as appropriate to provide existing data and contribute context to the assessment. These may include for example:

- local bat groups;
- local badger groups;
- local amphibian and reptile groups;
- local ornithological groups;
- local groups associated with individual nature reserves and other sites;
- local authorities; and
- local landowners.

11.4 Key aspects of the Proposed Scheme for the topic

11.4.1 Adverse effects on nature conservation could arise most obviously through direct land-take, resulting in habitat loss, fragmentation and barriers, and affecting the ability of habitats and populations to maintain conservation status. Loss or degradation of ecological corridors and networks, with a resulting decline in 'habitat connectivity', is recognised as an issue. At least in the short to medium-term, temporary land-take may give rise to effects as significant as permanent land-take, due to the slow recovery of species, populations and habitats. Some habitats, such as ancient woodland, are recognised as being essentially irreplaceable and where such habitats are affected, mitigation is not practicable, with a focus, instead, on avoidance or compensation measures.

11.4.2 Disturbance as a result of sound, noise, movement and/or light during site clearance, construction and operation could give rise to effects on some species. Ecological effects can also result from edge effects, air and water pollution, arising once again during site clearance and construction, and from changes in water levels or flows.

11.4.3 In addition, there is the potential for the Proposed Scheme to have beneficial effects, for example as a consequence of habitat creation designed to extend and link fragments of semi-natural habitat.

11.4.4 Key potential ecological impacts are listed in Section 11.6 (Assessment methodology).

11.5 Scope of assessment

Temporal scope

11.5.1 The main construction works for the Proposed Scheme are anticipated to take place between 2020 and 2026 (including commissioning). The assessment of construction effects will relate to the construction programme set out in the formal EIA Report. Effects arising from the operation of the Proposed Scheme will be assessed taking account of the services that are expected when HS2 reaches maximum capacity.

11.5.2 The baseline for the assessment will be taken as conditions at the time of the 2016 surveys. Where the baseline is considered likely to change between the date of the surveys and the future scenarios this will be made clear in the formal EIA Report[163]. The predicted ecology and biodiversity baseline(s) in the relevant year(s) will be based on projection methods described in Section 8.

Spatial scope

11.5.3 The spatial scope of the ecological assessment will be defined by the potential area of ecological impact. More details are provided in Section 11.2 (Establishment of baseline and definition of survey). In summary, the area of search for existing information will extend up to and potentially beyond 10km from the route of the Proposed Scheme. The extent of field surveys will vary according to the species and/ or habitat under study and the potential area of impact as explained in Section 11.2.5.

11.5.4 The spatial scope will include not only the physical extent of the works, including land-take associated with construction sites, road improvements and off-site works, but also indirect or secondary effects such as temporary and permanent changes in road traffic.

11.5.5 Due to the large scale of the Proposed Scheme and the large volumes of information to be collected in support of the assessment, the formal EIA Report will report on only those resources/receptors identified as potentially relevant to the assessment. For Natura 2000 sites this is identified through Habitats Regulations Assessment to determine the potential for likely significant effects. For other receptors, it has been defined as follows:

[163] In addition, there will be a need for a programme of repeating and updating ecological surveys to continue beyond the deposit of the hybrid Bill, up to the point of site clearance, with monitoring beyond that time

- all statutory and non-statutory designated sites (and Ancient Woodlands) located within a 500m radius of the land required for the construction of the Proposed Scheme, and any others considered potentially subject to significant effects; and
- protected and/or notable habitats and species[164] within or adjacent to land required for the construction of the Proposed Scheme, and any others considered potentially subject to significant effects.

Technical scope

11.5.6 The assessment will consider all ecological receptors with the potential to be directly or indirectly affected by the Proposed Scheme, including sites designated for their nature conservation value, legally protected or otherwise, notable species / habitats, all species and habitats of nature conservation value (e.g. veteran trees), i.e. not only those listed in Section 11.2, plus any other relevant information gathered. The assessment will include effects on individual sites or receptors, and the cumulative effects of the works on the ecology and biodiversity along the length of the Proposed Scheme, see Section 11.6 (Assessment methodology). It will also consider the effects on landscape-scale ecological features, including habitat connectivity.

11.5.7 In order to ensure that all likely significant effects of the Proposed Scheme will be identified, where baseline information is incomplete a precautionary approach of assuming a 'reasonable worst-case' valuation is to be adopted. This approach will be utilised to assign precautionary values to both known receptors and potential receptors based on the best available information. Further details are provided in the 'Ecological assessment method' Technical Note as referenced in Annex A.

11.5.8 In keeping with the aims set out in The Natural Environment White Paper[165] mitigation will be developed at both a strategic and local level, see Technical Note 'Ecological principles of mitigation' as referenced in Annex A.

11.5.9 The Government and HS2 Ltd are also seeking to achieve no net loss of biodiversity for HS2. The methodology used for this no net loss assessment will be based on that developed for Phase One, but adapted to take into consideration comments from a review of the methodology by Natural England. It will be used to compare the habitats present pre and post-construction. The outputs from the no net loss calculation will be reported separately at www.gov.uk/hs2.

11.5.10 The potential impacts and effects of climate change on ecological receptors, alongside the effects of HS2 on the ability of habitats and species in the wider landscape to respond to climate change, will be considered as part of the route-wide assessments for ecology and biodiversity and climate in Volume 3 of the formal EIA Report. The climate change assessment is set out in Section 8 of this SMR.

11.5.11 Impacts on relevant European designated sites will be described within the formal EIA Report, against the requirements of both the EIA and the Habitats Regulations.

[164] HM Government, 2006, Natural Environment and Rural Communities Act 2006, The Stationery Office
[165] HM Government, 2011, Department for Environment, Food & Rural Affairs, The natural choice, securing the value of nature, The Stationary Office

Supporting technical studies may be presented in a separate, standalone document(s).

11.5.12 A separate assessment will be made of the implications of the relevant aspects of the proposals covered by the Water Framework Directive[166] (WFD). This is discussed in Section 21.6, Water resources and flood risk. The WFD assessment will inform the assessment of effects related to water quantity and quality, as well as hydromorphology. The respective biological effects will be reported in the ecology and biodiversity section of the formal EIA Report.

11.5.13 There are a number of overlaps between the ecology and biodiversity assessment and other assessments being undertaken as part of the EIA. Section 10 should be referred to regarding the cultural heritage aspects of veteran trees affected by the Proposed Scheme; Section 15 should be referred to with regard to the landscape and visual impacts and effects from loss of habitat; Section 7 with regard to the air quality assessment; Section 18 with regard to the sound, noise and vibration assessment and Section 21 with regard to the water resources assessment.

11.6 Assessment methodology

11.6.1 The assessment is to be guided by the methodology advocated by the Chartered Institute of Ecology and Environmental Management (CIEEM) as published in the Second Edition in January 2016[167]. Full details of the assessment methodology are provided in the 'Ecological assessment method' Technical Note as referenced in Annex A.

Legislation

11.6.2 The assessment will take into account relevant national and international legislation including:

- The Wildlife and Countryside Act 1981 (as amended)[168];
- The Conservation of Habitats and Species Regulations 2010 (Amended 2012)[169];
- Protection of Badgers Act 1992[170];
- The Hedgerows Regulations 1997[171];
- Countryside and Rights of Way Act 2000[172];
- Natural Environment and Rural Communities Act 2006;[173]

[166] European Commission (EC), 2000, Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy, EC
[167] Chartered Institute of Ecology and Environmental Management (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland - Terrestrial, Freshwater and Coastal. CIEEM
[168] HM Government, 1981, The Wildlife and Countryside Act 1981 (as amended), The Stationery Office
[169] Defra, 2010, The Conservation of Habitats and Species Regulations (Amended 2012), Defra
[170] HM Government, 1992, The Protection of Badgers Act, The Stationery Office
[171] HM Government, 1997, The Hedgerows Regulations 1997, The Stationery Office
[172] HM Government, 2000, Countryside and Rights of Way Act 2000, The Stationery Office
[173] HM Government, 2006, Natural Environment and Rural Communities Act 2006, The Stationery Office

- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 [174];
- Salmon and Freshwater Fisheries Act, 1975 (as amended)[175]; and
- Directive 2014/52/EU amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.

Guidance

11.6.3 The assessment also takes into account relevant guidance set out in national, regional and local planning policy and other guidance, such as:

- NPPF (2012);
- Government Circular: Biodiversity and geological conservation – statutory obligations and their impact within the planning system[176];
- Natural Environment White Paper - The Natural Choice: securing the value of nature (2011);
- Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network (2010; the 'Lawton Report')[177];
- Biodiversity 2020: A strategy for England's wildlife and ecosystem services (2011)[178];
- Natural England and Forestry Commission Standing Advice for Ancient Woodland and Veteran Trees (2014) [179];
- Natural England Standing Advice for Protected Species (2014 / 2015)[180]; and
- Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines (2016).

11.6.4 As well as taking account of nature conservation policies in Local Development Frameworks, the assessment will consider other local plans.

Significance criteria

11.6.5 Further details of the significance criteria used for the assessment are provided within the Ecological assessment method Technical Note as referenced in Annex A.

[174] HM Government (2003), Statutory Instrument 2003 No. 3242 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, The Stationery Office

[175] HM Government (1975) Salmon and Freshwater Fisheries Act, 1975, Chapter 51. Her Majesty's Stationery Office

[176] Office of the Deputy Prime Minister (ODPM) and Defra, 2005, ODPM Circular 06/2005 and Defra Circular 01/05, Government Circular: Biodiversity and geological conservation – statutory obligations and their impact within the planning system, ODPM

[177] Defra, 2010, Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network, Defra

[178] Defra, Biodiversity 2020: A strategy for England's wildlife and ecosystem services, Defra, 2015

[179] Accessed on line at http://www.forestry.gov.uk/pdf/AncientWoodsSA_v7FINALPUBLISHED14Apr3.pdf/$FILE/AncientWoodsSA_v7FINALPUBLISHED14Apr3.pdf

[180] Natural England and Defra 2014/2015, Protected Species and sites: how to review planning proposals. Accessed online at: https://www.gov.uk/guidance/protected-species-and-sites-how-to-review-planning-proposals

11.6.6 Each potential ecological receptor will be evaluated against the following geographical frames of reference: international; national; regional; county/metropolitan; district/borough; local/parish; and negligible. The standard geographical frames of reference of 'site' and 'within zone of influence' will not be used as they are not considered appropriate for a linear scheme of this scale.

11.6.7 It is important that there is a consistent approach to the definition of significance across the different environmental topics reported in the formal EIA Report. Significant ecological effects on receptors at different geographical scales will therefore be related to the overall significance categories used by other environmental topic areas. This process will also ensure that the overall assessment focuses on the key significant ecological issues.

Construction effects

11.6.8 Potential impacts resulting from construction activities include:

- temporary and permanent land required;
- severance of ecological corridors and networks, resulting in a reduction in habitat connectivity;
- fragmentation of habitats and sites;
- barrier effects (to movement of fauna);
- noise and visual disturbance;
- disturbance from lighting;
- dust deposition;
- air pollutants emitted from construction vehicles and plant;
- risk of water quality changes from surface water runoff;
- hydrological effects, from changes in water levels and/or flows;
- effects on groundwater and any habitats reliant on them;
- changes in management, often resulting in habitat degradation; and
- introduction and spread of non-native invasive species.

11.6.9 The Proposed Scheme also offers opportunities for creation and enhancement of habitats. There are opportunities to restore, reconnect and to 're-naturalise' terrestrial and aquatic habitat, the value of which may be limited by existing modification. Both the landscape and drainage designs of the Proposed Scheme will be influenced by ecological opportunities, for example, through creation of more natural watercourses. Ensuring that the landscaping and habitat creation associated with the Proposed Scheme has a nature conservation legacy is reflected in the Environmental Design Aims.

Operational effects

11.6.10 Potential operational activities that could give rise to ecological effects include:

- barrier effects (to movement of fauna);
- mortality from collision;
- noise and visual disturbance;
- disturbance from lighting;
- accidental pollution; and
- introduction and spread of non-native invasive species.

Cumulative effects

11.6.11 Cumulative effects are those that result from a combination of a number of individual effects. In the context of the ecological assessment of the Proposed Scheme, these will include:

- the combined ecological effect on a single receptor of a number of individual environmental impacts, e.g. area of land required and noise and airborne dust, arising from the Proposed Scheme;
- the cumulative effects of localised ecological impacts along the length of the railway, for example the potential of cumulative loss of certain habitat types; and
- interaction between ecological effects arising from the Proposed Scheme and those from other relevant projects (including Phase One) and plans (both on single receptors and along the length of the route of the Proposed Scheme).

Significance of effects and monitoring

11.6.12 Details of the process for determining significance of effects are provided within the ecological assessment method Technical Note as referenced in Annex A.

11.6.13 In the event that any significant residual impacts remain, procedures for monitoring those significant effects will be developed, as appropriate, as part of the overall monitoring approach.

11.7 Assumptions

11.7.1 The ecology and biodiversity section of the formal EIA Report will include a section to explain any assumptions made in undertaking the ecological assessment.

11.7.2 It is recognised that, within certain areas, access for ecology and biodiversity surveys will be restricted (e.g. limited to PRoW only) or will be denied. Surveys will, therefore, necessarily be constrained to those areas where landowner access is granted.

12 Electromagnetic interference

12.1 Introduction

12.1.1 This section of the SMR covers the impacts and effects of the Proposed Scheme on Electromagnetic Fields (EMF), and Electromagnetic Interference (EMI), including Electro Magnetic Compatibility (EMC). EMF is produced whenever electricity is present.

12.1.2 EMI is disturbance that affects an electrical system due to magnetic and electric fields, electromagnetic induction or electromagnetic radiation emitted from an external source.

12.1.3 EMC is the ability of equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbance to other equipment in that environment.

12.1.4 The principal source of EMF from the Proposed Scheme that may have an effect on third parties will be the traction power supply system. Emissions from the signalling and communication systems, electrical and mechanical systems, generally only affect the internal railway operating system. In addition, equipment located within the infrastructure maintenance depot do not produce levels of EMF that will have an effect outside the operational railway.

12.1.5 The Proposed Scheme (and particularly its nature as an electrified railway) is not unique, hence, there exists data from HS1 for example, that can be used to illustrate the minimal effects of EMI to the environment.

12.1.6 EMI is an issue that can normally be mitigated though the application of EMC industry accepted practice during design and installation.

12.1.7 EMF limits are specified in the EU Directive 2013/35/EU Electromagnetic Fields (EMF) limits, published in 2013 and enforceable in the UK from July 2016.

12.1.8 EMF exposure to workers and the general public will be addressed as part of this assessment.

12.1.9 Many of the effects caused by EMI will be eliminated or reduced to acceptable standards during the design and installation period of the Proposed Scheme. Designs for the Proposed Scheme are covered by British, European Standards and industry accepted practice.

12.2 Establishment of baseline and definition of survey

12.2.1 A description of the baseline environment for the 2013 consultation scheme is contained within Section 5 of the Sustainability Statement (main report). Further information was provided in the Phase Two post-consultation Sustainability Report – post consultation update, West Midlands to Crewe, Section 4.

12.2.2 In constructing and operating the Proposed Scheme, there will be key interface issues that require evaluation and management. A definitive list of interfaces will be established as part of the initial survey scope. The new infrastructure will have an

impact on and be impacted upon by its surroundings, which will differ throughout the length of the route of the Proposed Scheme.

12.2.3 Where the Proposed Scheme is adjacent to an existing railway corridor, there will be a significant interface with the existing railway networks. Although the existing infrastructure may have systems and procedures to mitigate the effects of EMI, it is possible that the introduction of the Proposed Scheme's infrastructure may have an adverse effect on the existing railway infrastructure. Similarly, the existing railway infrastructure may have an effect on the Proposed Scheme (both infrastructure and rolling stock).

12.2.4 British and European Standards exist to mitigate the effects of EMI on neighbouring railways. These standards will be adopted through design, installation, operation and maintenance best practice. HS2 Ltd will consult with other infrastructure owners during the design period.

12.2.5 For areas not adjacent to an existing railway, the Proposed Scheme's infrastructure is likely to have a greater impact on its surroundings. It is therefore important to identify any key areas along the route where EMI could be an issue. These may include residential and business premises, hospitals and light industrial areas, telephone and communication systems.

12.2.6 EMI from the Proposed Scheme's rolling stock will only affect the operational railway. A desk top assessment will be undertaken to identify potential receptors at risk which are external to the operational railway. Examples of potentially sensitive sites that may be at risk and are to be considered are:

- universities;
- schools;
- hospitals;
- military establishments;
- airports;
- emergency and commercial radio stations;
- residential properties; and
- industrial properties.

12.2.7 These sites have been chosen in relation to their potential to host electrical equipment and the likely sensitivity of this equipment, as described in BS EN61000-6-2:2005, BS EN61000-6-1:2007, Ministry of Defence Standard 54-411:2007, BS EN60601-1-2:2015 and BS EN50121:2015.

12.3 Consultation and engagement

Consultation on the Sustainability Statement

12.3.1 Electromagnetic interference was not considered as part of the Sustainability Statement in relation to the 2013 consultation scheme or in the Phase Two post-consultation Sustainability Report.

Consultation on the draft SMR

12.3.2 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for electromagnetic interference.

Engagement as part of the EIA process

12.3.3 In producing the hazard log a list of interested parties will be developed including:

- Network Rail;
- Transport for London;
- electricity supply authorities;
- electricity distribution companies;
- data and telecommunication companies;
- local authorities;
- hospitals; and
- airports.

12.4 Key aspects of the Proposed Scheme for the topic

12.4.1 The following are potential sources of EMI:

- temporary sources: direct effects could be caused by construction from significant activities such as tunnelling, as a result of the use of electrical machinery, such as pumps, generators and compressors. Tunnel boring machines utilise high voltage electricity supplies. These activities will be supported from local work compounds close to the structure/tunnel being constructed, local worksites, or larger construction compounds where equipment may be used; and
- permanent sources: direct effects could be caused by the operational railway and its supporting systems (e.g. overhead line equipment (OLE) and traction distribution, infrastructure maintenance depots, ventilation shafts and other line side equipment, traction depots and rolling stock, both existing and proposed).

12.4.2 The main source of EMF will be the traction power system, as electromagnetic emissions are caused by the current flowing in an electrical system.

12.4.3 The higher currents found in high voltage power lines have the potential to create larger EMF, the strength of which diminish rapidly with distance from the source.

12.5 Scope of assessment

12.5.1 A desk study will be undertaken to identify potential sources of EMF and EMI that may be produced during both the construction and operational phases of the Proposed Scheme. This will identify the potential risk and the potential impact and effect. The desk-based study will also identify establishments where people are potentially at risk

from the EMF produced by the Proposed Scheme's 25 kilovolts (kV) electrification traction power.

12.5.2 The study will identify potentially sensitive receptor sites within a 50m corridor either side of the centreline of the nearest track within the Proposed Scheme, or from proposed power equipment (e.g. overhead lines and traction substations)

12.5.3 Once each receptor site has been identified, a risk assessment will be undertaken to categorise the perceived level of risk and to identify the potential mitigation for each receptor site.

12.5.4 A risk assessment will be undertaken to assess the impact of EMF effects on nearby equipment, installations and people.

12.5.5 The assessment will use data from the preliminary traction power modelling completed by HS2 Ltd, in undertaking the evaluation.

12.6 Assessment methodology

Legislation and guidance

12.6.1 The following standards are relevant:

- EU Directive 2013/35/EU Electromagnetic Fields (EMF) limits;
- The Electromagnetic Compatibility Directive 2014/30/EU;
- BS EN 61000-6-1:2007. Electromagnetic compatibility Part 6.1: Generic standards- immunity for residential, commercial and light industrial environments;
- BS EN 61000-6-2:2005. Electromagnetic compatibility Part 6.2: Generic standards- immunity for industrial environments;
- BS EN 50499:2008. Procedure for the assessment of the exposure of workers to electromagnetic fields;
- EC Recommendation 1999/519/EC on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz);
- EU Directive 2006/42/EC on machinery;
- BS EN 50121 series of standards, Railway Applications, Electromagnetic Compatibility, which contains the following parts:
  - BS EN 50121-1:2015 Part 1: General;
  - BS EN 50121-2:2015 Part 2: Emissions of the whole railway system to the outside world;
  - BS EN 50121-3-1:2015 Part 3-1: Rolling stock - train and complete vehicle;
  - BS EN 50121-3-2:2015 Part 3-2: Rolling stock – apparatus;
  - BS EN 50121-4:2015 Part 4: Emissions and immunity of the signalling and telecommunications apparatus; and

- BS EN 50121-5:2015 Part 5: Emissions and immunity of fixed power supply installations and apparatus.

- BS EN 50122 series of standards, Railway Applications - Fixed installations - Electrical safety, earthing and the return circuit, which consists of:
  - BS EN 50122-1:2011 Part 1: Protective provisions against electric shock;
  - BS EN 50122-2:2010 Part 2: Provisions against the effects of stray currents caused by d.c. traction systems; and
  - BS EN 50122-3:2010 Part 3: Mutual Interaction of a.c. and d.c. traction systems.

Significance criteria

EMC Zones

12.6.2 Using the estimated levels of generated EMF from the preliminary traction power modelling results, the levels of predicted EMF will be assessed against the maximum levels mandated by British and European Standards.

12.6.3 For the effects of EMF on human health, any level above 1,000 microTesla (μT) as stated within EU Directive 2013/35/EU will be considered as significant.

12.6.4 For the effects of EMI on susceptible electrical or electronic equipment, where the level exceeds 3 Amperes per metre (A/m) for residential and 30A/m for industrial equipment, this will be regarded as significant. These levels are the current limits identified in BS EN 61000-6-1 and BS EN 61000-6-2 respectively.

12.6.5 EM Zone 1: For equipment less than 10m from the centreline of the nearest track rails or from non-traction power equipment (i.e. cables transformers or switchgear). BS EN 50121-4:2015 (Signalling and Telecommunication Apparatus) and BS EN 50121-5:2015 (Fixed Power Supply Installations) will be applied in this zone. The emission and immunity levels are provided in the BS. BS EN 50121-4:2015 (Signalling and Telecommunication Apparatus) applies to any safety critical equipment located in this zone.

12.6.6 EM Zone 2: For equipment greater than 10m, but less than 20m from the centreline of the nearest track rails or from non-traction power equipment (i.e. cables, transformers or switchgear). BS EN 61000-6-2: 2005 (Generic standards - Immunity for industrial environments) and BS EN 61000-6-4 (Generic standard - Emissions for Industrial Environments), will be applied in this zone. The emission and immunity levels are given in the BSs. Any safety critical equipment located in this zone would also apply to these BSs.

12.6.7 EM Zone 3: For equipment greater than 20m from the centreline of the nearest track rails or non-traction power equipment (i.e. cables transformers or switchgear). BS EN 61000-6-1: 2007 (Generic standard - Immunity for residential, commercial and light industrial environments) and BS EN 61000-6-3: 2007 (Generic standards - Emissions for residential, commercial and light industrial environments), will be applied in this zone. The emission and immunity levels are given in these BSs.

12.6.8 For emissions affecting people outside the 20m zone, EU Directive 2013/35/EU Electromagnetic Fields (EMF) limits will be followed.

12.6.9 Where risk is identified, proposals for mitigation will be recommended.

12.6.10 In creating the hazard log, the impact and risk levels will be established thereby identifying key areas for assessment. At some point before energisation, baseline measurements will be taken to confirm the EMI background levels of the existing environment.

Construction effects

12.6.11 The effects of construction will be evaluated and mitigation measures implemented if required. Ongoing measurements and monitoring will be considered during construction, where significant risks are identified.

Operational effects

12.6.12 The effects of operation will be evaluated and mitigation measures implemented if required.

Cumulative effects

12.6.13 Any cumulative effect due to the Proposed Scheme running close to an existing electrified railway, for example, will be included in the assessment.

12.6.14 The traction power modelling, the results from which the assessment will be made, will be developed using the worst case traction loads for the proposed timetable. Any effects of EMF and EMI will therefore be considered using the worst case loads.

12.7 Assumptions

12.7.1 The following assumptions are made:

- no site visits will be conducted, rather a desk-based study will be undertaken;
- no modelling or detailed calculations will be undertaken;
- where information is not available, professional judgement will be used to reach a conclusion. It may be possible, subject to review, to use information from other recent and similar railway construction projects such as HS1;
- the compilation of information from which to assess the baseline measurements will be dependent on the availability of recorded information; and
- in accordance with good safety management principles, it is assumed that risks due to EMI will be reduced using the 'as low as reasonably practicable' (ALARP) principle.

13 Health

13.1 Introduction

13.1.1 This section of the SMR describes the health assessment process including baseline data gathering and community profiling, stakeholder engagement, assessment and mitigation of potential negative health effects.

13.1.2 When considering the health effects of development projects, health is viewed in a broad sense, encompassing physical and mental wellbeing/quality of life, as determined by a wide range of environmental, social and economic determinants. This broader understanding of health is captured in the World Health Organization (WHO) definition: *"Health is a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity"*[181]. Health effects will be assessed at community level, through the consideration of exposure to the environmental and socio-economic impacts of the Proposed Scheme and evaluation of the potential for these impacts to affect health. In addition, the assessment will highlight potential impacts on specific groups of receptors such as users of facilities that may be impacted by the Proposed Scheme, or vulnerable groups within the community.

13.1.3 Health assessment is a multi-disciplinary activity that cuts across the boundaries of health, public health, social sciences and environmental sciences. The potential health effects of the Proposed Scheme will be assessed alongside environmental effects through an integrated process. Impacts and effects on human health and population directly arising from the Proposed Scheme if it were to be affected by a major accident or natural disaster are considered in Section 16, major accidents and natural disasters.

13.1.4 The objectives of the assessment are to:

- describe how the Proposed Scheme has the potential to impact (directly and indirectly) on the factors that influence health and wellbeing (termed 'health determinants');
- identify the likely extent and intensity of exposure to impacts on health determinants;
- qualitatively or quantitatively assess the potential community health effects arising from these impacts;
- identify those sections of the population likely to be most affected, either positively or negatively, by impacts on health determinants; and
- identify measures to enhance the positive and mitigate the negative effects on community health and wellbeing.

[181] World Health Organisation, 1948: Constitution of the World Health Organisation Basic Documents, 45th edition supplement. Available online at: www.who.int/governance/eb/who_constitution_en.pdf

13.2 Establishment of baseline

Baseline data and community profiling

13.2.1 Baseline data will be collected from a variety of sources and will be used to construct a community health profile, providing an overview of the prevailing socio-economic status of the existing population, and an indication of levels of health and wellbeing. The analysis of data will focus on identifying vulnerable sub-groups that may be particularly sensitive to particular health and wellbeing effects. Reference will also be made to environmental baseline information collated by other topics, including environmental characteristics (e.g. noise, air quality and landscape character), and the presence of key features and resources used by the community.

13.2.2 The process of gathering baseline data will be undertaken in collaboration with related assessment topics including community and socio-economics. The principal sources of data will include:

- national datasets such as those from the Office of National Statistics, Local Authorities, Public Health Observatories, Public Health England (PHE), Sport England (Active People Survey), Joint Strategic Needs Assessment, and other sources;
- local public health reports;
- information from local strategies and policies relating to health and wellbeing;
- data obtained through consultation with public health authorities;
- feedback received through joint public consultations; and
- outputs from the EIA baseline assessment (e.g. sound noise and vibration, air quality and landscape and visual baselines).

13.2.3 Over the timescale of the Proposed Scheme's delivery, the profile and situation of affected communities will change, influenced by wider economic and policy change as well as demographic trends. Where data and forecasts are available, the likely future community profile will be considered.

13.3 Consultation and engagement

Stakeholder engagement

13.3.1 Stakeholder feedback will be sought in order to further understand the specific characteristics, concerns and perceptions of local communities that may not be picked up through a review of publicly available data. This will enable the susceptibility of communities to health and wellbeing effects to be more fully understood.

Consultation on the Sustainability Statement

13.3.2 The following issues (Table 22) were raised by PHE in response to the consultation on the Sustainability Statement.

Table 22 - Consultation responses from PHE

PHE issue raised	How issue is addressed through the health assessment
Health assessment	
PHE would welcome the opportunity to be consulted on the scope of the Health assessment.	PHE will be a key stakeholder to be consulted on health issues during the EIA process, see 13.3.6 below.
Widening the scope to include the health of the workforce in both constructing and operating HS2. This goes beyond health and safety responsibilities and recognises the importance of the workplace in improving health and wellbeing.	Accommodation and welfare facilities for the construction workforce are identified as a key aspect of the Proposed Scheme for the health assessment. Occupational health for operational workers will be addressed as part of HS2's operational management procedures.
Access to green spaces and physical activity should be considered as two separate, albeit interlinked, issues.	This is reflected in the health determinants set out in this SMR.
The health impact of climate change (e.g. flood risk) should be included.	Where appropriate, the potential for climate change to affect the nature and intensity of health effects resulting from the Proposed Scheme will be considered.
An up-to-date and systematic search for relevant health studies should be described in the Health assessment i.e. search terms, time period. This strategy should then be implemented for reference during the Health assessment. In relation to this issue, the scope of case studies of High Speed Rail projects should be broadened to include those beyond English-speaking countries.	See Section 13.6.6. The literature review undertaken for the Phase One Health impact assessment will be updated to take account of the latest available information.
Impacts on Rights of Way and Country Parks	
To promote physical activity and active travel it is essential that cycle routes are maintained through diversion or re-instatement as necessary.	This issue will be addressed in the health assessment under the 'physical activity' determinant.
Wider economic issues	
It is important that account is taken of deadweight, leakage, displacement, substitution and economic multipliers, as well as the geographic and social distributional impact of these issues. This will enable potential positive impacts on health inequalities to be maximised while adverse impacts can be minimised and mitigated against.	This issue will be addressed through the socio-economic assessment. The health effects associated with this will be assessed under the 'education, employment and income' determinant.

Consultation on the draft SMR

13.3.3 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for health.

Engagement as part of the EIA process

13.3.4 The integrated approach to health and environmental assessment includes an emphasis on integrated stakeholder engagement. Information obtained through stakeholder engagement will help to inform the health assessment. Engagement on

health issues will form part of the wider EIA consultation process and health considerations will be a key element of community engagement activities.

13.3.5 In conjunction with the wider consultation process, further engagement with relevant organisations and communities will be carried out. This will be undertaken on a community specific, and route wide basis.

13.3.6 Key health sector stakeholders will include PHE, Public Health Directors and representatives of mental health trusts and local authority health and wellbeing boards.

13.3.7 Local and regional health stakeholders will be identified through contact with parish councils and local authorities. Relevant organisations and special interest groups may be identified via national, regional and local databases, websites and other sources. Engagement will focus on groups that are well-positioned to provide information relating to the affected communities and identified information gaps.

13.3.8 Vulnerable groups in the population will be identified through consultation with local stakeholders and community representatives.

13.3.9 In line with HS2 EDI Policy, consultation and engagement will be accessible and inclusive in approach. This will involve planning and implementing measures to reduce and remove both spatial and non-physical barriers to involvement in the consultation and engagement processes.

13.4 Key aspects of the Proposed Scheme for the topic

13.4.1 The assessment of health effects will consider impacts on health determinants during the construction and operation of the Proposed Scheme. Due to the broad range of issues affecting health and wellbeing, the health assessment will consider the potential impacts of all aspects of the Proposed Scheme. The following aspects are likely to be particularly relevant to the health assessment:

- land required temporarily or permanently, including loss of residential and commercial property, public open space, PRoW, land or property used for sport/leisure, community, cultural and faith uses;
- impacts on residential properties;
- construction aspects:
  - site clearance and demolition activities;
  - earthworks and site preparation;
  - construction activities;
  - location and management of construction compounds;
  - construction traffic, including HGVs;
  - mitigation, including air, noise and vibration control measures, visual screening and traffic management;
  - employment generation; and

- accommodation and welfare for construction staff[182].

- permanent aspects:
  - passing trains (causing noise and visual effects);
  - presence of physical structures (affecting local views and/or causing severance);
  - electromagnetic interference;
  - severance or re-routing of local roads and PRoW;
  - direct and indirect employment and regeneration effects; and
  - direct and indirect impacts on community facilities and resources.

13.5 Scope of assessment

Spatial scope

13.5.1 The health and wellbeing effects of the Proposed Scheme will be considered at community and route-wide level.

13.5.2 The community level assessment of health and wellbeing effects will be aligned with the study areas for related EIA topics, where relevant. The study areas for each EIA topic will be defined according to the individual assessment methodologies and protocols. However, as far as possible, the study areas will be consistent to enable an assessment of the combined effects of different environmental and social impacts on communities.

Temporal scope

13.5.3 The temporal scope is outlined in Section 4.2 (Scope of the assessment) of this SMR. Health impacts during the pre-construction period, the construction and commissioning period (2020 – 2026) and operational period (post-2027) will be considered.

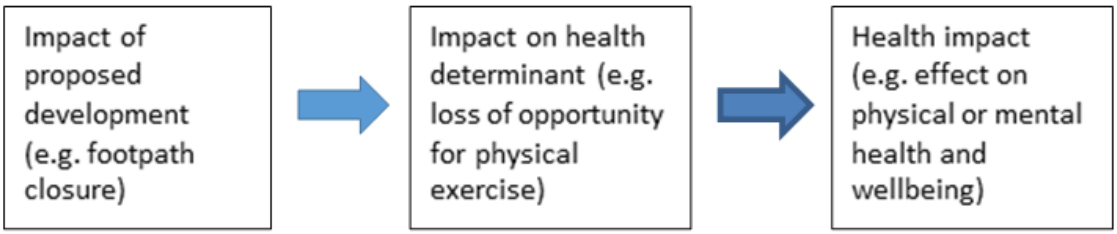
Technical scope

Health pathways and potential effects

13.5.4 Health effects may arise when a proposed development impacts upon factors known as 'health determinants', which have an influence on health and wellbeing. A 'health pathway' (Figure 12) is the series of links or stages between an aspect of a proposed development, its ability to change or influence a health determinant, a community's exposure to change(s) in a health determinant(s) and the generation of a health effect.

[182] Occupational health and safety assessments for the workforce are separate to HIA which is for the community, but where there are overlaps they will be included in the HIA

Figure 12 - Health pathways



13.5.5 Health effects may be defined as changes in the levels of the following public health outcomes:

- communicable diseases;
- non-communicable diseases;
- nutritional disorders;
- injuries; and
- mental health and wellbeing.

Scope of health assessment

13.5.6 Key health pathways arising from the planning, construction and operation of the Proposed Scheme, leading to potential health effects, may include:

- changes in employment opportunities during construction and operation – both positive and negative;
- displacement of occupants from residential and commercial properties, with impacts on housing and jobs;
- impacts on green space, affecting opportunities for physical activity and contact with nature;
- impacts on, or loss of, community facilities;
- impacts of exposure to noise and air emissions during construction and operation;
- visual impacts resulting in changes to the character of the local environment;
- temporary or permanent severance and/or diversion of public transport routes, and active travel routes such as footpaths and cycleways;
- congestion on local roads during construction; and
- presence of a large construction workforce (particularly important in less populated rural areas).

13.5.7 Based on the health pathways described above, the following health determinants have been identified for inclusion in the assessment:

- education, employment and income;
- transport – including traveller stress and road safety;

- housing;
- social capital;
- noise and vibration;
- air quality;
- neighbourhood quality – including greenspace and contact with nature, landscape and visual, crime and safety;
- opportunities for physical activity; and
- access to services, health and social care.

In combination effects

13.5.8 The combined effects of the Proposed Scheme on community receptors will be considered. Such effects may arise where a number of impacts on different health determinants are experienced together. The combined impacts will be qualitatively assessed, in conjunction with the community assessment, drawing on the conclusions from other assessment topics in order to identify potential wellbeing effects at community level.

13.6 Assessment methodology

Legislation

13.6.1 The health assessment methodology has been developed in accordance with the amended EIA Directive 2014 (2014/52/EU) regarding the assessment of the effects of certain public and private projects on the environment. This requires that EIA should 'identify, describe and assess' the effects of a project on 'population and human health'.

Guidance

13.6.2 There is no definitive guidance or methodology for assessing the health effects of projects. Furthermore, at the time of writing this methodology, no guidance exists on how to incorporate health into EIA as required by the 2014 amended EIA Directive. There are, however, numerous well established 'toolkits' and guides available, such as:

- Department of Health, 2010: Transport and Health Guidance;
- National MWIA Collaborative 2011: Mental Wellbeing Impact Assessment Toolkit;
- Health Scotland et al, 2007: Health Impact Assessment for Transport: A Guide;
- London Health Observatory, 2006: A Guide to Reviewing Published Evidence for use in Health Impact Assessment;
- Institute of Public Health in Ireland, 2005: Health Impacts of Transport; and
- NHS London Healthy Urban Development Unit (HUDU), 2015. Healthy Urban Planning Checklist and Rapid Health Impact Assessment Tool.

13.6.3 The proposed scope and methodology as set out in this SMR takes account of the above guidance documents, as well as recent good practice and feedback from the Phase One assessment. The assessment will be undertaken as an iterative process whereby information from the initial assessment and consultation is fed back to the design and wider EIA process.

Construction effects

13.6.4 Construction effects will be assessed following the health assessment process described below.

Operational effects

13.6.5 Operational effects will be assessed following the health assessment process described below.

Evidence base

13.6.6 The literature review undertaken for the Phase One Health Impact Assessment[183] will be updated to take account of more recent information. Evidence of health effects from other major infrastructure projects will be sought through consultation with local health authorities and other project proponents. However, previous investigations indicate that there has been no widespread monitoring of health effects associated with major infrastructure projects. International case studies from High Speed Rail projects will also be sought.

13.6.7 The literature review for Phase One identified evidence for links between health determinants and potential health outcomes. Evidence was drawn from published research, literature reviews and policy documents. The extent of available evidence varies between the different health determinants considered in the assessment. This ranges from concentration-response functions based on large bodies of research for which scientific consensus is established, to less well defined linkages drawn from a smaller number of studies where there is no clear consensus on the exact causal relationships between the health determinant and health outcomes.

13.6.8 The evidence obtained through the literature review will support the assessment of health effects. It should be noted that the strength of evidence is not proportional to the importance of a determinant and its potential effect on health and wellbeing.

Qualitative assessment criteria

13.6.9 The assessment of health effects will be based on evidence from published research. Where there is sufficient information available, and it is judged to be appropriate to do so, the health effects of the Proposed Scheme will be quantitatively assessed. However, many potential health effects cannot be quantified because there are currently no robust or scientifically widely agreed upon methods for quantifying them, or because the types of data required cannot realistically be obtained. Therefore it is anticipated that the assessment will be largely qualitative.

[183] High Speed Rail, London to West Midlands, Health Impact Assessment. DfT, November 2013

13.6.10 The assessment of health impacts will be based on a set of criteria informed by available, up to date guidance, and developed using professional judgement and precedent from other large scale Health Assessments. The starting point for determining assessment criteria for each health determinant will be the criteria used in the Phase One Health Assessment addendum (Euston Station and approach area)[184]. These assessment criteria will be reviewed during the process of consultation and development of detailed methodologies for the health assessment.

13.6.11 The assessment criteria for the Phase One Health Assessment addendum were as follows:

- description of change;
- exposure;
- strength of evidence;
- health inequalities and vulnerable groups; and
- perceived effects.

Description of change

13.6.12 The change to the health determinant is described, including commentary on the following factors:

- the aspect of the Proposed Scheme causing the change;
- a description of how the health determinant may change, including the direction of this change (beneficial or adverse); and
- the duration of change (operational effects are assumed to be permanent in most cases; construction effects may be short term if under six months, medium term if six months to two years, or long term if more than two years in duration).

Exposure

13.6.13 The degree of exposure of communities to changes in health determinants is assessed in terms of the 'extent' of exposure and 'intensity' of exposure, described as:

- the extent of exposure is judged to be low, medium or high depending on the number of people in the affected community likely to be exposed to the change in a health determinant;
- the intensity of exposure is judged to be low, medium or high. Factors such as the severity and duration of effect and/or the value of the affected resource will be taken into account when considering intensity; and
- the extent and intensity of exposure are applied where practical to do so. In some cases, such as issues that could potentially affect an unknown number of

[184] High Speed Rail, London to West Midlands, Health Impact Assessment addendum: Euston station and approach area. DfT, September 2015

individuals along the route as a whole, exposure may not be defined using the terms low/medium/high.

Strength of evidence

13.6.14 The evidence on which the link (or 'association') between a change in health determinant and a health effect is based will be described in the assessment as:

- anecdotal: based on the opinions or experiences of members of the public and other stakeholders consulted during the assessment process;
- weak: a few peer-reviewed research studies to suggest an association; or the studies show conflicting findings;
- moderate: a range of international (but not necessarily national) peer-reviewed research studies showing similar associations and strength of associations; the association is widely accepted by the public health community; and there may be debate about the specific causal factors, the mechanism of effect and/or the strength of association; and
- strong: a wide range of national and international peer-reviewed research studies showing similar associations and strengths of association. The association is widely accepted by the public health community and there is consensus on the specific causal factors, the mechanism of effect and the strength of association.

13.6.15 It should be noted that a lack of research studies or lack of consensus among the public health community does not necessarily mean that a link does not exist, but that there is currently uncertainty in the assessment of the likely effect.

Health inequalities and vulnerable groups

13.6.16 The assessment will consider the potential for an impact to exacerbate existing health inequalities on a community basis. The sensitivity of the population exposed to the change in health determinant will be considered in the assessment. This will be done qualitatively, based on the community profiling exercise and evidence base compiled for the health assessment, which will provide an indication of which groups are likely to be most affected, and their presence within the communities along the route.

13.6.17 'Vulnerable groups' are sections of the population that for certain reasons may be more likely to be exposed to a change in a health determinant, or more likely to experience health effects as a result of this exposure. Consideration of vulnerable groups will take into account:

- how a health determinant is shown (in scientific literature) to affect a particular section of the community;
- whether the affected community is already facing existing deprivation (social, economic or environmental) that could make them more vulnerable; and
- characteristics such as age, health conditions, or other physical or mental characteristics that make people more vulnerable to health effects.

13.6.18 The health assessment will evaluate potential inequalities in health impacts based on population characteristics, including for example age, health status, gender, disability, ethnicity, income and place (disadvantaged locations). The assessment will refer to the separate Equality Impact Assessment, as appropriate, to evaluate potential inequalities in health impact. In addition the Health assessment will explore the potential impacts on groups that are not covered by the protected characteristics under the Equalities Act 2010.

Perceived effects

13.6.19 Addressing perceived effects is important in reducing adverse effects on health, particularly mental wellbeing. Where there is known to be concern among the affected community about a potential health effect (based on consultation responses), this will be taken into account in the assessment.

13.6.20 These criteria will be used to inform qualitative judgements about potential health effects, in order to give an indication of the most important areas in which to focus recommendations for improving health outcomes.

Quantitative assessment

13.6.21 Where a quantitative assessment of health effects is undertaken, for example, for health and wellbeing effects associated with noise and air quality, this will be based on established assessment methodologies for these health determinants.

13.6.22 The likely extent and intensity of exposure to noise and air emissions will be reviewed at an early stage in the EIA process in order to determine whether quantitative health assessment is required. Professional judgement will be used to determine whether quantitative assessment methods are justified, based on the size of the exposed population and the level of exposure.

13.6.23 The proposed approaches for these topics are outlined below.

Quantifying the effects of noise and vibration on health and wellbeing

13.6.24 The following potential health effects may be included in the quantitative assessment of noise and vibration: annoyance, sleep disturbance, cardiovascular impacts and cognitive effects on school children.

13.6.25 Evidence suggests that chronic exposure to noise or vibration over a long period of time is an important factor influencing health and wellbeing. Therefore quantitative assessment of health effects will focus on operational railway noise. The effects of construction activities will be qualitatively assessed.

13.6.26 The spatial scope of the study area will be defined using the Lowest Observed Adverse Effect Levels[185] for noise from high speed railway lines, during the day and night. Account will also be taken of any unique features of the Proposed Scheme's sound or impacts in the area being considered. Exposure response relationships will then be used to quantify the number of people exposed to different levels of noise or vibration

[185] In line with the Noise Policy Statement for England - Department for the Environment, Food and Rural Affairs (Defra), 2010, Noise Policy Statement for England, Defra

from the Proposed Scheme. To provide context, the number of people exposed to different levels of noise or vibration from other sources of exposure to transport noise within the study area will be described. Significant Observed Adverse Effect Levels (SOAELs) will also be established where relevant in line with Government noise policy.

13.6.27 This information will be used to estimate the potential risk or scale of each health effect for each of the different sources of noise and to ensure that the mitigation strategy, within the context of Government policy on sustainable development, meets the aims of the government's noise policy, namely to: *"avoid significant adverse impacts on health and quality of life; mitigate and minimise adverse impacts on health and quality of life; and where possible, contribute to the improvement of health and quality of life."*

Quantifying the effects of air quality on health and wellbeing

13.6.28 For air quality related health effects of the Proposed Scheme, quantification is a possible option that could be used to support any conclusions. In circumstances where any air quality changes are obviously very small and/or the exposed population is also small, then the knowledge gained elsewhere with quantification would lead to a justifiable conclusion that the health effects are inconsequential. The findings from the air quality assessment will be reviewed to determine whether quantitative assessment of health effects is justified.

13.6.29 Evidence shows that long-term exposure to NO_2 and PM2.5 is associated with adverse health effects, which are defined in terms of premature mortality at population level. The techniques for quantifying these effects have been applied at the national level by the Committee on the Medical Effects of Air Pollutants (COMEAP) and also at local authority level by PHE, for example. These approaches can be adapted to quantify the effect that a change in NO_2 or PM2.5 resulting from a development proposal is likely to have on health outcomes. This requires:

- knowledge of a reliable 'concentration response function' (as recommended by the World Health Organization, for example);
- knowledge of the baseline rates of certain health outcomes in the population, e.g. mortality;
- air quality dispersion modelling output, defining the change in exposure of PM2.5, PM10 or NO_2 at all locations; and
- the population numbers within the affected area.

Cumulative effects

13.6.30 As outlined in Section 4.4 (Cumulative effects) of this SMR, the assessment will consider the interaction between the Proposed Scheme, Phase One and other consented or completed developments which may give rise to significant cumulative effects.

13.6.31 The health effects identified in the assessment will be considered in the context of the potential effects of future climate change. The potential for the combined impacts of the Proposed Scheme and climate change to increase the intensity of health effects will be considered.

13.6.32 Interactive effects between the different EIA topics will also be assessed.

13.7 Mitigation

13.7.1 During the assessment process, recommendations to address the negative effects and maximise the positive effects on health will be fed back to other EIA topics and the design team.

13.7.2 It is anticipated that the majority of potential design based interventions for health improvement will be incorporated through the scheme design and wider EIA process, for example, route design to avoid (where reasonably practicable) residential properties and other sensitive receptors, vertical alignment, incorporation of bunds and other measures to minimise the noise and visual effects of the alignment. This embedded mitigation will form part of the Proposed Scheme assessed in the EIA. Other, non-design related mitigation measures may be made in relation to the construction process and ongoing management and delivery of the Proposed Scheme. These will be incorporated into the CoCP and other HS2 strategies and policies as appropriate.

13.7.3 Local and central government strategies, programmes and frameworks aimed at enhancing health and wellbeing will be reviewed, and opportunities for the Proposed Scheme to align with these programmes will be identified where practicable. Initiatives which HS2 Ltd is already pursuing, for example, in relation to community outreach, education and training will also be reviewed in relation to the scope of the health assessment and the potential for positive health outcomes.

13.7.4 The proposed means of incorporating health recommendations into the Proposed Scheme will be described. This may comprise the inclusion of specific measures within documents such as the CoCP or Environmental Minimum Requirements.

13.8 Assumptions and limitations

13.8.1 For assessment purposes it will be necessary to assume that the baseline characteristics established during the health assessment process will remain largely unchanged, as mentioned in Section 13.2. However, where it is possible to predict change this will be incorporated into the future baseline.

13.8.2 The community profiles will be limited by the extent of publicly available data and data obtained through consultation and engagement with communities.

13.8.3 The assessment will be supported by a review of published research, using the most up to date and credible sources. The strength of evidence is in some cases well supported by research evidence and in other cases weak or non-existent. Consequently, professional judgement will be necessary concerning the likely way in which potential health impacts may occur.

14 Land quality

14.1 Introduction

14.1.1 This section of the SMR covers land quality which includes the environmental topic areas of land contamination, mineral resources and geology, which was considered within the Sustainability Statement and the Phase Two post-consultation Sustainability Report within the wider topic of 'Land use resources'.

Land contamination

14.1.2 Land and groundwater along the route of the Proposed Scheme may have become contaminated through previous industrial or agricultural potentially contaminative usage. Such land or groundwater could adversely affect people and the wider environment (including effects on groundwater quality, surface water quality and ecology and biodiversity). Contamination may be in topsoils, subsoil, deeper geology, groundwater or as ground gases. Construction of the Proposed Scheme will require excavation of the ground in earthworks, cut and cover and bored tunnelling, deep foundations, borings, temporary and permanent dewatering and other construction activities. Where the route crosses or lies close to existing sources of contamination, these activities could result in the disturbance of the contamination, which would need to be assessed and mitigated.

14.1.3 The land quality section of the formal EIA Report will present the findings of the assessment identifying significant areas of contamination along the route of the Proposed Scheme, and where appropriate, present a range of mitigation measures that will need to be considered in order to remediate significant areas of contamination. It will also present a review of measures to mitigate land contamination arising from the construction and operational stages of the project.

14.1.4 Contaminated land or groundwater which is already present at a site may already be causing environmental impairment. The purpose of the land quality assessment is to ensure that construction and operation of the Proposed Scheme manages existing contamination pre-dating the project and does not introduce new sources or pathways by which contamination can spread; and where there is a significant risk of this happening, to consider mitigation measures to avoid this. HS2 Ltd will be responsible for dealing with contamination on land it acquires.

14.1.5 The land quality section will have significant interaction with the water resources and flood risk, waste and material resources, health and major accidents and natural disasters sections of the formal EIA Report.

Geological and mineral features

14.1.6 Along the route of the Proposed Scheme there may also be areas of land that have special geological significance, either from a scientific, or mineral resources point of view, such as:

- geological SSSI or Local Geological Sites (LGS);
- areas of designated mineral resources, such as Mineral Preferred Areas (MPA), Mineral Safeguarding Areas (MSA) and Mineral Consultation Areas (MCA); and

- areas of currently permitted mineral extraction, which may be compromised or sterilised by the construction and operation of the Proposed Scheme.

14.2 Establishment of baseline and definition of survey

14.2.1 The method for determining the baseline conditions will involve access to a combination of the following:

- data collected for the Sustainability Statement;
- analysis of the results of previous investigations carried out in the immediate area of the Proposed Scheme;
- historical Ordnance Survey mapping;
- published geological and hydrogeological mapping/information;
- data held by local authorities, including the adopted Mineral Plans;
- route wide site inspections, including depot areas, where access is available;
- Foot and Mouth Disease (FMD) burials data; and
- other publicly available environmental data.

14.2.2 Documentary data are available from a number of governmental and non-governmental organisations including:

- Environment Agency;
- water companies;
- British Geological Survey;
- The Coal Authority;
- The Ministry of Defence (MoD);
- The Crown Estate;
- mining and quarrying companies; and
- county councils and district councils.

14.2.3 Much of the data is also held on commercial environmental databases. Site inspections at key sites will be used to supplement the documentary study data obtained.

14.2.4 Generally, a zone extending to 250m either side of the boundary of the land required for the construction of the Proposed Scheme including land required for construction of depots, construction/storage sites and other land required for the works will be reviewed. The extent of this zone has been developed using professional judgement on the basis that contamination migration beyond this distance is likely to be minimal or could be mitigated. This principle has been applied in assessing previous railway projects such as Crossrail and was used in the Phase One assessment. The 250m zone may be widened where evidence suggests that it is required. Groundwater resources

over a much larger area will be considered for the water resources study and will be available for assessment of groundwater contamination effects.

14.2.5 A risk based approach in accordance with Defra and the Environment Agency guidance will be taken to assessing contamination which may have a significant effect upon the construction and operation of the Proposed Scheme, or upon the wider environment as a consequence of the Proposed Scheme. Following a review of desk study data, the Sustainability Statement and site inspections, where the identified past uses of land indicate a high risk of previous significant contamination and potential risk to receptors, intrusive investigations may be carried out (where practicable). These will be undertaken at the same time as geotechnical investigations, following completion of the formal EIA Report and prior to construction works commencing on site and subsequently, in order to provide additional data on which risks and impacts can be assessed. Such investigations would be carried out based upon the Model Procedures for the Management of Land Contamination: Contaminated Land Report 11[187] and BS10175: 2011[188] and based on a developed conceptual site model (see Section 15.6).

14.2.6 With regards to sites of geological interest, information will be obtained from Natural England, the British Geological Survey, The Coal Authority and from local authorities (usually county councils) who hold information on such sites.

14.3 Consultation and engagement

Consultation on the Sustainability Statement

14.3.1 During the consultation on the Sustainability Statement, both the Environment Agency and local authorities were consulted, and a number of responses related to land quality were received. These comments have been addressed in this SMR.

Consultation on the draft SMR

14.3.2 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

Engagement as part of the EIA process

14.3.3 During the preparation of the EIA, wider and more comprehensive consultation on land quality will be undertaken with the following organisations:

- Environment Agency;
- The Canal & River Trust;
- Natural England (if 'geological SSSI' are affected);

[187] Defra and the Environment Agency, 2004, Model Procedures for the Management of Land Contamination: Contaminated Land Report 11, Environment Agency
[188] British Standards Institute (BSi), 2011, BS10175 Investigation of potentially contaminated sites. Code of practice, BSi

- GeoConservation UK and Geology Trusts;
- British Geological Survey;
- Network Rail;
- landfill and mineral abstraction companies;
- The Coal Authority;
- Health and Safety Executive;
- mining and quarrying companies and mineral owners;
- local authorities (primarily Environmental Health Officers, Petroleum Officers/Fire Brigade and Contaminated Land Officers);
- county councils; and
- water companies.

14.4 Key aspects of the Proposed Scheme for the topic

14.4.1 Impacts from disturbance to contaminated land will principally arise where the works break such ground during the construction phase (e.g. construction of portals, or ventilation shafts) or where the ground is disturbed (e.g. through removal of existing structures). Contaminated land and groundwater may be present as a result of historical activities at a particular location or as a result of current land uses.

14.4.2 The urban areas along the route are areas where existing contamination is likely to be most prevalent. There may also be significant areas of contamination resulting from historical mining or landfilling land uses at a number of locations along the route of the Proposed Scheme, particularly in rural areas.

14.4.3 In the rural areas, there may be localised industries, old and existing landfill sites, old sewage farms, mining dereliction and other issues that need to be assessed with respect to contaminative effects.

14.4.4 The impairment or destruction of geological sites of interest would be considered an adverse impact. Although new exposures of rock and soil may be created by the Proposed Scheme (e.g. within new cuttings) they would not necessarily be accessible to the public.

14.4.5 The sterilisation of minerals by the Proposed Scheme would be considered an adverse impact for which mitigation measures will be proposed.

14.5 Scope of assessment

14.5.1 The EIA will assess the likelihood of existing contamination being encountered during the construction process, such that it could cause significant environmental or health effects if not addressed adequately at the construction and/or operational stages. The construction of the railway will entail bringing materials onto site (such as fuel) which if spilt or leaked could result in land or groundwater contamination. Impairment and sterilisation of geological and mineral resources will likewise be addressed.

14.5.2 Although the maintenance of the railway once it is operational will be required to be in compliance with appropriate environmental legislation in order to mitigate land, surface water or groundwater contamination, the major operational sources of contamination will be reviewed and appropriate mitigation measures proposed. In addition, during the operational period, monitoring works (such as for groundwater and gas) may continue in order to demonstrate the effectiveness of any remedial works, or as part of a strategy of any agreed Monitored Natural Attenuation (MNA).

14.6 Assessment methodology

Legislation

14.6.1 Part 2A of the Environmental Protection Act 1990 (as amended)[189] provides a statutory definition of contaminated land: *"Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that significant harm is being caused or there is a significant possibility of such harm being caused; or pollution of controlled waters is being, or is likely to be caused."*

Guidance

14.6.2 In the guidance[190] that accompanies the Environmental Protection Act 1990, there is advice on what constitutes significant harm and what constitutes a significant possibility. The following reports provide further guidance on the risk assessment process, and introduce the Contaminated Land Exposure Assessment (CLEA) model:

- Model Procedures for the Management of Land Contamination: Contaminated Land Report 11 (Defra and the Environment Agency);
- Guidance on the legal definition of contaminated land[191];
- Human Health Toxicological Assessment of Contaminants in Soil[192];
- Updated Technical Background to the CLEA Model[193]; and
- Guiding Principles on Land Contamination[194].

14.6.3 The impacts associated with contaminated land are generally assessed by means of a source/hazard-pathway-receptor methodology in accordance with Model Procedures for the Management of Land Contamination: Contaminated Land Report 11 and BS10175: 2011, where the following definitions apply:

- source: contamination that has the potential to cause adverse impacts to a receptor. It may comprise chemical, biological or physical agents. It does not include naturally occurring contaminants;

[189] HM Government, 1990, Environmental Protection Act 1990, The Stationery Office
[190] HM Government, 2012, Environmental Protection Act 1990, Part 2A: Contaminated Land Statutory Guidance, The Stationery Office
[191] Department of Environment, Food and Rural Affairs (Defra), 2008, Guidance on the legal definition of contaminated land, Defra
[192] Environment Agency, 2008, Science Report – SC050021/SR2 - Human Health Toxicological Assessment of Contaminants in Soil, Environment Agency
[193] Environment Agency, 2008, Science Report – SC050021/SR3 - Updated Technical Background to the CLEA Model, Environment Agency
[194] Environment Agency, 2010, Guiding Principles on Land Contamination, Environment Agency

- receptor: a target that may be affected by contamination; examples include human occupants or users of the site, water resources or structures; and
- pathway: a route whereby a hazardous substance may come into contact with the receptor; examples include ingestion of contaminated soil and leaching of contaminants from soil into water resources.

Significance criteria

14.6.4 The previously described approach forms the basis of the methodology to be used in the assessment of land quality. For contamination to present a significant potential effect, the likelihood must be demonstrated that there is an identifiable source of contamination (be it an onsite or off site source), potential sensitive receptors and potential pathways through which the former may affect the latter (a contaminant linkage).

14.6.5 The sensitivity of potential receptors can be described qualitatively according to the categories shown in Table 23 - 25. However, the distance criteria quoted may be reduced if pathways between source and receptor are weak (for example, where underlying ground is impermeable to groundwater flow, the groundwater migration pathway can be negligible).

Table 23 - Criteria for assessing receptor sensitivity[195]

Receptor sensitivity/ Value of Resource	**Receptor/ Resource**
High	Residential areas, schools and playing fields within 50m of ground disturbed by construction Nearby surface water bodies of high quality and/or route located on Principal aquifer Nationally designated areas e.g. SSSI Major strategic mineral resource areas Strategic underground storage space
Moderate	Residential areas, schools and playing fields within 250m of ground disturbed by construction Allotments and market gardens Nearby surface water bodies of moderate quality, and/or route located on Secondary Aquifer Regionally designated areas e.g. local nature reserves or LGS Regionally or locally important mineral resource areas (MPA or MSA)
Low	Adjacent commercial or industrial development Forestry areas, ornamental plant nurseries

[195] Based on the Highways Agency, 2008, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 2 Environmental Impact Assessment, Part 5 Assessment and Management of Environmental Effects, The Stationery Office

Receptor sensitivity/ Value of Resource	Receptor/ Resource
	Nearby water bodies of low quality, and/or route located on unproductive strata Mineral Consultation Areas (MCA) or non-designated land

14.6.6 Construction and/or maintenance workers are not included in the list of receptors, as it will be a fundamental requirement that any construction/maintenance workers on the project are adequately protected from the effects of any contamination through project specific health and safety plans and procedures which will be put in place prior to the construction phase. Any such effects during construction would be controlled through use of the CoCP. Railway users are considered to be protected from any residual land quality impact by ensuring the design of the scheme provides suitable protection measures built into structures and public areas.

14.6.7 The magnitude of potential Proposed Scheme impacts regarding contamination issues will be assessed using a four-point scale as shown in Table 24.

Table 24 - Impact magnitude criteria[196]

Impact Magnitude	Criteria	Examples
High	Results in loss of attribute and/or likely to cause exceedance of statutory objectives and/or breach of legislation.	Likely significant human health impact, contamination of a Principal aquifer, or loss or isolation of strategic mineral resource.
Moderate	Results in impact on integrity of attribute/or loss of part of attribute, and/or possibly cause exceedance of statutory objectives and/or breach of legislation.	Reduction in the value of a feature, moderate human health impact[197], loss or isolation of regional/local mineral resource.
Low	Results in minor impacts on attribute.	Measurable change in attribute, but of limited size/proportion.
Negligible	Results in no change or impact on attribute.	No significant loss in quality of feature/attribute.

14.6.8 The prediction of significance is based on the magnitude of the impact and the importance or sensitivity of the receptors. The significance of the potential effects is identified, as well as those of the residual effects for geological, mining and mineral impacts. Once remediated, there should be no residual effects with respect to land contamination issues.

14.6.9 Effects have the potential to be adverse, beneficial or negligible. For example, in terms of beneficial effects, the Proposed Scheme may remove a source of contamination or it may break a pathway that currently links a source to a receptor.

14.6.10 The significance of the effect will be affected by:

- the value of the resource;

[196] Based on the Highways Agency, 2008, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 2 Environmental Impact Assessment, Part 5 Assessment and Management of Environmental Effects, The Stationery Office
[197] Defined as a chronic rather than acute impact

- the sensitivity of the receptor;
- the strength and length of the pathway; and
- the size of the area affected.

14.6.11 Adverse and beneficial effects are further classified as being minor, moderate or major in significance.

14.6.12 Table 25 summarises the criteria for assessing effect significance.

Table 25 - Significance of effects criteria[198]

Significance	Description
Major adverse	Considerable detrimental effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability/legislation/policy standards.
Moderate adverse	Limited detrimental effect (by extent, duration or magnitude) that may be considered significant.
Minor adverse	Slight, very short or highly localised detrimental effect.
Negligible	No appreciable effect.
Minor beneficial	Minor reduction in risk (slight, short or highly localised effect).
Moderate beneficial	Moderate reduction in risk.
Major beneficial	Major reduction in risk.

Construction effects

14.6.13 The impact of existing land contamination will become manifest during the construction phase. A fundamental requirement of the project will be to carry out sufficient mitigation or remediation of contamination such that, following construction, there are no continuing significant adverse effects from the contamination during the operational phase of the Proposed Scheme.

14.6.14 Remediation of contaminated land, and other construction activities, can lead to a number of secondary effects such as potential issues of dust migration and surface water impairment during the remediation and construction processes. Any such effects would be controlled through use of the CoCP.

14.6.15 Where remediation of soil and groundwater is carried out for the Proposed Scheme, this would be regarded as a beneficial effect, as future risks to human health and the wider environment from the pre-existing contamination would have been reduced by the remedial works.

[198] Generally based on the Highways Agency, 2008, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 2 Environmental Impact Assessment, Part 5 Assessment and Management of Environmental Effects, The Stationery Office

Operational effects

14.6.16 The major operational sources of contamination will be reviewed and appropriate mitigation measures proposed. In addition, during the operational period, monitoring works (such as for groundwater) may continue in order to demonstrate the effectiveness of any remedial works.

Cumulative effects

14.6.17 The assessment of cumulative effects would be limited to those areas/sites at which contamination remediation is likely to be required and at which construction of the Proposed Scheme would be undertaken at the same time as other nearby construction work within an area of contaminated land.

14.6.18 Cumulative effects would also need to be taken into account, for example, when assessing the Proposed Scheme impact on mineral resources; effects at a local scale on a number of mineral resources may have a cumulative effect at a regional scale.

14.7 Assumptions

14.7.1 The assessment within this topic area considers land quality from the perspective of land contamination. It excludes soils quality from an agricultural or forestry perspective. Such an assessment will be found in Section 6 (Agriculture, forestry and soils) of this SMR.

14.7.2 Land contamination has the potential to affect groundwater resources. There will be significant interaction between the land quality and water resources assessments in order to determine the potential effects on the quality of groundwater from contaminated land. Wider issues of groundwater and surface water resources are contained within Section 21 (Water resources and flood risk) of this SMR.

14.7.3 Land contamination has the potential to affect ecological resources. Other ecological issues are contained in Section 11 (Ecology and biodiversity) of this SMR.

14.7.4 Remediation of contamination can lead to a requirement for treatment and/or disposal of contaminated materials. Issues of onsite treatment and re-use of contaminated materials will be dealt with in the land quality assessment whereas issues of the disposal of contaminated soils off site are dealt with in Section 20 (Waste and material resources) of this SMR.

15 Landscape and visual

15.1 Introduction

15.1.1 This section of the SMR sets out the methodology for assessing the likely significant effects of the Proposed Scheme on landscape and visual receptors. The definition of landscape is 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (European Landscape Convention (ELC) – Council of Europe[199], 2000). The scope of assessment is discussed in detail at Section 15.4.

15.1.2 The ELC gives an inclusive definition to landscape with the need to take into account all landscapes, recognising that it is not just the special or designated places that have value but also 'ordinary' landscapes. For this assessment, the term 'landscape' encompasses rural, urban and peri-urban landscapes, all types and forms of open space and development in the countryside, villages, towns and cities, in line with the ELC. The term 'landscape' has been consistently used throughout this report to avoid the use of interchangeable terms (such as townscape), which may cause confusion.

15.1.3 The topic specific methodology presented in this section builds upon the general assessment methodology summarised in Section 4 (EIA methodology) of this SMR. This has been developed to take account of the range of likely significant environmental effects on the landscape and visual receptors arising from the construction, existence and operation of the Proposed Scheme. The methodology has also been designed to be consistent with the approach set out in the Guidelines for Landscape and Visual Assessment, 3rd Edition ('GLVIA3')[200].

15.1.4 The process for the landscape and visual assessment is illustrated in Figure 13 Landscape assessment, and Figure 14 Visual assessment. Each stage of the assessment process is then described in more detail through the following sections. A key principle is for the landscape baseline and the visual baseline to first be identified and understood before assessment takes place. The assessment of significant effects is a judgement based on a combination of receptor sensitivity and magnitude of change.

[199] Council of Europe, 20/10/2000 Florence, European Landscape Convention CETS No.: 176
[200] Landscape Institute and Institute of Environmental Management and Assessment, 2013, Guidelines for Landscape and Visual Impact Assessment, 3rd Edition

Figure 13 - Assessment process for the landscape assessment

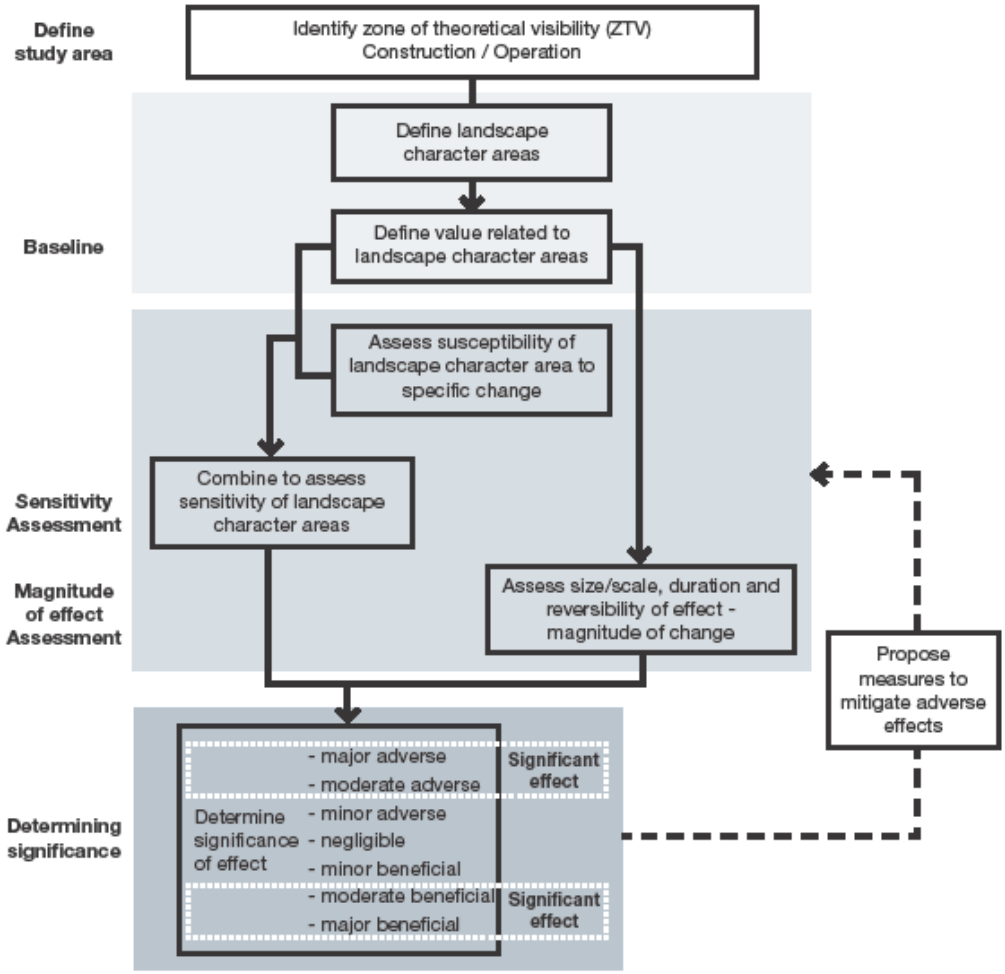
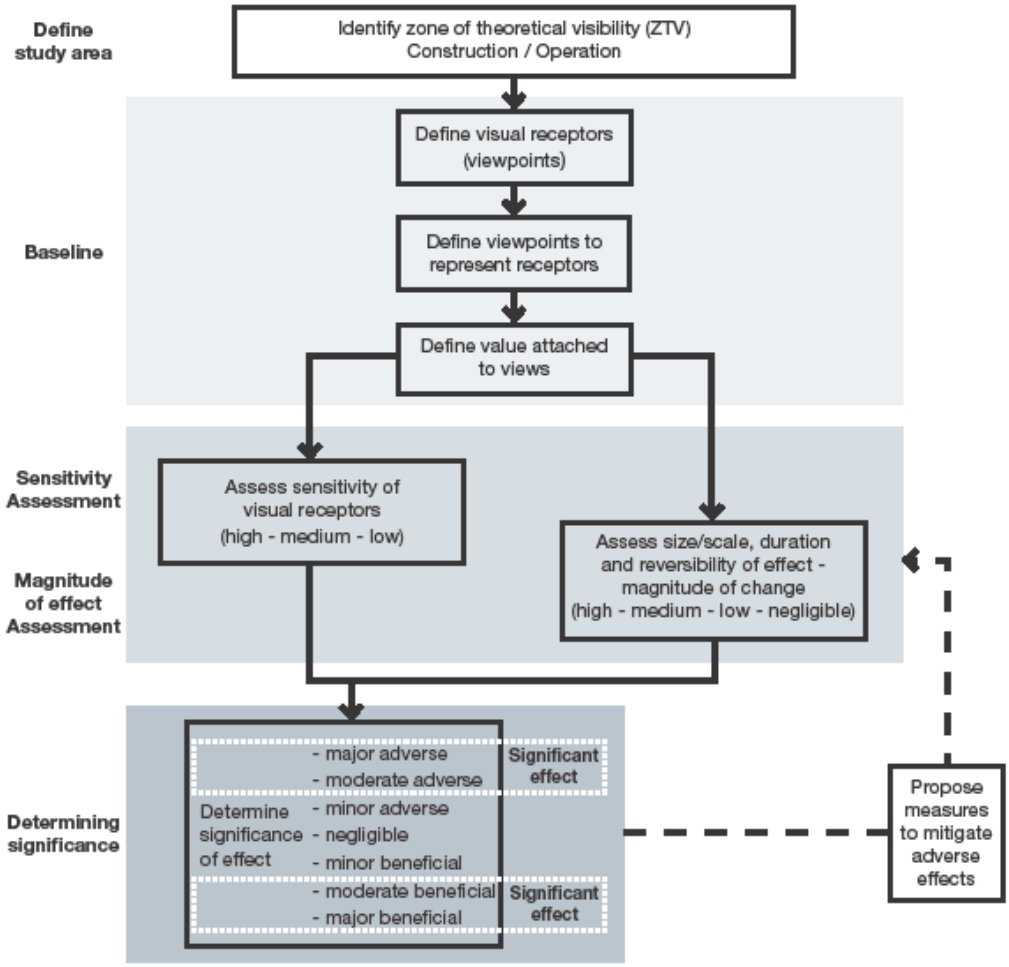


Figure 14 - Assessment process for the visual assessment



15.2 Establishment of baseline and definition of survey

15.2.1 The Proposed Scheme would pass through a wide range of different landscape character areas between the rural and agricultural landscape of Staffordshire, Cheshire and the urban fringes of Crewe. The overall character of the study area from south to north is as follows:

- the rural and agricultural landscape of Staffordshire north of Birmingham, where the Proposed Scheme would join the Phase One scheme, including lowland riparian and canal landscapes;
- the distinct flat topography around the Trent Valley floodplain;
- the landscape associated with the Cannock Chase Area of Outstanding Natural Beauty (AONB), which is close to the route of the Proposed Scheme, with associated special qualities and setting;
- the designed landscapes of Shugborough Park and other landscape parklands such as Ingestre and Tixall;
- extensive PRoW networks, access tracks and intricate local small scale historic field patterns;
- visual prominence and setting of Swynnerton Old Park and the wider planned estate landscape and associated hill top woodlands; and
- ancient woodlands and small scale field patterns around Madeley, and the rural landscapes of East Cheshire.

15.2.2 The landscape character of the study area (see Section 15.5, Scope of assessment – Spatial scope) and the nature of existing views will be established through desk based research, field survey and reviews of consultation responses for the Sustainability Statement.

15.2.3 The landscape and visual surveys will be carried out by Chartered Landscape Architects experienced in EIA. Assessments made will be verified by at least two other Chartered Landscape Architects experienced in EIA. Survey work will be carried out in both winter and summer, in order for seasonal change to be considered in the assessment. The survey work will be undertaken in a methodical order as follows:

- verification of the zone of theoretical visibility (ZTV) to inform the study area (see Section 15.5, Scope of assessment - Spatial Scope);
- definition and verification of the landscape character areas (reviewing and adapting information in existing landscape character assessments);
- determination of the value of each of the character areas;
- assessment of the susceptibility to change of each of the character areas;
- assessment of the sensitivity of each of the character areas based on their value and susceptibility;
- definition of viewpoints representative of groups of visual receptors within the

ZTV;

- definition of the type and nature of the view from each viewpoint;
- determination of the value of each of the representative viewpoints;
- assessment of the susceptibility to change of each of the representative viewpoints; and
- consideration of size/scale, duration and reversibility to determine the magnitude of change for each landscape character area and representative viewpoint.

15.2.4 The field study will include a comprehensive photographic record carried out in both the summer and winter, to illustrate each landscape character area and viewpoint.

Landscape baseline

15.2.5 The landscape baseline will include an overview of the elements that form the baseline within the study area, using text and plans to describe:

- topography and geology;
- cover, distribution and type of land use and open space;
- statutory and non-statutory designations relevant to the landscape and visual assessment (for example AONB and Conservation Areas), with consideration of appropriate special qualities for which they are designated and setting issues;
- development patterns and scale, including age, massing and density of buildings, levels of enclosure, skyline characteristics, building materials and landmark features;
- vegetation patterns and extents derived from aerial photography and site visits;
- transport routes and PRoW, National Trails and other routes to include roads, railways, cycleways, bridleways, footpaths, historic green lanes and drovers roads and waterways;
- heritage features, including conservation areas, listed buildings, registered parks and gardens and other historic landscape characterisation; and
- existing landscape character assessments, AONB Management Plan, local landscape designations, local green infrastructure strategies or plans prepared by authorities, National Character Areas and Profiles from Natural England.

Landscape character assessment

15.2.6 The landscape baseline elements will be used to prepare a character area assessment covering the full extent of the study areas. Landscape character areas are defined as

areas with broadly homogenous characteristics[201]. The identification of character areas will be influenced by published character assessments, including those prepared at national, county and district scales. If these are sub-divided to create units of character appropriate to the scale of the Proposed Scheme, this will be clearly set out in the formal EIA Report. The character area boundaries will follow natural changes in the landscape rather than political or administrative boundaries.

15.2.7 The character of each landscape character area will be described with reference to the following seven criteria, which also inform the discussion on landscape value:

- geological, topographical and hydrological (physiographic) interest;
- historic landscape interest;
- natural landscape interest;
- recreational value;
- perception of the landscape;
- landscape condition; and
- scenic qualities.

15.2.8 For each criteria the value will be determined in a scale from low to high using professional judgement with reference to site visits and existing documentation including local authority character assessments, historic landscape character assessments and conservation area character appraisals where available.

15.2.9 An overall level of value for each landscape character area will be determined by comparing the judgements made for each category described above.

15.2.10 Further detail on the attributes that influence the value judgements for each criteria will be described in a Phase 2a Technical Note 'Approach to landscape sensitivity' to be issued with the formal EIA Report. This will be developed through engagement with relevant environmental stakeholders and be published at the time of the formal EIA Report.

Visual baseline

Selection of viewpoints

15.2.11 Representative and specific viewpoints will be selected to allow an assessment of effects upon visual receptors within the study area. Visual receptors are divided into the following categories: residential, recreational, hotel, healthcare, educational, transport, active sports and employment.

15.2.12 All viewpoints will be agreed[202] with local planning authorities and other relevant stakeholders, for example Historic England, the National Trust, Natural England, the Cannock Chase AONB Unit and the Canal & River Trust.

[201] The approach used for this is consistent with that set out in Natural England, 2014, An Approach to Landscape Character Assessment
[202] Viewpoints cannot provide an exhaustive picture, hence the need for selection

15.2.13 Photos taken during both winter and summer periods will be included in the formal EIA Report for each viewpoint. The composition of the view will be described, including foreground, middle ground and background characteristics, the nature of the view towards the land to be acquired or used for the Proposed Scheme, that which obstructs the view (if anything) and whether a view is panoramic, framed, glimpsed or sequential (e.g. promoted long distance routes, canal paths).

15.2.14 The view at night will be described in cases where significant effects arising from lighting during construction or operation are likely. A Phase 2a Technical Note 'Approach to night time assessments' will be issued with the formal EIA Report.

15.2.15 For each viewpoint any particular elevated value will be determined using professional judgement and with reference to site visits and existing documentation. Some views may be specifically recognised, for example in relation to heritage assets, or through planning designations. Value may also be indicated by appearance in guidebooks or on tourist maps.

15.3 Consultation and engagement

Consultation on the Sustainability Statement

15.3.1 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for the landscape and visual assessment for the Proposed Scheme.

Consultation on the draft SMR

15.3.2 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them. In addition this section has been updated in response to changes in guidance[203].

15.4 Engagement as part of the EIA process

15.4.1 Consultees for this section of the formal EIA Report will include (but not be limited to) local planning authorities, county councils, Natural England, Historic England, the National Trust, the Forestry Commission, the Cannock Chase AONB Unit and the Canal & River Trust and other groups with appropriate technical knowledge.

Key aspects of the Proposed Scheme for the topic

15.4.2 The main features of relevance to the landscape and visual assessment during construction include:

- construction sites (including vehicles, construction lighting);
- construction plant, such as cranes;

[203] Landscape Institute and Institute of Environmental Management and Assessment, 2013, Guidelines for Landscape and Visual Impact Assessment, 3rd edition

- site compounds and storage areas, including temporary fencing and signage;
- earthworks (including temporary stockpiles or earth bunds for screening);
- construction of buildings, structures such as tunnels and viaducts and electrical apparatus;
- construction of embankments, cuttings and associated drainage works, plus construction of balancing ponds;
- demolition of existing buildings and structures and vegetation clearance, for example felling of woodland and trees, loss of hedgerows;
- construction traffic, including use of existing roads as haul routes and the construction of bespoke routes, movement of excavated materials and movements on public roads; and
- infrastructure and utility diversions.

15.4.3 The main features of relevance to the landscape and visual assessment during operation include:

- the track and track bed;
- traffic (including trains and maintenance vehicles), and 'arcing' from trains;
- the overhead line equipment (OLE), lighting, communication masts and signage;
- tunnel portals and ventilation shafts;
- viaducts and bridges (including both road and pedestrian);
- earthworks including cuttings, embankments, cut and cover 'green tunnels' and earthworks such as earth bunding and regrading works, much of which would assist with screening and integrating the Proposed Scheme;
- planting, for example new woodland, copse, specimen trees, hedgerows;
- balancing ponds and other drainage features plus new ecological ponds;
- noise barriers and visual screens;
- a new infrastructure maintenance depot, and associated development such as road widening, junction changes and increased traffic, plus new permanent buildings such as tunnel headhouses and auto-transformer stations and auto-transformer feeder stations; and
- associated developments, such as utility and permanent road diversions or upgrading, plus diverted highways and footpaths.

15.5 Scope of assessment

15.5.1 The methodology for the landscape and visual assessment follows the guidance set out in the GLVIA3[204] and, where appropriate, the Design Manual for Roads and Bridges ('DMRB')[205].

15.5.2 The assessment will also draw upon other topic assessments where relevant, such as cultural heritage, ecology and biodiversity, community and health. The methodology in this section is compatible with these other topics to ensure that all data generated can be shared in a logical and transparent way. The methodology in this section describes the assessment process for effects on landscape character and on visual receptors. Section 10 (Cultural heritage) of this SMR will consider the effects of the Proposed Scheme on the setting of individual cultural and heritage assets. For example this may include effects on the setting of scheduled monuments, listed buildings and registered parks and gardens.

Spatial scope

15.5.3 The landscape and visual assessment study area will be determined through the production of ZTV models for:

- construction – defined as the area over which the proposed construction activity would be visible;
- operation year 1 – defined as the area over which the components of the Proposed Scheme (including trains) would be visible; and
- operation year 15 – defined as the area over which the components of the Proposed Scheme (including trains) will be visible taking into account the screening effect new planting established as part of the Proposed Scheme may have in summer after 15 years of growth.

15.5.4 The landscape study area will be defined by the maximum extent of all character areas located partially or entirely within the ZTV except in those locations where the Proposed Scheme during construction or operation would be barely perceptible. The visual assessment area will be defined by the maximum extents of the ZTV except in those locations where the Proposed Scheme during construction or operation will be barely perceptible.

15.5.5 The ZTVs will be based on the most recently available topographic data. A datum of 1.6m above ground level would be used to represent the eye level view of an average height person. The validity of the route wide ZTV will be checked on site, using professional judgement, to ensure the output is a fair representation of the theoretical visibility of the proposed development, in line with guidance provided by the Landscape Institute. The detailed methodology for producing the ZTV is described in

[204] Landscape Institute and Institute of Environmental Management and Assessment, 2013, Guidelines for Landscape and Visual Impact Assessment, 3rd edition
[205] http://www.standardsforhighways.co.uk/dmrb/

the Phase One ZTV production methodology Technical Note (as referenced in Annex A).

Temporal scope

15.5.6 The landscape and visual assessment will be undertaken for the following years:

- construction - an assessment of effects in winter during the construction phase;
- operation year 1 - an assessment of effects in winter and summer during operation year 1;
- operation year 15 - an assessment of effects in summer during operation year 15, once any vegetation planted as part of the Proposed Scheme has matured or has achieved its design intention; and
- operation year 60 - to consider the benefits and/or negative effects in summer of maturity of tree planting.

Climate change

15.5.7 Projections of future climate change will be incorporated in the definition of the future baseline for the landscape assessment. The methodology and timeframes for assessing climate change impacts on sensitive receptors and significant effects assessed by the Landscape topic are set out in Section 8.

15.6 Assessment methodology

15.6.1 Physical changes to the landscape may give rise to effects on character. Effects may be direct (whereby landscape components are lost, damaged or altered by the construction or operation of the Proposed Scheme), or indirect (whereby the proposed development alters the setting of surrounding character areas).

Landscape assessment methodology

Determining landscape character sensitivity

15.6.2 The sensitivity of the landscape character area is made up of judgements about susceptibility of the landscape character area to the type of change arising from the Proposed Scheme; and the value attached to the landscape in the baseline.

15.6.3 The susceptibility of the landscape will be assessed against the following five criteria:

- landform;
- land cover and land use;
- scale;
- prominent landmarks; and
- perceptual aspects and tranquillity.

15.6.4 For each criteria the susceptibility will be assessed on a scale from low to high using professional judgement with reference to site visits and existing documentation, to

including local authority character assessments, historic landscape character assessments and conservation area character appraisals where available.

15.6.5 An overall level of susceptibility for each landscape character area will be assessed by comparing the judgements made for each category described above.

15.6.6 Further detail on the attributes that influence the susceptibility judgements for each criteria will be described in the Phase 2a Technical Note 'Approach to landscape sensitivity', which is to be issued with the formal EIA Report.

15.6.7 With reference to the overall value and susceptibility of the landscape, the sensitivity of the landscape will be assessed. The assessment of sensitivity requires the application of professional judgement, in line with guidance provided by the Landscape Institute. The presence of any combination of attributes within the criteria described may be considered when assessing the sensitivity of a character area. This allows professional judgement to be used when determining the relative importance of different attributes.

15.6.8 The attributes which influence the sensitivity of a character area are described in Table 26.

Table 26 - Landscape sensitivity

Sensitivity	**Where the character area:**
High	Is mostly unspoilt and of high scenic quality Is highly valued by virtue of its designation or recreational value Is predominantly characterised by landscape components that are rare and distinctive and/or listed Has a strong sense of tranquillity and remoteness Is highly susceptible to change Has components that are not easily replaced or substituted (e.g. mature trees) Has limited scope for effective mitigation in character with the existing landscape Is well maintained and in a good condition
Medium-high	Is mostly unspoilt and of notable scenic quality Is valued by virtue of its designation or recreational value Is largely characterised by landscape components that are distinctive, rare and/or listed Has a largely strong sense of tranquillity and remoteness Has components that are not easily replaced or substituted (e.g. mature trees) Has relatively limited scope for effective mitigation in character with the existing landscape Is mostly well maintained and in a good condition
Medium	Displays scenic qualities albeit with some erosion around infrastructure and settlement edges Has a generally intact landscape with the presence of some uncharacteristic development Is valued locally for its recreational facilities and footpath network

Sensitivity	Where the character area:
	Has many components that are rare and distinctive and/or listed Has a moderate sense of tranquillity and remoteness Has a moderate degree of susceptibility Has components that are easily replaced or substituted Has some scope for effective mitigation in character with the existing landscape Is of a fair condition
Low-medium	Displays few scenic qualities albeit degraded around infrastructure and settlement edges Has a partially intact landscape with a clear presence of uncharacteristic development Has some components that are rare and distinctive and/or listed Has localised areas with a sense of tranquillity and remoteness Has many components that are easily replaced or substituted Has scope for effective mitigation in character with the existing landscape Is of a fair, albeit partly degraded condition – land management issues may be evident
Low	Has a landscape affected heavily by uncharacteristic development eroding scenic qualities Has limited landscape value with few recreational facilities or footpath networks Has few or no distinctive components, or components that detract from the overall character of the site Has limited tranquillity by virtue of the dominance of infrastructure and human activity Has limited susceptibility to change Has components that are easily replaced or substituted Has considerable scope for effective mitigation in character with the existing landscape, and opportunities for an improvement in character Is in a poor condition

Determining magnitude of change

15.6.9 The magnitude of change on the landscape is influenced by:

- size and scale of the change - for example is there a complete or partial loss of a particular element of the landscape;
- geographical extent of the area that will be altered; and
- duration of the change and its reversibility.

15.6.10 Factors that would be considered in assessing the magnitude of change to the character areas are summarised in Table 27. These criteria are based on guidance provided by the Landscape Institute.

Table 27 - Landscape magnitude of change

Impact magnitude	Definition
High	Total loss or substantial alteration to key characteristics of the character and/or setting of the character area. Addition of new uncharacteristic features or components that alter a substantial proportion of the character and/or a large part of the setting of the character area. Introduction of irreversible change over a substantial area of an LCA or its setting. Introduction of long term or permanent change uncharacteristic of the area.
Medium	Noticeable change or alteration to one or more key characteristics of the character and/or setting of the character area. Addition of new features or components that form prominent elements of the character and/or setting of the character area, but are largely characteristic of the existing setting. Uncharacteristic changes across only a proportion of the character area or its setting. Introduction of some irreversible changes in parts of a character area or its setting. Introduction of medium to long term uncharacteristic changes and/or permanent changes largely characteristic of the existing setting.
Low	Slight loss or alteration to one or more characteristics of the character and/or setting of the character area. Addition of new features or components that form largely inconspicuous elements of the existing character and/or setting. Introduction of short to medium term uncharacteristic changes and/or long term / permanent changes in a small proportion of a character area or its setting.
Negligible	No change to, or barely perceptible loss or alteration of inconspicuous characteristics of the character and/or setting of the character area. Addition of new features or components that do not influence the overall character and/or setting of the character area, or are entirely characteristic of the existing setting. Introduction of short term uncharacteristic changes in parts of the area and/or longer term changes in a small part of the wider setting.

Assessing significance of effects

15.6.11 Assessment of the significance of an effect requires the application of impartial professional judgement including experience of other major infrastructure schemes to weigh the findings of the sensitivity of the landscape character area and the magnitude of change. This approach is recommended by the Landscape Institute. The presence of any combination of factors may be considered when assessing the level of effect. This allows professional judgement to be used when determining the relative importance of different factors, which varies on a site specific basis. Effects may be adverse or beneficial. The broad criteria that influence the level of landscape effects are noted in Table 28. Both the major and moderate categories are considered to comprise a significant effect as these would discernibly alter the character of an area. Any one aspect described may result in a categorisation within that significance level. These criteria are based on guidance provided by the Landscape Institute.

Table 28 - Significance of effects for landscape assessment

Significance level	Description **The proposed development would result in effects that:**
Major beneficial – significant	Would considerably and distinctly improve and enhance the existing character. Would restore or enhance valued characteristic features substantially or entirely lost through other land uses.
Moderate beneficial - significant	Would markedly improve and enhance the existing character. Would restore or enhance valued characteristics substantially lost through other land uses.
Minor beneficial	Would slightly enhance the existing character. Would restore valued characteristic features partially lost through other land uses.
Negligible	Would be compatible with the existing character.
Minor adverse	Would be slightly at variance with the existing character. Would damage or partially remove some valued characteristic features.
Moderate adverse - significant	Would be at variance with the existing character. Would degrade, diminish or destroy valued characteristic features, elements and/or their setting. Would not be wholly compatible with local environmental policies for the protection and enhancement of the landscape.
Major adverse - significant	Would be at considerable variance with the existing character, degrading its integrity. Would permanently degrade, diminish or destroy the integrity of valued characteristic features, elements and/or their setting. Would comprehensively conflict with national, regional or local environmental policies for the protection and enhancement of the landscape.

Visual assessment methodology

Determining visual sensitivity

15.6.12 The sensitivity of viewpoints is made up of judgements about susceptibility of the visual receptor to the type of change arising from the Proposed Scheme; and the value attached to the certain views that are experienced, as defined in the baseline.

15.6.13 Susceptibility to change of visual receptors depends on occupation or activity of people and the extent to which attention is focused on views and visual amenity.

15.6.14 The most susceptible visual receptors (people) include:

- residents at home;
- people engaged in outdoor recreation whose interest is likely to be focused on landscape and views (e.g. users of open access land, long distance routes, PRoWs and the canal network);
- visitors to the heritage assets or other attractions where views are important

to the experience; and

- communities where views contribute to landscape setting is enjoyed by residents.

15.6.15 Those less likely to be focused on the landscape and views include:

- people engaged in outdoor sport or recreation not involving appreciation of views of the landscape;
- people at places of work where setting is not important to quality of working life; and
- travellers on road rail or other routes tend to fall into an intermediate category depending on whether travel involves recognised scenic routes.

15.6.16 The sensitivity of visual receptor types will be mapped by category according to the hierarchy shown in Table 29.

Table 29 - Visual sensitivity

Sensitivity	Level of interaction with the landscape
High	Occupiers of residential properties Recreational users or tourists whose attention may be focussed on the landscape (e.g. visitors to the AONB, users of the PRoW and canal network) Designated or protected views
Medium	People travelling along scenic roads through the landscape People staying in hotels and healthcare institutions People walking along residential streets
Low	People at work and in educational institutions People engaged in formal sports activities People walking through urban areas (for example commuters) People travelling on main roads through the landscape

15.6.17 Visual effects relate to:

- the changes that arise in the composition of available views as a result of changes arising from the Proposed Scheme; and
- people's likely responses to changes.

15.6.18 For sites where substantial lighting is anticipated during construction or operation, an assessment of visual effects at night time arising from additional lighting would also be made, in line with the methodology described for the day time assessment below.

15.6.19 The construction phase assessment will be undertaken during winter, when construction works are likely to be most visible.

15.6.20 The operation year 1 assessment will be undertaken during winter and summer to account for seasonal change in the visibility of the proposed development.

15.6.21 The purpose of the operation year 15 and 60 assessments will be to account for any vegetation planted as part of the Proposed Scheme that has matured or has achieved its design intention, and would be in full leaf. Therefore, the assessment for these years would be undertaken during summer.

Determining magnitude of change

15.6.22 The magnitude of the effect on views is made up of judgements about:

- size and scale of the effect - for example is there complete or partial loss of a particular element in the view;
- geographical extent of changes in view ; and
- duration of the change and their reversibility.

15.6.23 The factors that will be considered in assessing the magnitude of change on views and on representative views are summarised in Table 30.

Table 30 - Visual magnitude of change

Impact magnitude	Definition
High	Total loss or substantial alteration to key characteristics of the view from a receptor Addition of new features or components that are continuously highly visible across the majority of the view and incongruous with the existing view from a receptor Substantial changes in close proximity to the visual receptor, within the direct frame of view Introduction of long term or permanent change uncharacteristic of the view
Medium	Noticeable change or alteration to one or more key characteristics of the view from a receptor Addition of new features or components that may be continuously highly visible across much of the view, but are largely characteristic of the existing view from a receptor Changes a relatively short distance from the receptor, but viewed as one of a series of components in the middle ground of the view Substantial change partially filtered by intervening vegetation and/or built form, or viewed obliquely from the visual receptor Introduction of medium to long term change uncharacteristic of the view and/or permanent changes largely characteristic of the existing view or in a small proportion of the view
Low	Slight loss or alteration to one or more characteristics of the view from a receptor Addition of new features or landscape components that may be continuously or intermittently visible in part of the view, but are largely characteristic of the existing view from a receptor Changes within the background of the view, viewed as one of a series of components in the wider panoramic view from a receptor Change largely filtered by intervening vegetation and/or built form, or viewed obliquely from the visual receptor Introduction of short to medium term change uncharacteristic of the view and/or long term /

Impact magnitude	Definition
	permanent changes in a small proportion of the view
Negligible	No change to, or barely perceptible loss or alteration of inconspicuous characteristics of the view from a receptor. Addition of new features or landscape components that are largely inconspicuous and characteristic of the existing site when viewed from a receptor Changes within the background of the view, viewed as an inconspicuous element within the wider panoramic view from a receptor Change from a visual receptor almost entirely obscured by intervening vegetation and/or built form Short term changes in a small proportion of the view

Assessing significance of effects

15.6.24 Assessment of the significance of an effect requires the impartial application of professional judgement to weigh the sensitivity of the representative viewpoint with the magnitude of an impact. Effects may be adverse or beneficial. The broad criteria that influence the level of significance of visual effects are set out in Table 31. Both the major and moderate categories are considered to comprise a significant effect as these would discernibly alter the existing view. The significance for visual effects follows the guidance provided by the Landscape Institute.

Table 31 - Significance of effects for visual assessment

Significance level	Description **The proposed development would result in:**
Major beneficial - significant	A marked improvement in the existing view
Moderate beneficial - significant	A noticeable improvement in the existing view
Minor beneficial	A discernible improvement in the existing view
Negligible	No perceptible deterioration or improvement in the existing view
Minor adverse	A discernible deterioration in the existing view
Moderate adverse - significant	A noticeable deterioration in the existing view
Major adverse - significant	A marked deterioration in the existing view

15.6.25 Residual significant effects are reported for those effects that will persist after any mitigation. For construction, these residual effects will be temporary, lasting the duration of the peak construction phase. For operation residual effects will be reported only for significant effects that persist from year 15 after opening, on the basis that the planting incorporated into the design of the Proposed Scheme would mitigate other effects reported at year 1.

Verifiable photomontage methodology

15.6.26 In some locations, to be agreed with statutory consultees, the assessment of visual effects would be accompanied by the production of verifiable photomontages, recognising that photomontages can only be an aid to assessment and decision-making. These would be prepared for viewpoints where:

- the receptor is highly sensitive to change and/or the viewpoint is identified in the Local Plans and Supplementary Planning Guidance (SPG), Conservation Area character appraisals or the AONB Management Plan; or
- the magnitude of change cannot be easily assessed with reference to plans, sections, elevations and 3D visualisations (e.g. where views may be partially filtered or partially screened by vegetation or built form, or where the precise position of elements has a particular importance in relation to the composition of a view).

15.6.27 Verifiable photomontages would be produced for construction, operation year 1, and operation year 15 as required. The detailed methodology for producing the verifiable photomontages is described in the 'Approach to verifiable photomontages ' Phase One Technical Note[206]. The methodology has been informed by Landscape Institute Advice Note 01/11[207] and GLVIA3.

Cumulative effects assessment

15.6.28 Cumulative effects (also known as in combination effects) arising from the Proposed Scheme in conjunction with other developments within the study area would be described with reference to how the findings of the main assessment would change.

15.6.29 The construction phase cumulative assessment would consider the effects of construction of the Proposed Scheme in conjunction with all other major developments likely to be under construction at the same time within the construction phase study area.

15.6.30 The operation year 1 cumulative assessment would consider the effects of the operation of the Proposed Scheme in conjunction with all other major developments in operation in year 1 within the operational phase study area.

15.7 Assumptions

15.7.1 The assessment is based on professional judgement and takes into account both the adverse and beneficial contribution that new development can have upon the existing landscape character and on the visual resource of surrounding receptors.

15.7.2 During the baseline survey there may be some areas which are inaccessible (such as private land, commercial premises and residential buildings). In these instances, professional judgement will be used to approximate the likely views from these

[206] London – West Midlands Environmental Statement Volume 5 Technical Appendices, Scope and methodology report addendum (CT-001-000/2), November 2013.
https://www.gov.uk/government/publications/hs2-phase-one-environmental-statement-scope-and-methodology

[207] Landscape Institute, 2011 Advice Note 01/11: Photograph and photomontage in Landscape and Visual Impact Assessment

locations. Where viewpoints are selected to reflect the visibility of the site from tall residential properties, a photo will be included from public land close to the property, taken at ground level, and a commentary included as to the likely appearance of the view from a higher elevation. In line with industry accepted guidance, in these instances, no photomontages will be included from an elevated perspective.

15.7.3 The ZTVs will be generated using (LiDAR) topographic data (where available) or Ordnance Survey Landform Profile data. It is acknowledged that changes in the assessment area through new development and/or demolition will not necessarily be identified by this model. However, professional judgement will be used to verify the ZTVs on site as far as possible.

16 Major accidents and natural disasters

16.1 Introduction

16.1.1 This section of the SMR sets out the methodology for identifying and assessing the likely significant environmental (including human health and population) effects arising directly from the Proposed Scheme if it were to be affected by a major accident or natural disaster. The assessment of the vulnerability of the project to major accidents and natural disasters is included in this SMR following changes to the EU legislation. The change to the legislation is through the agreement by the European Parliament and Council of Ministers to make amendments to the EIA Directive (2011/92/EU). The new EIA Directive (2014/52/EU) entered into force on 15 May 2014 and states the need to assess "*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 which are relevant to the project concerned".*

16.1.2 Paragraph 15 of the Directive states that:

"(15) In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain 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. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment".

16.1.3 The Proposed Scheme will be designed to reduce as far as possible the risk of major accidents occurring. For example:

- for construction, the HS2 Corporate Health and Safety Strategy and 'Safe at Heart' are applied to identify and mitigate accident risks; and
- for operation of the high speed railway, the safety of the railway is being considered under application of EU Regulation 402/2013 (as amended) the Common Safety Method for Risk Evaluation and Assessment (CSM-RA). Under CSM-RA, hazards with the potential to cause a major accident during railway operation are identified, assessed and mitigated.

16.1.4 In accordance with Paragraph 15 of the new EIA Directive (2014/52/EU)[208], safety assessments undertaken for the Proposed Scheme will be used to inform the identification and assessment of likely significant environmental effects.

16.1.5 The methodology presented in this section builds upon the general assessment methodology summarised in Section 4 of this SMR. It sets out how the vulnerability (exposure and resilience) of the Proposed Scheme to major accidents and/or natural

[208] Paragraph 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 referenced Directives relate to operating sites which contain large quantities of dangerous substances (for example oil refineries, oil storage depots and nuclear facilities) which are not relevant to the Proposed Scheme

disasters will be assessed, with reference to available relevant information. For the purposes of this assessment, the vulnerability is defined as the potential weakness of the Proposed Scheme to the risks to which it is exposed. A risk is defined as the hazard of an event (its consequences) factored by its probability (how likely it is to take place).

16.1.6 Major accidents or natural disasters are hazards which have the potential to affect the Proposed Scheme include (but are not restricted to) accidents during construction and operation caused by operational failure or natural hazards.

16.1.7 The assessment of 'Significant adverse effects' will consider all factors defined in the new Directive, i.e. population and human health, biodiversity, land, soil, water, air and climate and material assets, cultural heritage and the landscape.

16.2 Establishment of baseline and definition of assessment process

16.2.1 The method by which the environmental baseline has been established is presented in Section 4 of the SMR and within each of the environmental topics specialist sections. There is no new baseline information required as part of the major accident and disasters assessment and therefore no additional surveys are planned.

16.2.2 Assessing the adverse effects on the environment will require interaction with other sections of the formal EIA Report, in particular air quality, climate, community, ecology and biodiversity, health, socio-economics and water resources and flood risk.

16.2.3 The assessment of significant adverse effects on the environment will be undertaken with reference to the regulatory requirements, legislation and design standards in place for the construction and operation of the Proposed Scheme, including those referred to in paragraph 16.1.3.

16.2.4 The baseline for the assessment will consider the regulatory requirements in place and will not reproduce for example the safety risk assessment that must be in place for the licence to use and operate the railway under CSM-RA.

16.3 Consultation and engagement

Consultation on the Sustainability Statement

16.3.1 Consultation on the scope and methodology of the major accidents and natural disasters topic has not previously been undertaken as part of the Phase Two consultation on the Sustainability Statement. The European Union requirement to undertake such an assessment as part of the EIA process required under the 2014 EU EIA Directive has only recently been enacted and UK regulatory compliance with the legislation is not required until mid-2017.

Consultation on the draft SMR

16.3.2 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for major accidents and natural disasters.

Consultation as part of the EIA process

16.3.3 General consultation on the scope, methodology and outcomes of the EIA, including major accidents and natural disasters assessment would be undertaken with appropriate bodies.

16.3.4 Consultation will be undertaken in an integrated way in conjunction with the consultation proposed for the other EIA topic areas.

16.4 Scope of assessment

16.4.1 As part of the assessment process, likely impacts and effects will be identified to enable potential scenarios for each environmental topic to be understood. Sensitive areas classed as having high environmental vulnerability will be considered.

16.5 Assessment methodology

16.5.1 The operational safety of the Proposed Scheme will be considered in detail in accordance with regulatory requirements, and construction risks will be assessed in accordance with legislation.

16.5.2 The accident and disaster hazards during construction and operation that have been identified and mitigated through the application of safety studies referred to in Section 16.1, will be used to identify the risks of potential significant environmental effects. These risks will be assessed appropriately in relation to all the topics included in this SMR. The framework for the environmental risk assessment will follow a standard source-pathway-receptor approach, where sources (accidents and disasters) will be based on existing risk assessments, and receptors will consider population and human health, biodiversity, land, soil, water, air and climate and material assets, cultural heritage and the landscape.

16.5.3 A Phase 2a Technical Note will be prepared to define in further detail how the assessment will align with existing safety risk assessments and other topic areas of the EIA. This will be issued with the formal EIA Report. As far as is practicable, a consistent framework will be presented, whilst recognising that differing approaches (e.g. modelling, statistics, expert opinion) may be used for the detailed evaluation of specific risks.

16.5.4 The assessment will consider the likelihood and extent of hazard events in line with other risk assessments, and define the likely significant environmental impacts of these events where these are not covered by existing risk assessments.

16.5.5 Risk mitigation options (prevention and response/measures) beyond those in place (regulatory controls, design features and existing / established operational procedures) with reference to the technical development of the design will be considered to address any impacts if necessary. As safety risks will be required to be adequately addressed within the regulatory framework for the Proposed Scheme, residual effects are expected to be negligible.

Legislation

16.5.6 The relevant legal framework is provided in Section 16.1.

Guidance

16.5.7 There is currently no published guidance for the application of this aspect of the new EIA directive. The scope and methodology presented here may be subject to change on the basis of new guidance or professional judgement. However, the Guidelines for Environmental Risk Assessment (referred to as the Green Leaves III document) published by Defra (2011)[209] provides relevant generic guidance on the assessment of risks to the environment. These guidelines will be used to inform the assessment methodology.

Significance criteria

16.5.8 No new significance criteria are anticipated for this topic. Significance will be considered for each identified receptor in conjunction with the appropriate environmental topic for this EIA.

16.6 Assumptions

16.6.1 Key assumptions for the major accidents and natural disasters assessment are that:

- the railway will not carry freight; and
- only those hazard events with a feasible source-pathway-receptor model will be considered.

[209] Department for Environment, Food and Rural Affairs (Defra), 2011, Guidelines for Environmental Risk Assessment and Management Green Leaves III, Defra

17 Socio-economics

17.1 Introduction

17.1.1 This section of the SMR sets out the methodology for the socio-economic assessment, which focuses on identifying significant economic and employment effects during the construction and operational phases of the Proposed Scheme. The need for a socio-economic assessment results from the potential for the Proposed Scheme to generate impacts on:

- existing businesses and organisations;
- local economies, including employment;
- planned growth and development; and
- wider concentrations of economic activity.

17.1.2 The assessment will draw upon other assessments where relevant, such as agriculture, forestry and soils, sound, noise and vibration, landscape and visual, air quality and traffic and transport. Specifically the socio-economic topic will focus on the implications for employment.

17.1.3 The assessment is distinguished from the wider business case in that it will identify direct and significant impacts on local economies. The wider business case is related to, but differs from, the socio-economic assessment in that it predicts overall benefits to the output of the national economy. Benefits to the national economy arise through the circulation of monies over a wide area, which may not have directly observable or significance consequences in the context of the EIA.

17.2 Establishment of baseline and definition of survey

Characteristics of communities

17.2.1 The need to minimise negative socio-economic effects has influenced the design development of the Proposed Scheme, for example, by alignment of the route's centreline to avoid the majority of communities between Fradley and Crewe as well as changes to the height of the route over or under roads, railways and watercourses. At certain locations, viaducts have been extended.

17.2.2 However, the route passes through, and will potentially effect, a diverse range of communities. The main centres of population comprise of Crewe and Stafford. Other key settlements near the Proposed Scheme include Madeley, Whitmore, Swynnerton, Yarlet, Marston, Hopton, Great Haywood, Colton and Fradley. The route will also pass close to a number of villages, hamlets and isolated farmsteads in the countryside. These communities are more dispersed, rural/agricultural communities.

Baseline data and methods

17.2.3 The assessment will rely on two general sources of information, namely technical evidence and stakeholder views. Stakeholder views will inform how best to approach the more qualitative aspects of the assessment.

17.2.4 The baseline information will be developed following an integrated approach with health and community. Baseline information will be presented against comparable performance statistics for areas associated with communities where impacts are being assessed, known as benchmark areas. Benchmark areas will include the host district and wider areas or a region where appropriate. The baseline for the benchmark areas will draw upon a number of sources covering:

- existing planning, economic and regeneration plans and strategies;
- population;
- labour supply;
- employment and unemployment;
- enterprises;
- development potential/ capacity; and
- existing studies on wider economic effects during operation of the Proposed Scheme.

17.2.5 Data will be collected by a variety of methods including: accessing national data sets, requesting and accessing local information; exchange of information with other environmental topics; and carrying out investigations into the character and nature of businesses in the area.

17.3 Consultation and engagement

Consultation on the Sustainability Statement

17.3.1 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for socio-economics for the Proposed Scheme.

Consultation on the draft SMR

17.3.2 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for socio-economics.

Engagement as part of the EIA process

17.3.3 Relevant stakeholders will be contacted as part of the EIA process including local authorities along the route of the Proposed Scheme including proposed junctions and the infrastructure maintenance depot (and potentially local authorities affected by any secondary effects on the WCML and other routes).

17.4 Key aspects of the Proposed Scheme for the topic

17.4.1 Relevant aspects of the Proposed Scheme include:

- direct and indirect effects of construction and operation;
- demand for labour, particularly during construction, including labour skills and sources; and

- relocation of businesses during construction e.g. for development of new infrastructure.

17.5 Scope of assessment

Spatial scope

17.5.1 The spatial scope of the assessment will vary according to the type of resource and receptor as shown in Table 32.

Table 32 - Socio-economic assessment: resources, receptors and spatial scope

Resource	Impacts	Effects:		Spatial scope
		On resources	On receptors	
Existing businesses and organisations – land required and in combination effects of noise, HGV traffic, vibration, air quality and visual impacts on businesses and organisations' operations[210]	Businesses (non-community) lost to land required	Loss or impairment of business activities	Change in employment and skills mix	Direct land required by the Proposed Scheme
	Community activities lost to land required	Loss or impairment of community activities	Change in employment and skills mix	Direct land required by the Proposed Scheme
	In combination effects of noise, HGV traffic, vibration, air quality and visual impacts on businesses and organisations' operations[210]	Character or quality of businesses and organisations' environment changes as a result of noise, HGV traffic, vibration; air quality and visual impacts	Impact on (non-community) businesses	Relevant impact area from the edge of the Proposed Scheme is a minimum 250m in both urban and rural areas unless subsequent analysis from other topic areas suggests a greater or lesser extent at specific locations
	Severance of infrastructure (used for employment purposes) from receptors resulting in an impact on businesses and organisations' operations	Physical e.g. islanding or isolation of resource results in change to business and organisations' environment	Impact on (non-community) businesses	All or part of the catchment area of affected resource where it is subject to severance[211].
Employment associated with construction	Direct employment opportunities associated with	Demand for construction sector services	Demand for construction sector jobs and changes in opportunities for local	Travel to Work Area of construction sites for daily commute workforce and UK

[210] Noise, HGV traffic, vibration, air quality and visual's significant effects will be identified for the in-combination assessment as it is those effects which are most likely to potentially contribute to a change of amenity value of infrastructure (used for employment purposes)
[211] The distance of the diversion and duration are factors in determining whether or not there is an impact

Resource	Impacts	Effects:		Spatial scope
		On resources	On receptors	
	the construction phase		employment	wide for migrant workers
	Indirect impacts on the economy of the construction phase	Indirect impacts on other construction sector projects, multiplier impacts on the wider economy	Demand for construction sector jobs and changes in opportunities for local employment	UK
Employment associated with operations	Direct employment opportunities associated with the operational phase	Demand for operational phase services	Demand for operational phase associated jobs and change in opportunities for local employment	Travel to Work Areas associated with the off-route stations and depots during the operational phase employment locations
	Indirect impacts on the economy of the operational phase	Indirect impacts on sectors of the economy, multiplier impacts on the wider economy	Change in employment and skills and change in opportunities for local employment	Induced effects are most likely to occur within the Crewe area where the operational workforce is located. Indirect (supplier based) effects are likely to occur within the UK

Temporal scope

17.5.2 The temporal scope is outlined in Section 2.2 (Scope of assessment) of this SMR. Socio-economic impacts will generally be assessed for the construction period (2020 – 2026, including commissioning) and 2027 for operation (i.e. the first year of operation of the Proposed Scheme).

17.6 Assessment methodology

17.6.1 The effects of the Proposed Scheme will be considered at varying spatial levels according to the nature of the effect in each cases, through comparison of the baseline conditions and those as a result of the Proposed Scheme.

Legislation and guidance

17.6.2 The available guidance on socio-economic assessment sets out the overarching principles, including the assessment of gross and net impacts and recognition of the wider economic impacts of transport schemes. The HCA employment densities guide[212] will be used where necessary to estimate employment in identified floorspace where it is not practical to undertake a direct survey. Other relevant guidance includes:

[212] Homes and Communities Agency (HCA), November 2015, Employment Density Guide, 3rd edition

- Treasury Green Book: Appraisal and Evaluation in Central Government[213] ;
- DfT WebTAG guidance (on wider economic effects of transport); and
- English Partnerships (2008) Additionality Guide, A standard approach to Assessing Additional Effects of Projects[214].

17.6.3 The methodology will also take into account good practice from other infrastructure project EIAs, for example, Phase One, Crossrail and Thames Tideway Tunnel.

Significance criteria

17.6.4 Since there is no definitive guidance on significance criteria for socio-economic effects, the assessment will draw on existing industry accepted practice. The significance of a socio-economic effect will be determined by assessing both the:

- magnitude of the impact; and
- sensitivity of receptors.

Determining magnitude of impacts

17.6.5 The magnitude of an impact represents its severity or scale, and is influenced by:

- spatial extent (localised/ isolated versus widespread with potential secondary effects);
- extent (number of employees or businesses affected);
- duration;
- conformity with standards for provision or accessibility (as set out in regional, sub regional or local planning guidance);
- permanence;
- likelihood of occurrence;
- the scope for incorporated environmental design features or mitigation; and
- value of the resource.

17.6.6 Based on the above considerations, guidance criteria will be used to determine the magnitude of the impacts on the basis of professional judgement and existing industry accepted practice (Table 33).

[213] HM Treasury 2003, The Green Book: Appraisal and Evaluation in Central Government, The Stationary Office
[214] English Partnerships, 2008, Additionality Guide, A standard approach to Assessing Additional Effects of Projects (3rd Edition), English Partnerships

Table 33 - Socio-economic impact magnitude criteria

Impact magnitude	Definition
High	An impact that will be very adverse/ beneficial, and very likely to affect large numbers of businesses and/ or people (with numbers depending on the local context and nature of impact), and that will usually continue and effectively constitute a permanent, long term impact on the baseline conditions.
Moderate	An impact that is likely to affect a moderate number of businesses and/ or people (with numbers depending on the local context and nature of the impact).
Low	An impact that is likely or may affect a small number of businesses and/ or people (with numbers depending on the local context and nature of the impact) and/ or that usually does not extend beyond the life of the project so that the baseline is not affected beyond a short or medium term duration.
Negligible	An impact that is temporary in nature and/ or is anticipated to have a slight or no effect on the well-being of businesses and/ or people.

Determining receptor sensitivity

17.6.7 Guideline criteria have been established using professional judgement and existing industry accepted practice to determine the sensitivity of the receptors as shown in Table 34.

Table 34 - Socio-economic receptor value/sensitivity criteria

Receptor value and/ or sensitivity	Definition
High	Businesses, workforces or economies that are at risk and that have little or no capacity to experience the impact without incurring a significant socio economic loss (or gain) of an economic resource, or employment.
Moderate	Businesses, workforces or economies that have a limited or average capacity to experience the impact without incurring a significant socio economic loss (or gain) of an economic resource, or employment.
Low	Businesses, workforces or economies that generally have adequate capacity to experience impacts without incurring a significant socio-economic loss (or gain) of an economic resource, or employment.

Determining the significance of effects

17.6.8 The significance of a socio-economic effect is a product of the magnitude of the impact and the sensitivity of the receptor, and will be assessed on the basis of professional judgement and existing industry accepted practice.

17.6.9 The approach to determining significance is summarised in Table 35.

Table 35 - Socio-economic - significance of effect criteria

Significance		Impact magnitude			
		High	**Medium**	**Low**	**Negligible**
Sensitivity of receptor	High	Major adverse/beneficial - significant	Major adverse/beneficial - significant	Moderate adverse/beneficial - significant	Minor adverse/beneficial – not significant
	Moderate	Major adverse/beneficial - significant	Moderate adverse/beneficial - significant	Minor adverse/beneficial – not significant	Negligible – not significant
	Low	Moderate adverse/beneficial - significant	Minor adverse/beneficial – not significant	Negligible – not significant	Negligible – not significant

17.6.10 Effects are considered to be significant if both impact magnitude and receptor sensitivity are high or medium. Additionally, effects are considered to be significant if impact magnitude is high and receptor sensitivity is low, or alternatively, if receptor sensitivity is high and impact magnitude is low. This equates to major and moderate adverse/ beneficial effects.

17.6.11 Other effects equating to minor adverse/ beneficial and negligible effects, are not considered to be significant.

Construction effects

17.6.12 Construction effects will be assessed following the accepted EIA assessment processes including:

- establishment of the baseline with definition and collection of relevant data and information as outlined in Section 17.2 (Establishment of baseline and definition of survey);
- consultation including those outlined in Section 17.3 (Consultation);
- assessment of impacts and effects against key aspects of the Proposed Scheme as outlined in Section 17.4 (Key aspects of the Proposed Scheme for the topic), covering the scope outlined in Section 17.5 (Scope of assessment) and using the significance criteria outlined in Table 35; and
- iterative further assessment of impacts identified through other environmental topics as part of the EIA.

Operational effects

17.6.13 The same process will be used for assessment of operational effects as outlined for construction effects.

Cumulative effects

17.6.14 Cumulative effects will be identified on the basis of a high level assessment of other developments individually or cumulatively in the planning pipeline that have the potential to interact significantly with the Proposed Scheme. Other developments will

include major infrastructure projects such as HS2 Phase 2b and large scale urban developments (e.g. urban extensions). The known characteristics of such developments will be converted into an employment effect using employment density assumptions and identified in relation to the Proposed Scheme's own timeline.

17.7 Assumptions

17.7.1 Key assumptions include:

- construction labour productivity underpinning the construction labour demand curve remains constant over the life of the Proposed Scheme (e.g. no major changes in technology and method of work that lead to changes in the skills mix); and
- projections of the baseline/ counterfactual (without HS2 economic trends) remain constant over the lifespan of the Proposed Scheme (in terms of known major projects, macro-economic conditions etc.).

18 Sound, noise and vibration

18.1 Introduction

18.1.1 This section of the SMR presents the proposed approach for assessing sound, noise and vibration impacts and effects. It has been divided into two parts, the first dealing with ground-borne sound, noise and vibration and the second dealing with airborne sound and noise.

18.1.2 The terms sound and noise are used in this section. 'Sound' is the neutral term used to describe the fluctuating pressure waves in the air that stimulate the sense of hearing. Noise is often defined as unwanted sound. The term sound is used in this scope and methodology for two reasons. Firstly, during consultation for Phase One in 2011, communities along HS2's line of route requested that the 'sound quality' in their local area be taken into consideration when assessing the effects of HS2. Secondly, the Noise Policy Statement for England[215] notes "*... sound only becomes noise ... when it exists in the wrong place or at the wrong time such that it causes or contributes to some harmful or otherwise unwanted effect, like annoyance or sleep disturbance".* Therefore the term sound is used here until the assessment methodology evaluates that there is a potential adverse effect on a receptor, at which stage the term noise is used. Mitigation is therefore noise mitigation.

18.2 Ground-borne sound and vibration

Introduction

18.2.1 This section of the SMR presents the proposed approach for assessing ground-borne sound and vibration associated with the construction and operation of the Proposed Scheme.

18.2.2 Without mitigation, ground-borne vibration created by either construction activities or train services can propagate through the ground to surrounding buildings where it may result in the vibration of floors, walls and ceilings which could also be heard as a low frequency 'rumbling' sound (called ground-borne sound).

18.2.3 The assessment will cover all noise and vibration sensitive receptors (e.g. occupied buildings) including, where appropriate, properties for which planning permission has been granted before the safeguarding date but are not yet completed, subject to the screening distances discussed within the specific subject areas. Where a receptor has multiple uses, the assessment will be made based on the most sensitive use.

Establishment of baseline and definition of survey requirements

Ground-borne sound

18.2.4 Absolute criteria, rather than sound change criteria, apply for ground-borne sound for four main reasons, as follows:

- there is rarely any appreciable existing ground-borne sound at a receptor;

[215] Department for the Environment, Food and Rural Affairs (Defra), 2010, Noise Policy Statement for England, Defra

- the character and nature of ground-borne sound differs from other ambient sound heard inside buildings;
- the body of experience and research available with regard to human response to ground-borne sound has mostly been based on the assessment of the maximum sound level for each train pass-by (i.e. an absolute sound level); and
- ground-borne sound can affect any room in a property so the criteria consider situations where existing internal background sound levels are at their lowest for a particular classification of receptor (e.g. rooms on a quiet façade of a residential receptor or new build concert hall or broadcast facility).

18.2.5 No ground-borne sound baseline survey is therefore proposed.

Consultation and engagement

Consultation on the Sustainability Statement

18.2.6 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for ground-borne sound and vibration for the Proposed Scheme.

Consultation on the draft SMR

18.2.7 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for ground-borne noise, sound and vibration.

Engagement as part of the EIA process

18.2.8 Principal consultees on the approach to the assessment of ground-borne sound and vibration are the local and county authorities.

18.2.9 Dialogue with local stakeholder groups will be via community areas throughout the design and assessment of the Proposed Scheme as well as through public consultation on the formal EIA Report.

Key aspects of the Proposed Scheme for the topic

18.2.10 The key aspects for ground-borne sound and vibration are the following generic types of potential significant adverse effect that could occur without mitigation:

- at very high levels, which very rarely occur during the construction or operation of modern railways, vibration could give rise to a risk of cosmetic damage to buildings;
- perceptible ground-borne sound and vibration in residential buildings;
- low levels of ground-borne sound caused by imperceptible vibration could adversely affect buildings where low ambient sound levels are critical to their operation (e.g. recording and broadcast studios, concert halls and theatres); and
- low levels of vibration that would be imperceptible to people can adversely affect buildings where low ambient vibration is critical to operations (e.g.

nanotechnology laboratories).

18.2.11 The following are potential sources of ground-borne sound and vibration:

- temporary sources: e.g. tunnel boring machine(s) and their supporting temporary construction railways, some types of piling and vibro-compaction; and
- permanent sources: train operation and to a lesser extent other rail systems such as infrastructure maintenance depots.

Scope of assessment

18.2.12 Temporal scope: The construction of the Proposed Scheme will be assessed throughout the construction period. The operation of the Proposed Scheme will be assessed at the year of opening and for the year with the highest traffic patterns forecast for the first 15 years of operation. These will be compared, as necessary, with the future baseline in the year of opening (without the Proposed Scheme).

18.2.13 Spatial scope for direct effects: there is very little national guidance available on identifying screening distances for operational ground-borne vibration. The application of the United States (US) Federal Railroad Administration guidance[216] and Federal Transit Administration guidance[217] is consistent with the assessment of previous UK infrastructure projects. For a mitigated scheme, and taking account of reasonably foreseeable worst case assumptions, the US guidance sets the following screening distances for the assessment of the potential impact arising from the operation of a new rail system. A quantitative assessment will be undertaken for all receptors within the following areas:

- residential and non-residential receptors (except as defined below) - whichever is the greater of either 85m from the centreline of the track or nearest construction activity or the area within which impacts from ground-borne sound and/or vibration from the Proposed Scheme are forecast; and
- non-residential receptors / land uses where low ambient vibration or sound is critical to operations, for example, very sensitive laboratory equipment such as nanotechnology laboratories, sound recording / broadcast studios, large auditoria / theatres or concert halls - 200m from centreline of the track or nearest construction activity.

18.2.14 Spatial scope for indirect effects: a qualitative assessment will be made where the increase or decrease in rail traffic volumes or types caused by the Proposed Scheme would cause a change in the baseline Vibration Dose Value (VDV) from existing railways greater than 25% (refer to Table 39). On the assumption that the surface of temporary and permanent access roads and temporary haul routes for the Proposed Scheme will be maintained through the construction of the Proposed Scheme, the

[216] U.S. Department of Transportation and the Federal Railroad Administration (Office of Railroad Development), 2005, High-Speed Ground Transportation Noise and Vibration Impact Assessment, Federal Railroad Administration

[217] U.S. Department of Transportation and the Federal Transport Administration, 2006, Transit Noise and Vibration Impact Assessment Guidance Manual, Federal Transit Administration

effects of ground-borne vibration from construction road traffic are not considered to be significant.

Assessment methodology

Legislation and guidance

18.2.15 Relevant legislation includes the Control of Pollution Act 1974[218], the Environmental Protection Act 1990, the Noise and Statutory Nuisance Act 1993[219] and the Land Compensation Act 1973[220] (all as amended).

18.2.16 Relevant policy includes the NPPF, the Noise Policy Statement for England 2010 and the Government's planning guidance[221] on noise (PPGN).

18.2.17 The ground-borne sound and vibration potentially generated by the majority of construction activities will be calculated using the guidance in Transport Research Laboratory (TRL) Report 53[222] and TRL Report 429[223], and guidance in BS5228-2[224].

Impact criteria – direct impacts

18.2.18 The impact criteria differ according to the nature of the noise source, the sensitivity of the receptor and the local context so that it reflects the effect that the noise or vibration from the construction and operation of the Proposed Scheme exerts on the receptor. Therefore, the impact criteria are representative of what Government's Planning Practice Guidance Noise describes as the effect on the receptor.

18.2.19 The ground-borne sound and vibration potentially generated by rail operations associated with the Proposed Scheme, both temporary operations during construction and permanent, will be calculated using the calculation method developed and validated for the design and construction of Phase One[225] The method is empirical, developed from thousands of measurements, is fully consistent with ISO 14837[226], and takes account of all key parameters, including train design, train speed, track design, tunnel design, tunnel depth, ground conditions, receiving building foundations and receiving building type. The method has been further tested, validated and scrutinised at public inquiry on many urban mass transit systems around the world.

Ground-borne sound - construction and operation

18.2.20 There are no relevant national or international standards setting criteria for ground-borne sound. The impact criteria set out in Tables 36 and 37 have therefore been drawn from similar projects in the UK and Ireland (e.g. Phase One, Crossrail, the

[218] HM Government, 1974, Control of Pollution Act 1974, The Stationery Office
[219] HM Government, 1993, Noise and Statutory Nuisance Act, The Stationery Office
[220] HM Government, 1973, Land Compensation Act 1973, The Stationery Office
[221] Planning Practice Guidance – Noise: http://planningguidance.planningportal.gov.uk
[222] Transport Research Laboratory (TRL), 1986, TRL Report 53: Ground vibration caused by civil engineering works, TRL
[223] Transport Research Laboratory (TRL), 2000, TRL Report 429: Groundborne vibration caused by mechanised construction works, TRL
[224] British Standards Institute (BSi), 2009+A1:2014, BS 5228-2 Code of Practice for Noise and Vibration Control on Open Construction Sites - Part 2: Vibration, BSi
[225] HS2 Phase One Environmental Statement Volume 5, Appendix SV-001-000 Methodology, assumptions and assessment (route-wide) - Sound, noise and vibration
[226] International Standards Organisation (ISO), 2005, 14837 Mechanical vibration – Ground-borne noise and vibration arising from rail systems – Part 1: General Guidance, ISO

Jubilee Line, Dublin Area Rapid Transport Underground, Dublin Metro North and HS1). These projects assess ground-borne sound in terms of the absolute level of sound.

Table 36 - Ground-borne sound impact criteria for residential receptors

Impact classification	Ground-borne sound level dB LpASmax, (measured indoors, near the centre of any dwelling room on the ground floor)	**Effect**[227]
Negligible	< 35	Generally no adverse effect
Low	35-39	Potential significant effect when assessed on a community basis
Medium	40-44	
High	45-49	Significant effect
Very high	>49	

Table 37 - Ground-borne sound impact criteria for non-residential receptors

Category of building	**Impact criterion dB LpAS,max (Measured inside the noise sensitive part of the receptor)**
Theatres / large auditoria and concert halls	25
Sound recording / broadcast studios	30
Places of meeting for religious worship / courts / cinemas lecture theatres / museums / small auditoria or halls	35
Offices / schools / colleges / hospitals / hotels / libraries	40

Ground-borne vibration: buildings - construction and operation

18.2.21 The impact criteria for building damage are based upon guidance within BS7385: Part 2[228]. The standard differentiates between transient and continuous vibration (refer to the footnotes within Table 38). For transient vibration the standard notes that the risk of cosmetic damage to residential buildings starts at a Peak Particle Velocity (PPV) of 15 millimetres per second (mm/s) at 4 hertz (Hz). The standard also notes that below 12.5 mm/s PPV, the risk of damage tends to zero. When considering continuous vibration, the standard recommends the guide values are reduced by 50%.

18.2.22 Vibration from the operation of the permanent railway and all construction will be assessed in terms of the potential impact on buildings using the criteria presented in Table 38.

[227] As considered in the context of the EIA Regulations and defined in HS2 Phase One Environmental Statement Volume 5, Appendix SV-001-000 Methodology, assumptions and assessment (route-wide) - Sound, noise and vibration

[228] British Standards Institute (BSi), 1993, BS7385-2 Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration, BSi

Table 38 - Category of building impact criterion

Category of building	Impact criterion: (Peak Particle Velocity - PPV - at building foundation)	
	Transient[229] vibration	Continuous[230] vibration
Potentially vulnerable buildings[231]	≥6 mm/s	≥3 mm/s
Structurally sound buildings	≥12 mm/s	≥6 mm/s

Ground-borne vibration: disturbance of occupants and users of buildings - construction and operation

18.2.23 Guidance on the impact and effect of vibration on people in buildings is presented in BS6472: 2008[232]. Part 1 of the standard assesses the impact of vibration using the VDV. This is an indicator taking into account how people respond to vibration in terms of frequency content, vibration magnitude and the number of vibration events during an assessment period.

18.2.24 Vibration from the operation of the permanent railway and all construction will be assessed in terms of the potential impacts and adverse effects due to disturbance of occupants and users of buildings using the criteria presented in Table 39.

18.2.25 The change criteria presented in Table 39 have been developed using the guidance in BS6472 and are consistent with those applied to other projects such as Phase One, HS1 and Crossrail.

18.2.26 In the majority of locations along the Proposed Scheme, no existing appreciable level of vibration exists and therefore an absolute criterion is proposed. In certain locations, such as those close to an existing railway, change-based criteria are used. This approach is consistent with the vibration assessment of other major railway schemes.

[229] Transient vibration relative to building response such as impulsive vibration from percussive piling
[230] Continuous vibration relative to building response such as vibrating rollers
[231] BS7385 highlights that the criteria for aged buildings may need to be lower if the buildings are structurally unsound. The standard also notes that criteria should not be set lower simply because a building is important or historic (e.g. listed). Where information about these structures is not currently known, the significance criteria for these receptors has been set at a lower level on a precautionary basis
[232] British Standards Institute (BSi), 2008, BS6472 Guide to evaluation of human exposure to vibration in buildings Parts 1 and 2, BSi

Table 39 - Vibration impact criteria for the disturbance (annoyance) of occupants and building users

Impact classification	In the absence of appreciable existing levels of vibration[233] [234]		Appreciable existing levels of vibration[235]	Effect[236]
	VDV m/s1.75 Daytime (0700-2300)	VDV m/s1.75 Night time (2300 – 0700)	% increase or decrease in VDV	
Negligible	≤ 0.2	≤ 0.1	≤ 25	Generally no adverse effect
Minor	> 0.2 - 0.4	>0.1 - 0.2	25 - 40	Potential significant effect when assessed on a community basis
Moderate	> 0.4 - 0.8	> 0.2 - 0.4	> 40 - 100	
Major	> 0.8	> 0.4	>100	Significant effect

Ground-borne vibration: particularly vibration-sensitive equipment and processes – construction and operation

18.2.27 As noted in ISO 14837-1, there are no standard criteria for assessing the potential impact of vibration on sensitive equipment or processes. Where a receptor within the study area is identified that is likely to be especially sensitive to ground-borne sound and/or vibration, a risk assessment will be undertaken for that receptor based on the information currently available for the relevant equipment/process, or information provided by the building owner or equipment manufacturer.

Impact criteria - indirect impacts

18.2.28 The impact criteria differ according to the nature of the noise source, the sensitivity of the receptor and the local context so that it reflects the effect that the noise or vibration of the Proposed Scheme exerts on the receptor. Therefore, the impact criteria are representative of what Government's Planning Practice Guidance Noise describes as the effect on the receptor.

18.2.29 Changes in road / rail traffic flows on the existing network will be used to calculate changes in vibration, at source, in VDV. These changes will be compared with the criteria in Table 39 to indicate whether the change could result in a potential impact.

Significance criteria

Significance criteria - residential receptors

18.2.30 For residential receptors, significant effects will be determined by taking into account:

- the type of effect being considered;

[233] Highest impact category used, daytime or night–time
[234] Determined at the worst location on a normally loaded floor (usually the centre of the floor)
[235] Where there is an appreciable existing level of vibration and daytime and night-time vibration dose vales (VDVs) exceed 0.2ms-1.75 and 0.1ms-1.75 respectively
[236] As considered in the context of the EIA Regulations and defined in HS2 Phase One Environmental Statement Volume 5, Appendix SV-001-000 Methodology, assumptions and assessment (route-wide) - Sound, noise and vibration

- the magnitude of the impacts and available dose-response information;
- the number and grouping of impacts;
- the potential combined impacts of airborne sound, ground-borne sound and ground-borne vibration;
- any unique features of the Proposed Scheme's sound or vibration impacts in the area being considered (which may require secondary acoustic indicators/criteria);
- the frequency and duration over which temporary construction impacts may occur; and
- the effectiveness of mitigation through design or other means.

Significance criteria - non-residential receptors

18.2.31 For non-residential receptors, significant effects will be determined by taking into account:

- the type of effect being considered;
- the magnitude of the impact;
- the design of the receptor affected;
- the existing ambient sound and vibration levels in the receptor affected;
- the use and sensitivity of the receptor;
- the potential combined impacts of airborne sound, ground-borne sound and vibration;
- any unique features of the Proposed Scheme's sound or vibration impacts in the area being considered (which may require secondary acoustic indicators/criteria);
- the frequency and duration over which temporary construction impacts may occur; and
- the effectiveness of mitigation through design or other means.

Cumulative effects

18.2.32 Sound and vibration impacts, both permanent and temporary, will be identified for the Proposed Scheme and other developments, either under construction or consented as referred to in Section 4 (EIA Methodology) of this SMR. The results of these assessments will then be used to qualitatively assess potential cumulative significant effects arising from the Proposed Scheme and any other developments having regard to, amongst other things, spatial and temporal overlap of the sound and vibration impacts.

18.2.33 Community, ecological or heritage adverse effects arising from impacts and effects identified for ground-borne noise and vibration will be considered and reported in the relevant sections of the formal EIA Report.

Assumptions

18.2.34 Assumptions, relevant to scope and methodology, for the ground-borne sound and vibration assessment include:

- design assumptions (e.g. train specification, revenue service speeds and timetables); and
- maintenance specifications.

18.3 Airborne sound

Introduction

18.3.1 This section presents the proposed approach to assessing airborne sound associated with the construction and operation of the Proposed Scheme. Sound generated by the Proposed Scheme has the potential to cause disturbance to neighbouring sound sensitive receptors.

18.3.2 Without mitigation, during construction, airborne sound would be generated by equipment, construction worksites, construction vehicles on haul routes and local roads, and changes to road traffic.

18.3.3 During operation, airborne sound would be generated by trains and other (fixed) sources such as: line side equipment; ventilation shafts and stations. The Proposed Scheme may also cause changes in road and rail traffic flow on the current road and rail networks.

18.3.4 The assessment will cover all sound sensitive receptors, including properties for which planning permission has been granted before the safeguarding date but are not yet completed, subject to the screening distances discussed within the specific subject areas. Where a receptor has multiple uses the assessment will be made based on the most sensitive use.

Establishment of baseline and definition of survey

18.3.5 To facilitate dialogue with stakeholders, baseline information will be gathered incrementally through field surveys focused on locations where likely significant effects are forecast. The baseline and impact assessment for the Proposed Scheme will be developed and refined in three stages.

18.3.6 Initially, existing data will be gathered to form the 'desk top' baseline (Baseline 1). Baseline 1 data will be used early in the programme to support initial dialogue, assessment work and design development. Following Baseline 1, initial field surveys will be undertaken to fill gaps in Baseline 1 data and provide more detailed information at locations where significant effects are likely. Combined with Baseline 1, these data will form Baseline 2, to be used for the working draft EIA Report. Further, more targeted surveys will be undertaken in responses to the findings of the working draft EIA Report assessments and ongoing stakeholder dialogue. Combined with Baseline 2, these data will provide Baseline 3 for the formal EIA Report.

18.3.7 The baseline data gathering will focus not just on collecting objective data that describes the ambient sound environment, but also information on the local sound environment, including indicators of its soundscape.

Consultation and engagement

Consultation on the Sustainability Statement

18.3.8 Responses to consultation on the Phase Two Proposed Scheme raised the following matters in respect of the acoustic assessment presented in the Sustainability Statement. The manner in which each matter will be considered as part of the EIA follows:

- the use of landscape earthworks to provide noise mitigation;
- the mitigation design will be developed (utilising landscape earthworks and noise fence barriers as appropriate) and will be detailed in the formal EIA Report;
- consideration of PRoW and waterways; and
- the potential effects of noise on users of PRoW and waterways will be considered in the EIA and detailed in the formal EIA Report.

18.3.9 None of the Phase Two Sustainability Statement consultation responses were considered to alter the scope and methodology for airborne sound for the Proposed Scheme.

Consultation on the draft SMR

18.3.10 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for airborne noise, sound and vibration.

Engagement as part of the EIA process

18.3.11 Principal consultees on the approach to the assessment of airborne sound are the local and county authorities.

18.3.12 Engagement with local stakeholder groups will be via community areas throughout the design and assessment of the Proposed Scheme.

Key aspects of the Proposed Scheme for the topic

18.3.13 The following are potential sources of airborne sound:

- temporary sources:
  - direct effects could be caused by airborne sound from significant construction activities such as tunnelling, demolition, earthworks, viaducts, bridges, road realignments, utility works and track works. These activities would be supported from local work compounds close to the structure or tunnel being constructed, local worksites, or larger worksites from where activities are coordinated; and
  - indirect effects could be caused by temporary changes to road and rail traffic patterns on the existing networks during construction.
- permanent sources:
  - direct effects could be caused by the operational railway and its supporting systems

(e.g. infrastructure maintenance depots, vent shafts, other line side equipment and maintenance); and

- indirect effects could be caused by long term changes to road and rail traffic pattern on the existing networks.

Scope of assessment

18.3.14 Temporal scope: The construction of the Proposed Scheme will be assessed on a monthly basis throughout the construction period. The operation of the Proposed Scheme will be assessed, as necessary, in the short term at the year of opening; and in the long-term with the highest rail traffic patterns forecast for the first 15 years of operation. These will be compared, as necessary, with the future baseline in the year of opening (without the Proposed Scheme).

18.3.15 Spatial scope for direct effects - for a mitigated Proposed Scheme and taking account of reasonably foreseeable worst case assumptions, the following screening distances will be used which are consistent with Phase One, HS1 and in excess of guidance from sources such as US Federal Railroad Administration Guidance for high speed rail:

- construction (from BS5228-1[237]) - 300m from any construction activity or the area within which sound levels from the Proposed Scheme are forecast to give rise to potential impacts, whichever is the greater; and
- operational Proposed Scheme - 500m and 1km from the centreline of the line of route in urban and rural areas respectively, or the area within which sound levels from the Proposed Scheme are forecast to give rise to potential impacts, whichever is the greater.

18.3.16 Spatial scope for indirect effects - a qualitative assessment will be made where the increase or decrease in road or rail traffic volumes or traffic types caused by the construction and operation of the Proposed Scheme would be likely to cause a change in the baseline sound level (LpAeq,T) exceeding 1dB during either the day (07:00 to 23:00) or night time periods (23:00 to 07:00).

Assessment methodology

Legislation and guidance

18.3.17 Relevant legislation includes the Control of Pollution Act 1974, the Environmental Protection Act 1990, the Noise and Statutory Nuisance Act 1993, the Land Compensation Act 1973 (including the Noise Insulation Regulations) and the European Communities Act 1972 (including the Environmental Noise (England) Regulations 2006) (all as amended).

18.3.18 Relevant policy includes the NPPF, the Noise Policy Statement for England 2010 and the Government's PPGN.

[237] British Standards Institute (BSi), 2009+A1:2014, BS 5228-1 Code of Practice for Noise and Vibration Control on Open Construction Sites - Part 1: Noise, BSi

18.3.19 Relevant guidance and standards include, in part, the Transport Analysis Guidance[238], and as identified in each of the following sections.

18.3.20 The airborne sound generated by construction activities will be calculated in line with the method set out in BS5228-1.

18.3.21 The airborne sound generated by rail operations associated with the Proposed Scheme, both mainlines and connecting chords, and classic lines will be calculated using the calculation method developed and validated for the Phase One environmental assessment[239]. The method is empirical, developed from over a thousand measurements. The method calculates maximum sound levels for each train, as well as equivalent continuous sound levels. The Calculation of Road Traffic Noise (CRTN) 1988[240] will be used to predict the airborne sound from road traffic with the spatial scope (see Section 19, Traffic and transport).

18.3.22 The airborne sound generated by the Proposed Scheme's rail supporting systems (e.g. depots, train stabling, vent shafts) will be calculated using appropriate national or international standards (e.g. ISO9613[241]). Plant is generally not finalised until the detailed design phase. As such, where insufficient information is available on plant to be used, limits will be set based on baseline sound data.

18.3.23 The impact criteria differ according to the nature of the noise source, the sensitivity of the receptor and the local context so that it reflects the effect that the noise or vibration of the Proposed Scheme exerts on the receptor. Therefore, the impact criteria are representative of what Government's PPGN describes as the effect on the receptor.

18.3.24 The number and location of properties estimated to qualify under the Noise Insulation Regulations and the HS2 discretionary construction and operational policies will be reported.

Impact criteria - direct impacts

Airborne sound – construction

18.3.25 The construction sound assessment categories for the Proposed Scheme are presented in Table 40. These are based upon the experience from other major infrastructure projects and BS5228-1. The criteria are guided by the prevailing baseline ambient sound levels in the locale of the receptor.

[238] Department for Transport (DfT), 2015, Transport Analysis Guidance (TAG), Unit A3 Environmental Impact Appraisal, Section 2, Noise Inputs, DfT

[239] HS2 Phase One Environmental Statement Volume 5, Appendix SV-001-000 Methodology, assumptions and assessment (route-wide) - Sound, noise and vibration

[240] Department of Transport (Welsh Office), 1988, Calculation of Road Traffic Noise, HMSO

[241] International Standards Organisation (ISO), 1996, ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation, ISO

Table 40 - Airborne sound from construction - impact criteria at residential receptors (construction sound only)

Period	Assessment category		
	A	B	C
Day: T=12hr, Weekdays, 07.00-19.00, T=6hr, Saturday, 07.00-13.00	>65 dB LpAeq,T	>70 dB LpAeq,T	>75 dB LpAeq,T
Evenings and weekends: T=1hr Weekdays 19.00–23.00, Saturdays 13.00-23.00, Sundays 07.00-23.00	>55 dB LpAeq,T	>60 dB LpAeq,T	>65 dB LpAeq,T
Night: T=1hr Every day 23.00-07.00	>45 dB LpAeq,T	>50 dB LpAeq,T	>55 dB LpAeq,T

Notes:

All sound levels are defined at the façade of the receptor.

Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values.
Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values.
Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values.

If the ambient sound level exceeds the Assessment Category C threshold values given in the table (i.e. the ambient sound level is higher than the above values), then an impact is deemed to occur if the construction LpAeq,T sound level for the period is greater than the ambient noise level.

18.3.26 During the day, evening or night, a construction noise adverse effect on a receptor will be identified where the impact of the Proposed Scheme is greater than the relevant assessment category value.

18.3.27 During the day, evening or night, a construction noise adverse significant effect on a receptor will be identified where the impact of the Proposed Scheme is greater than the Assessment Category C value or if the ambient sound level exceeds the Assessment Category C threshold values given in Table 40, whichever is the higher.

Airborne sound – operational

18.3.28 The magnitude of an impact arising from a change in sound level due to the operation of the Proposed Scheme (road or rail, direct or indirect sources) will be quantified using the scale in Table 41.

Table 41 - Airborne sound from operational train movements - impact criteria for residential receptors[242]

Long term impact classification	**Short term impact classification**	**Sound level change dB LpAeq, T (positive or negative) T = either 16hr day or 8hr night**
Negligible	Negligible	≥ 0 dB and < 1 dB
	Minor	≥ 1 dB and < 3 dB
Minor	Moderate	≥ 3 dB and < 5 dB
Moderate	Major	≥ 5 dB and < 10 dB
Major		≥ 10 dB

18.3.29 During the day (0700-2300), operational noise adverse or beneficial effects on residential receptors will be identified where the impact of the Proposed Scheme is:

- an absolute free-field sound level at or above 50dB $L_{pAeq,16hr}$; and
- where the magnitude of the impact and its effect on a receptor is indicated by the change in the equivalent continuous sound level as defined in Table 41.

18.3.30 During the day (0700-2300), an operational noise significant adverse effect at residential receptors will be identified where the impact of the Proposed Scheme is an absolute free-field sound level at or above 65dB $L_{pAeq,16hr}$.

18.3.31 During the night (2300-0700), operational noise adverse or beneficial effects on residential receptors will be identified where the impact of the Proposed Scheme is:

- an absolute free-field sound level at or above 40 dB $L_{pAeq,8hr}$; and
- where the magnitude of the impact and its effect on a receptor is indicated by the change in the equivalent continuous sound level as defined in Table 41.

18.3.32 During the night (2300-0700), an operational noise adverse effect on a residential receptor will also be identified where the impact of the Proposed Scheme exceeds an absolute sound level of 60 dB L_{pAFmax} at the façade.

18.3.33 During the night (2300-0700), an operational noise significant adverse effect will be identified on residential receptors where the impact of the Proposed Scheme is:

- an absolute free-field sound level at or above 55 dB $L_{pAeq,8hr}$; or
- an absolute sound level above 85 dB L_{pAFmax} at the façade (outside) of a residential receptor (where the number of events exceeding this value is less than or equal to 20); or

[242] Based on the Highways Agency, 2011, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7 Noise and Vibration document HD213/11

- an absolute sound level above 80 dB L_{pAFmax} at the façade (outside) of a residential receptor (where the number of events exceeding this value is greater than 20).

18.3.34 By exception, impacts and resulting adverse or beneficial effects may also be identified following consideration of any unique features of the sound impact from the Proposed Scheme and/or the character of the existing soundscape.

18.3.35 The impact criteria at non-residential properties set out in Table 42 have been drawn from various national and international guidance documents and are as utilised on Phase One.

Table 42- Airborne sound from operational train movements - impact criteria at non-residential properties

Category of building		**Impact (screening) criterion**		**Potential effect**	**Reference**
Code	**Description**	**Day 0700-2300**	**Night 2300-0700**		
G1	Theatres; large auditoria and concert halls	60dB[1] LpAFmax or 50dB[1] LpAeq,T and Not > than existing		'Q' deterioration of acoustic Quality	FRA/FTA, BS8233[243]
G2	Sound recording; broadcast studios	60 dB[1] LpAFmax or 50 dB[1] LpAeq,T and Not > than existing			
G3	Places of meeting for religious worship; courts; cinemas; lecture theatres; museums; and small auditoria or halls	50 dB[2] LpAeq,T and a change > 3dB	-	'D' Disturbance	BS8233, EFA's Acoustics Performance Standards[244], TDM4032:0.3: England[245], WHO Guideline
G4	Schools; colleges; hospitals*; hotels*; and libraries	50 dB[2] LpAeq,T and a change > 3dB	45* dB[3] LpAeq,T and a change > 3 dB	'DSd' Disturbance and sleep disturbance	

[243] BS8233 (2014) Guidance on sound insulation and noise reduction for Buildings. British Standards Institution

[244] Building Bulletin 93 (2014). Acoustic design of schools: Performance standards. Department for Education / Education Funding Agency. The Stationery Office Limited

[245] Stationary Office (2011) Acoustics: Technical Design Manual 4032:0.3. The Stationery Office Limited

Category of building		Impact (screening) criterion		Potential effect	Reference
Code	Description	Day 0700-2300	Night 2300-0700		
G5	Offices and external amenity spaces[246]	ABC[4] / 55dB[5] [6] LpAeq,T and a change > 3dB	-	'D' Disturbance	BS8233, BCO guidance[247]

[1] Based on an internal level of 25 LpAeq,T consistent with BS8233 and 25 dB LpASmax consistent with FRA/FTA guidance for the operation of the railway and specific construction activities such as percussive piling. To require these criteria the internal sound levels due to existing sources (internal and external) must already be reduced to these criteria or lower. Given typical environments this would suggest any such receptor would have a level of sound insulation from the building shell (including windows and ventilation penetrations) that would reduce external levels by at least 25 to 30 dB. Also allows for façade correction and conversation from slow to fast time response.

[2] Based on an internal level of 35 dB LpAeq,T consistent with Building Bulletin 93 and BS8233 etc. Equivalent external level assuming 15 dB for a partially open window.

[3] Based on an internal level of 30 dB LpAeq,T consistent with BS8233, WHO guidelines etc. Equivalent external level assuming 15 dB for a partially open window.

[4] For construction assess using A and B categories from ABC method consistent with AL72.

[5] Based on an internal level of 40 dB LpAeq,T consistent with BS8233, BCO guidelines etc. Equivalent external level assuming 15 dB for a partially open window.

[6] Based upon guidance from World Health Organisation 'Guidelines for community noise'.

Airborne sound – operational static sources

18.3.36 Static sources include a range of permanent works associated with the Proposed Scheme, such as fixed plant at depots, line side equipment, tunnel ventilation shafts and tunnel pressure relief shafts.

18.3.37 Sound from static sources will be evaluated by comparing the rating level against background levels following the principles set out in BS4142[248]. The background level used in the evaluation will be representative of those typically occurring at the receptor during the day and night depending on the source's hours of operation.

18.3.38 Operational static source impacts will be identified where the rating level of the new sound source exceeds the background level by a margin greater than 5dB. The semantic descriptors used to describe the impact will be as described in Table 43.

[246] As referred to in the Planning Practice Guidelines – Noise (2014), these are relatively quiet outdoor areas: for sole use by residents as part of the amenity of their dwelling; protected for sole use by a limited group of residents as part of the amenity of their dwelling; or protected as publicly accessible for residents as part of the amenity of their dwelling that are nearby

[247] British Council for Offices (2014). Guide to Specification. The British Council for Offices

[248] British Standards Institute (BSi), 2014, BS4142 Method for rating industrial noise affecting mixed residential and industrial areas, BSi

Table 43 - Airborne sound from operational static sources - impact criteria

Impact classification	Rating level – background level
No impact	< -10dB
Negligible	≥ -10dB and < 0dB
Minor	≥ 0dB and < 5dB
Moderate	≥ 5dB and < 10dB
Major	≥ 10dB

18.3.40 The impact criteria differ according to the nature of the noise source, the sensitivity of the receptor and the local context so that it reflects the effect that the noise or vibration of the Proposed Scheme exerts on the receptor. Therefore, the impact criteria are representative of what Government's Planning Practice Guidance Noise describes as the effect on the receptor.

Impact criteria - indirect impacts

18.3.41 Changes in traffic flows on the existing road and rail network will be used to calculate changes, at source, in equivalent continuous sound levels ($L_{pAeq,16hr}$). A minor impact (3dB or greater) will be taken as an indicator of a potential significant effect unless the area being considered is currently exposed to high levels of sound, in which case, a change of 1dB or greater may be taken as an indicator of potential significance.

Significance criteria

Significance criteria - residential receptors

18.3.42 For residential receptors, significant effects will be determined for any source from the Proposed Scheme by taking account of the following factors:

- type of effect being considered;
- the number and grouping of receptors subject to impacts[249];
- the magnitude of the impacts and available dose-response information;
- the existing sound environment in terms of the absolute level[250] and the character of the existing soundscape;
- any unique features of the Proposed Scheme's sound or impacts in the area being considered (which may require secondary acoustic indicators / criteria);
- the potential combined impacts of sound and vibration;

[249] Evaluated using the impact criteria set out earlier in this section

[250] As one example: for operational rail sound, greater weight will be given to a sound level change between 1 dB and 3 dB if the area is already exposed to high levels of noise. High levels of noise exposure will be evaluated having regard to the criteria contained in the Noise Insulation (Railway and Other Guided Transport Systems) Regulations 1996, and the Noise Action Plans in England (Defra 2012) for 'First Priority Locations' and 'Important Areas'

- the duration of impact for temporary sources; and
- the effectiveness of mitigation through design or other means.

Significance criteria - non-residential receptors and land uses

18.3.43 For non-residential receptors and land uses, significant effects will be determined, on a receptor-by-receptor basis, by taking into account:

- the type of effect being considered;
- the use and sensitivity of the receptor or land use;
- the design of the receptor or land use affected;
- the existing sound environment in the receptor, or on the land use, affected;
- the magnitude of the forecast impact;
- the potential combined impacts of sound and vibration;
- any unique features of the Proposed Scheme's sound or impacts in the area being considered (which may require secondary acoustic indicators / criteria);
- the frequency and duration over which temporary construction impacts may occur; and
- the effectiveness of mitigation through design or other means.

Significance criteria - quiet areas

18.3.44 Effects on quiet areas or other resources which are valued for providing tranquillity will be assessed having regard to:

- the type of effect being considered;
- the criteria set out in the Noise Action Plans in England for 'Quiet Areas'[251];
- tranquillity indicators (for land use) - refer also to Section 15 (Landscape and visual) of this SMR;
- any unique features of the Proposed Scheme's sound or impacts in the area being considered (which may require secondary acoustic indicators / criteria);
- the duration over which temporary construction impacts may occur; and
- the effectiveness of mitigation through design or other means.

[251] Department for Environment, Food and Rural Affairs (Defra); Environmental Noise; Noise Action Plans, 2014 Accessed online at: https://www.gov.uk/government/publications/noise-action-plans-large-urban-areas-roads-and-railways

Cumulative effects

18.3.45 Community, socio-economic, ecological, landscape/visual (including tranquillity) or heritage effects arising from impacts and effects identified for airborne sound will be considered and reported in the relevant section of the formal EIA Report.

18.3.46 In line with Government noise policy (NPPF and PPGN) the scope and methodology in this section aims to ensure that, in line with Government policy on sustainable development, significant adverse impact on health and quality life (wellbeing) due to noise are avoided and adverse impacts on health and quality of life (wellbeing) are minimised. This section of the SMR should be read in combination with the heath section of the SMR.

18.3.47 Secondary effects (e.g. on landscape) associated with mitigation (e.g. noise barriers) proposed to reduce or remove significant airborne sound effects will be considered under the relevant section of the formal EIA Report.

18.3.48 Sound and vibration impacts, both permanent and temporary, will be identified for the Proposed Scheme and other developments, either under construction or consented as referred to in Section 4.4 (Cumulative effects) of this SMR. The results of these assessments will be used to qualitatively assess potentially significant cumulative effects arising from the Proposed Scheme and these committed developments having regard to, amongst other things, spatial and temporal overlap of the sound and vibration impacts.

Assumptions

18.3.49 Assumptions, relevant to scope and methodology, for the airborne sound assessment include:

- design assumptions (e.g. train specification, revenue service speeds and timetables);
- maintenance specifications; and
- sound emission limits as set by the Technical Specification for Interoperability as amended[252].

[252] European Commission, 2014, Commission Regulation (EU) No 1304/2014 of 26 November 2014 on the technical specification for interoperability relating to the subsystem 'rolling stock -noise' amending Decision 2008/232/EC and repealing Decision 2011/229/EU

19 Traffic and transport

19.1 Introduction

19.1.1 This section of the SMR provides guidance for the traffic and transport assessment. Further details on criteria and application of the guidance are provided in the 'Traffic and transport guidance on further development of significance criteria' Phase One Technical Note as referenced in Annex A.

19.1.2 The traffic and transport assessment will present an assessment of the impacts on pedestrians, cyclists, equestrians, mobility impaired people, highways and public transport. It will cover the impacts that are likely to occur during both the construction and where appropriate the operational periods of the Proposed Scheme.

19.1.3 The Proposed Scheme is a transport project and therefore by its very nature will affect existing transport networks. A transport assessment is being undertaken which will inform the traffic and transport section of the formal EIA Report.

Issues to be considered:

19.1.4 The following key effects will be among those assessed:

- changes in traffic (including heavy goods vehicles (HGV)), public transport, pedestrian and cyclist flows;
- alterations to road layout/closures/diversions/widening/alterations (including stopping and passing places)/junction improvements/diversion of PRoW;
- changes to journey times and journey distances for private and commercial vehicle occupants;
- changes in accessibility, journey times and public transport;
- changes to interchange, parking, taxi parking/ operation, and delivery and servicing;
- changes to bus routes and stop locations; and
- changed journey times and distances, and changes in amenity and ambience, for vulnerable road users and waterway users.

19.2 Establishment of baseline and definition of survey

19.2.1 Traffic data, traffic surveys and, where appropriate, modelling will be undertaken to inform the transport assessment along the route of the Proposed Scheme. These transport data will also be used to provide information to determine the baseline for the traffic and transport assessment within the formal EIA Report.

19.2.2 The future baseline will include consideration of the growth in travel demand, including the changes arising from other developments and proposed transport network improvements.

19.3 Consultation and engagement

Consultation on the Sustainability Statement

19.3.1 Traffic and transport was not specifically covered by the Sustainability Statement as an individual topic. This is because the effects on traffic and transport from the construction and operation of HS2 are dependent on detailed information that was not available at the early strategic stage of the Appraisal of Sustainability.

19.3.2 Nevertheless, a number of consultation responses received were about the impacts on local communities from construction traffic. These comments were made largely in relation to the noise, dust, emissions, disruption and congestion that construction traffic would cause.

Consultation on the draft SMR

19.3.3 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

Engagement as part of the EIA process

19.3.4 The following organisations will be amongst those to be consulted on traffic and transport issues:

- highway authorities;
- Highways England; and
- Network Rail.

19.3.5 As the Proposed Scheme develops, other relevant stakeholders may also be consulted.

19.4 Key aspects of the Proposed Scheme for the topic

19.4.1 Construction and operation of the following elements, where relevant to the phase of the Proposed Scheme being assessed and to the topic of traffic and transport, will include:

- the railway itself;
- stabling, infrastructure maintenance and rolling stock depots;
- interfaces with other public transport and highway networks including changes to existing, new and improved infrastructure and services;
- PRoW and users (pedestrians, cyclists etc.);
- all construction including tunnelling, tunnel portals and vent shafts, HGV routes and points of access, haul routes and construction sites;
- car parking; and
- waterway users.

19.5 Scope of assessment

Spatial scope

19.5.1 The spatial scope of the traffic and transport assessment will be different for the construction and operational impacts being assessed.

Spatial scope – construction

19.5.2 The assessment will focus on traffic and transport issues resulting from land required for worksites, the presence of construction traffic on the local road network, and effects on routes crossing the construction areas (PRoW and highways). The extent of the assessment will include:

- the highway network (including parking, loading and access arrangements) affected by construction worksites and on routes used by construction traffic, focusing on routes between worksites and the strategic road network surrounding the Proposed Scheme;
- public transport networks affected by construction works including rail, bus and coach services, including lines, routes, services and stations/interchanges that may be indirectly affected by the Proposed Scheme;
- transport interchange arrangements such as bus to rail in the vicinity of the Proposed Scheme;
- pedestrian, cyclist and equestrian routes in the vicinity of the Proposed Scheme;
- railways used to transport materials and excavated materials; and
- navigable waterways.

Spatial scope – operation

19.5.3 The spatial scope will include the transport routes where there is a significant change in the usage either through people accessing the Proposed Scheme, or from changes to travel demand on other routes or modes. It will also include roads and other rights of way that are permanently diverted or stopped up.

19.5.4 The assessment will therefore include:

- the highway network where changes are likely to occur as a result of the Proposed Scheme;
- the public transport system (and transport networks used to access the public transport system) where it is affected by the increased usage or changed journey patterns arising from the Proposed Scheme, including heavy and light rail, underground and bus and coach services;
- pedestrian, cyclist and equestrian routes in the vicinity of the Proposed Scheme; and
- navigable waterways potentially affected by the Proposed Scheme.

Temporal scope

19.5.5 Potential effects of the Proposed Scheme will be considered for the following:

- construction Period (2020-2026, including commissioning) to be assessed against a base year of 2023: impacts arising from construction;
- opening year for operation (2027): impacts associated with operation; and
- future assessment year for operation (2041): consistent with the Phase One assessment and assumed to reflect the full technical capacity and operation of HS2 as a whole (Phase One, Phase 2a and Phase 2b).

19.6 Assessment methodology

19.6.1 The traffic and transport effects arising from the construction strategy and engineering design for the Proposed Scheme will be assessed as part of the EIA process. The traffic and transport assessment developed for the Proposed Scheme will provide the forecasts of passenger and vehicle movements and transport network characteristics that will be used in the EIA.

19.6.2 Having established the likely changes on the road, public transport, PRoW or waterway networks during construction and operation, impacts will be assessed using a set of criteria developed for the Proposed Scheme.

19.6.3 The criteria used for the identification and assessment of potentially significant impacts are provided below. The magnitude of each impact and its significance will be assessed by a variety of mechanisms, including as necessary computer modelling and professional judgement.

Guidance

19.6.4 Whilst there is no legislation on how traffic and transport assessments should be undertaken the following guidance documents are relevant:

- DfT's Guidance on Transport Assessment[253] (now withdrawn);
- NPPF, March 2012; and
- DCLG, March 2014, Guidance on Travel Plans, transport assessments and statements in decision-taking[254].

Significance criteria for construction assessment

19.6.5 The criteria outlined below will be used to assess the significance of temporary traffic and transport impacts during the construction of the Proposed Scheme from work sites along the Phase 2a route. Some of the significance criteria may be further refined in the development of the traffic and transport assessment.

[253] Department for Transport (DfT), 2007, Guidance on Transport Assessment, DfT – now archived
[254] Department for Communities & Local Government, 2014, Guidance on Travel Plans, transport assessments and statements in decision-taking

19.6.6 The criteria have been based on information included in the guidance documents previously referenced, in the following documents, and using professional judgement:

19.6.7 DMRB Volume 11: Environmental Assessment (1993 and updates):

- DfT's WebTAG;
- Guidelines for the Environmental Assessment of Road Traffic[255]; and
- Guidelines for Traffic Impact Assessment[256].

19.6.8 With the exception of accidents and safety, impacts with a duration of less than four consecutive weeks in any 12 month period are not generally considered significant.

Public transport delay

19.6.9 A significant impact on journeys by bus and heavy and light rail affected by the Proposed Scheme will be identified from the traffic and transport assessment and the transport modelling results; and is defined as any of the following where this lasts for more than four consecutive weeks in any 12 month period:

- changes of more than 10% in a majority of journey times by rail based modes;
- changes in journey distance by bus of more than 400m in urban areas and 1km in rural areas;
- a relevant delay, disruption or overcrowding impact affecting the public transport network over a wide area; and
- a relevant change to service frequency, capacity, loss of through connections or reduction in hours of operation.

Station/interchange impacts

19.6.10 Although there are no stations or interchanges within the Proposed Scheme, potential impacts during construction on stations or interchanges at locations not included in the Proposed Scheme will be assessed. A significant impact on stations/interchanges is defined as a change in the vicinity of stations/interchanges that lasts for more than four consecutive weeks in any 12 month period including:

- loss of physical linkage for the next stage of the journey;
- loss of or relocation of more than 100m of bus facilities and operations (e.g. of bus stops, passenger waiting facilities, bus stands or operator facilities);
- loss of or relocation of more than 100m of taxi facilities and operations (e.g. taxi stands, passenger waiting facilities or operator facilities); and
- loss of or relocation of more than 100m of 'park-and-ride' facilities or operations (e.g. dropping off areas).

[255] Institute of Environmental Assessment (IEA), 1993, Guidelines for the Environmental Assessment of Road Traffic, IEA
[256] Institution of Highways and Transportation, 1994, Guidelines for Traffic Impact Assessment, Institution of Highways and Transportation

Traffic flows and delays to vehicle occupants

19.6.11 A significant change in driver/vehicle passenger delay (including delays to bus and coach passengers) is defined as any one of the following:

- a diversion for more than four consecutive weeks in any 12 month period that leads to an increase in journey length of more than 1km on a route carrying more than 100 vehicles per day, or 5km on a route carrying more than 40 vehicles per day, or 10km on any other route;
- where a significant change in delay relating to junction congestion resulting from the construction of the Proposed Scheme is forecast in the traffic and transport assessment and the outputs from the traffic modelling. This will be measured either as the forecast ratio of flow to capacity or degree of saturation. The junctions for consideration will be discussed with the local Highways Authority; and
- where there is a change in traffic flow along a road link and the capacity of that link is constrained to a greater extent than the junctions along it, then a similar approach will be used to assess potential delays to road users.

19.6.12 A change in traffic levels can result in changes to traffic-related severance for non-motorised road users, particularly pedestrians using or seeking to cross a road. A significant change is defined as: a 30% increase in traffic flows (either HGVs or all vehicles)[257], where the increase is greater than 40 vehicles per day in urban areas or 10 vehicles per day in rural areas.

19.6.13 Where the road affected by increased traffic levels is not, in any case, suitable for pedestrians crossing (such as a high speed dual carriageway) or safe and adequate crossing points exist, increased traffic levels would not generally be considered significant in relation to traffic-related severance for non-motorised users.

Parking and loading

19.6.14 A significant impact arising from the Proposed Scheme on parking and loading, where facilities are identified to be heavily used, is defined as a change for more than four consecutive weeks in any 12 month period of:

- a predicted increase of 10 or more, or 10%, whichever is the greater, in on-street parking demand;
- a loss of any designated on-street or off-street spaces, including spaces for disabled persons, buses, taxis, doctors, ambulances, police vehicles and car club bays;
- a loss of 10 or more, or 10%, whichever is the greater, of restricted on-street parking (such as residents' parking bays) or private off-street car parking spaces;

[257] Based on Institute of Environmental Assessment (IEA), 1993, Guidelines for the Environmental Assessment of Road Traffic, IEA

- a loss of 10 or more, or 10%, whichever is the greater, off-street station car parking spaces;
- a loss of 10 or more, or 10%, whichever is the greater, pedal or motorcycle parking spaces; and
- a loss of 10% or more designated loading bay spaces or facilities.

Vulnerable road user delay, amenity and ambience

19.6.15 Impacts of delays on pedestrians, cyclists, equestrians and others will be assessed based on changes in the 'person-minutes' of the journey times of pedestrians and other non-motorised travellers[258]. The following information will be addressed:

- numbers of pedestrians, cyclists equestrians and others;
- changes in journey time in minutes; and
- changes in ambience (journey quality) of the route used.

19.6.16 The changes in journey times will be defined in proportion to the scale of the impacts being assessed, for example as not significant (less than one minute), minor (between one and two minutes), moderate (between two and three minutes) and major (greater than three minutes); and the numbers of travellers affected as: minor (less than 200 per day in total), moderate (between 200 and 1,000 per day) and major (greater than 1,000 per day). The significance of the impacts are based on the matrix shown in Table 44, where beneficial impacts occur if journey times are reduced or adverse impacts occur if journey times are increased.

Table 44 - Significance levels for travellers affected by delay during construction[259]

	Number of travellers affected		
Journey time changes	**Minor**	**Moderate**	**Major**
Minor	Neutral	Neutral	Minor
Moderate	Neutral	Minor	Moderate
Major	Minor	Moderate	Major

19.6.17 In addition, the convenience and attractiveness of the routes for vulnerable users will be considered. This should be assessed in relation to the scale of any change although this will require a more qualitative assessment. WebTAG Unit 3.3.13's The Journey Ambience Sub-Objective document [260], describes the assessment of ambience, which includes traveller's amenity. Traveller's journey ambience can be affected by:

[258] Based on Department for Transport (DfT), 2003, Transport Analysis Guidance (TAG), Impacts on Pedestrians, Cyclists and Others: WebTAG Unit 3.5.5, DfT
[259] Source: Department for Transport (DfT), 2003, Transport Analysis Guidance (TAG), Impacts on Pedestrians, Cyclists and Others: WebTAG Unit 3.5.5, DfT
[260] Department for Transport (DfT), 2003, Transport Analysis Guidance (TAG), The Journey Ambience Sub-Objective: WebTAG Unit 3.3.13, DfT

- traveller care;
- travellers' views; and
- traveller stress.

19.6.18 Traveller care for pedestrians, cyclists, equestrians and others will be considered in relation to changes to the provision and design of facilities (e.g. footpaths, cycle lanes and crossings, information), as well as their cleanliness and environment.

19.6.19 The extent to which travellers can see the landscape view will vary with the relative height of the Proposed Scheme and the surrounding ground, vegetation, buildings and structures. Views can be categorised as providing:

- no view - where the route is in a deep cutting, a tunnel or surrounded by environmental barriers;
- restricted view - where there are frequent cuttings, tunnels or barriers;
- intermittent view - where there are shallow cuttings or barriers; and
- open view - where the view extends over many miles.

19.6.20 Traveller stress is the adverse mental and physiological effects experienced by travellers. Three main factors influence traveller stress:

- frustration;
- fear of potential accidents; and
- route uncertainty.

19.6.21 Taken together, these can lead to feelings of discomfort, annoyance, frustration or fear culminating in physical and emotional tension that detracts from the quality and safety of a journey.

19.6.22 Assessments will be made of the traveller care, travellers' views and traveller stress ambience factors using the matrix in Table 45. These assessments will consider the impact of the Proposed Scheme on each of these sub-factors using a simple three point scale (i.e. better, neutral or worse than existing ambience).

Table 45 - Environment: journey ambience

Factor	Sub-factor	Better	Neutral	Worse
Traveller care	Facilities			
	Cleanliness			
	Information			
	Environment			
Travellers' views	-			
Traveller stress	Frustration			
	Fear of potential accidents			
	Route uncertainty			

19.6.24 An overall impact score for the quality of a journey will be determined using the following guidelines:

- the overall assessment is likely to be neutral if the assessment is neutral for all or most of the sub-factors, or improvements on some sub-factors are generally balanced by deterioration on others;
- if the change in impact across the sub-factors is, on balance, for the better, the assessment is likely to be beneficial, and, conversely, it is likely to be adverse if there is an overall change for the worse;
- the overall assessment is likely to be minor (beneficial or adverse) where the numbers of travellers affected is low (less than 200 a day);
- the overall assessment is likely to be major (beneficial or adverse) where the numbers of travellers affected is high (more than 1,000); and
- the overall assessment is likely to be moderate (beneficial or adverse) in all other cases.

19.6.25 The methodology, set out above will be applied to the Proposed Scheme on a locational basis where ambience issues for pedestrian, cyclists, equestrians and others are considered likely to be of concern.

Accidents and safety

19.6.26 Significant impacts on accidents and safety risks will be defined for links and junctions as: links and junctions for which data is available that have experienced on average more than nine personal injury accidents in a three-year period ending in 2014-15 and which would be subject to an increase of 30% or more in total traffic flow during construction.

Severance

19.6.27 Severance due to, for example, extended travel distances or broken links (other forms of severance are dealt with under different topics such as traffic severance) can affect travellers using non-motorised modes, especially pedestrians. Where reasonable, practically and economically, public footpaths and routes will be reinstated or convenient alternatives provided. Cyclists and equestrians are less susceptible to severance because they can travel more quickly than people on foot, although there may still be significant impacts on these groups. Severance[261] will be classified according to the following four broad levels: no impact, minor, moderate and major.

19.6.28 To ensure a consistent approach, the classification and assessment will be based only on pedestrian movements unless a change in route is only relevant for cyclists and/or equestrians in which case the distances set out as having the potential to result in significant effects would be adjusted accordingly. The proposed categories of effect are discussed below.

19.6.29 Minor: In general the current journey pattern is likely to be maintained, but there may be some hindrance to movement for example:

- pedestrians at-grade crossing of a new road carrying less than 8,000 vehicles per day (annual average daily traffic - AADT); or
- a new bridge which will need to be climbed or a sub-way traversed; and/or
- journey lengths being increased by up to 100-250m (less than 100m increase in journey length is considered to be of no impact).

19.6.30 Moderate: Some residents, particularly children and elderly people, are likely to be dissuaded from making trips. Other trips will be made longer or less attractive, for example:

- two or more of the hindrances set out under 'minor' applying to an individual journey; or
- pedestrians at-grade crossing of a new road accommodating between 8,000-16,000 vehicles per day (AADT) in the opening year; and/or
- journeys lengths being increased by 250 - 500m.

19.6.31 Major: People are likely to be deterred from making trips to an extent sufficient to induce a change in their habits. This could lead to a change in the location of centres of activity or in some cases to a permanent loss to a particular community. Alternatively, considerable hindrance will be caused to people making their existing journeys. Such impacts can result from:

- pedestrians at-grade crossing of a new road carrying over 16,000 vehicles per day (AADT) in the opening year;

[261] Based on Department for Transport (DfT), 2011, Transport Analysis Guidance (TAG), The Severance Sub-Objective: WebTAG Unit 3.6.2, DfT; and the Highways Agency, 1993, Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects, The Stationery Office

- journey lengths being increased by over 500m; and/or
- three or more of the hindrances set out under 'minor' or two or more set out under 'moderate'.

19.6.32 An overall assessment for the option will then be based on the following guidelines (in each case, the assessment is beneficial if severance is reduced and adverse if severance is increased):

- the overall assessment is likely to be of no impact if increases in severance (including the impact of changes in traffic flows) are broadly balanced by relief of severance;
- the overall assessment is likely to be minor where change in severance is slight or the total numbers of people affected across all levels of severance is minor (less than 200 per day);
- the overall assessment is likely to be major where change in severance is major, and effects a moderate or high number of people or the total numbers of people affected across all levels of severance is major (greater than 1,000); and
- the overall assessment is likely to be moderate where greater than 200 and less than 1,000 people are affected.

Waterways

19.6.33 British Waterways' (now the Canal & River Trust) document Third Party Works' Procedures, Section 2, Code of Practice[262] (Sections 4.1 - 4.3) identifies their requirements that need to be followed in relation to works affecting the navigation or amenity of canals. In summary, these are that generally no stoppages of the canal or navigation or towpath will be allowable, except for technical reasons. Stoppages must be discussed and agreed in advance with the Canal & River Trust and all the duration of stoppages must be minimised. For the purpose of the EIA, a significant stoppage is defined as occurring when an unbroken stoppage exceeding six weeks in duration is required, as this is when specific arrangements regarding the transfer of boats around the works by road may be required.

19.6.34 The Canal & River Trust also require that towing paths must remain open wherever possible. If a diversion is unavoidable, these should be localised. They may be used by the Canal & River Trust's maintenance plant and be of a standard to allow continued use by existing visitors – walkers, anglers, people with disabilities, cyclists etc. Only as an unusual event would towing paths be permitted to be used for access to the temporary and permanent works for the Proposed Scheme because of conflict with visitors and the unsuitability of the towing path for vehicular use. Impacts on pedestrians, cyclists, mobility impaired persons and equestrians using the towing paths will be assessed in relation to the vulnerable road user and ambience heading and associated criteria.

[262] British Waterways, 2012, Third Party Work's Procedures Section 2 Code of Practice, British Waterways

Significance criteria for operational assessment

19.6.35 The criteria outlined below will be used to assess the significance of traffic and transport impacts during the operational phase of the Proposed Scheme.

Public transport delay

19.6.36 Significant permanent impacts on journeys by bus and heavy and light rail affected by the Proposed Scheme will be identified from the traffic and transport assessment and the transport modelling results; and are defined as any of the following:

- a 10% change in a majority of journey times by any public transport mode; and
- a change in journey distances by bus of more than 400m in urban areas and 1km in rural areas.

Station/interchange impacts

19.6.37 Although there are no stations or interchanges within the Proposed Scheme, potential impacts on stations or interchanges at locations not included in the Proposed Scheme will be assessed. Impacts that may be caused by additional passengers of the Proposed Scheme arriving and departing at the stations/interchanges will be assessed to identify any changes in forecast numbers of additional passengers. Where the change in forecast passenger numbers is expected to be minor, no further assessment will be undertaken. Where it is considered that any change may have a significant effect, further assessment will be undertaken taking account of:

- forecast numbers of additional passengers;
- local transport conditions at each location;
- resulting increases in congestion levels arising from increased usage or changed journey patterns arising from the arrival and departure, by all available modes, of passengers using the Proposed Scheme; and
- any loss of physical linkage for the next stage of the journey.

19.6.38 The results from the traffic and transport assessment and modelling will be used to identify if there are any significant journey time, interchange and accessibility changes for travellers.

Traffic flows and delays to vehicle occupants

19.6.39 A significant change in driver and vehicle passenger delay will be defined as any of the following:

- a permanent diversion that results in an increase in journey length of more than 1km;
- where a significant change in delay relating to junction congestion resulting from the operation of the Proposed Scheme is forecast in the traffic and transport assessment and the outputs from the traffic modelling. This will be measured with congestion indicators based on the forecast ratio of flow to capacity (RFC), degree of saturation (DoS) or the practical reserve capacity (PRC). The junctions for consideration will be discussed with the local

highways authority; and

- where there is a change in traffic flow along a road link and the capacity of that link is constrained to a greater extent than the junctions along it, then a similar approach will be used to assess potential delays to road users.

19.6.40 A change in traffic levels can result in changes to traffic-related severance for non-motorised road users, particularly pedestrians using or seeking to cross a road. A significant change is defined as:

- a 10% increase change in peak hour two-way traffic flows where the increase is greater than 40 vehicles per day in urban areas or 10 vehicles per day in rural areas; and
- a 30% increase in the average off-peak hour two-way traffic flows where the increase is greater than 40 vehicles per day in urban areas or 10 vehicles per day in rural areas.

19.6.41 Where the road affected by increased traffic levels is not, in any case, suitable for pedestrians crossing (such as a high speed dual carriageway) or safe and adequate crossing points exist, increased traffic levels would not generally be considered significant in relation to traffic-related severance for non-motorised users.

Vulnerable road user delay, amenity and ambience

19.6.42 The assessment criteria for the operational phase of the Proposed Scheme will be the same as that described previously for the construction phase.

Accidents and safety

19.6.43 The assessment criteria for the operational phase of the Proposed Scheme will be the same as that described previously for the construction phase.

Parking and loading

19.6.44 The assessment criteria for the operational phase of the Proposed Scheme will be the same as that described previously for the construction phase.

Severance

19.6.45 The assessment criteria for the operational phase of the Proposed Scheme will be the same as that described previously for the construction phase.

Waterways

19.6.46 The assessment criteria for the operational phase of the Proposed Scheme will be the same as that described previously for the construction phase.

19.7 Assumptions

19.7.1 The following assumptions are relevant to the traffic and transport assessment:

- operational patterns and capacities of the Proposed Scheme and Phase Two;
- number of train services associated with the Proposed Scheme and Phase Two;

- change in operational patterns and stations serviced by other operators;
- changes to both temporary and permanent PRoW; and
- construction related volumes (HGV and other) and workforce trips.

19.7.2 The traffic and transport assessment will require a number of assumptions to be made, including:

- committed developments and transport schemes;
- socio-economic forecasts (e.g. population, employment and economic conditions);
- demand forecasts; and
- travel characteristics including:
  - modal share of trips;
  - traffic flows;
  - public transport passenger flows;
  - traffic speeds and congestion; and
  - journey times.

20 Waste and material resources

20.1 Introduction

20.1.1 This section of the Report describes the scope and methodology that will be used to assess the likely significant environmental effects associated with the management of solid waste arising during the construction and operation of the Proposed Scheme.

20.1.2 Liquid waste such as wastewater from dewatering operations is covered in Section 21 (Water resources and flood risk) of this SMR.

20.1.3 The consideration of material resources in the context of this SMR comprises maximising the beneficial reuse of materials arising from the construction of the Proposed Scheme (e.g. excavated material). Only if excavated material is not required or is unsuitable for the construction of the Proposed Scheme will it become waste.

20.1.4 The likely significant environmental effects from the use of materials (e.g. aggregate, concrete, brick and steel) for the construction of the Proposed Scheme will not be addressed in the formal EIA Report.

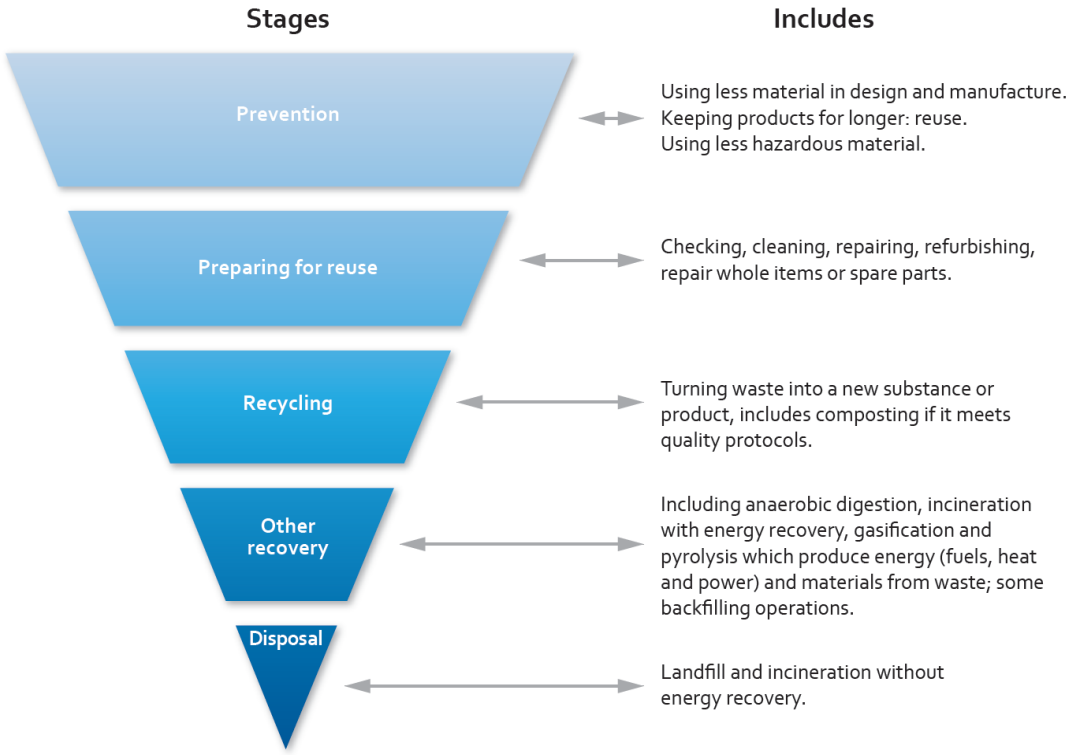
20.1.5 Safeguarding and extraction of mineral resources located along the route of the Proposed Scheme will be considered as part of the route engineering design, construction logistics as well as within Section 14 (Land quality) of this SMR.

20.1.6 The principal objective of sustainable waste and material resource management is to use material resources more efficiently, thereby preventing and reducing the amount of waste generated as well as minimising the quantity of waste that requires final disposal to landfill.

20.1.7 Where waste is generated, HS2 Ltd proposes that it will be dealt with in line with the Government's waste hierarchy (see Figure 15), which is a guide to sustainable waste and material resource management, and implements the revised EU Waste Framework Directive[263].

[263] The revised EU Waste Framework Directive (revised WFD) 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 WFD entered in to force on 12 December 2008: Available online at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF

Figure 15 - The Government's Waste Hierarchy[264]



20.1.8 The waste hierarchy generally describes a priority order of what constitutes the best overall environmental option for the management of waste. It advocates the use of disposal only as a last resort, due to the range of potential adverse environmental effects associated with its use, such as loss of valuable land resources, greenhouse gas (GHG) emissions, and nuisance effects (e.g. dust and odour emissions).

20.1.9 The following types of waste to be generated by construction of the Proposed Scheme will be considered in the assessment:

- excavation wastes;
- demolition wastes;
- construction wastes; and
- worker accommodation site waste.

20.1.10 The following types of waste to be generated by operation of the Proposed Scheme will be considered in the assessment:

- railway station and train waste;
- rolling stock maintenance waste;
- track maintenance waste; and
- ancillary infrastructure waste.

[264] Department for Environment, Food and Rural Affairs (Defra), 2011, Government Review of Waste Policy in England 2011, Defra

20.2 Establishment of baseline and definition of survey

20.2.1 A baseline will be developed for waste and material resources as part of the formal EIA Report. Baseline conditions will be identified with respect to:

- types, quantities and management of construction, demolition and excavation waste arisings generated in England and within each of the county and former regional planning jurisdictions through which the route of the Proposed Scheme will pass;
- types, quantities and management of commercial and industrial waste generated in England and within each of the county and former regional planning jurisdictions through which the route of the Proposed Scheme will pass; and
- availability (types and capacity) of waste infrastructure within each of the county and former regional planning jurisdictions through which the route of the Proposed Scheme will pass.

20.2.2 The local area will be defined as the relevant district or county councils of the regional areas, which include West Midlands and North West[265]. Waste planning authorities are usually constituted at a county or unitary authority (e.g. most cities and larger towns) level.

Local and regional baseline - waste arisings

20.2.3 Data on construction, demolition and excavation waste arisings for the route of the Proposed Scheme will be identified as part of baseline data gathering where this information exists using information from, for example, the Environment Agency and other public sources.

20.2.4 Data on commercial and industrial waste generated for the route of the Proposed Scheme will be identified as part of the baseline data gathering where this information exists. Sources of information will include:

- operational waste data from train operating companies, where available; and
- operational waste data for existing railway stations along the route of the Proposed Scheme (e.g. Birmingham New Street and Crewe) and rail stabling and maintenance depots operated by Network Rail, where available.

Local and regional baseline - waste management infrastructure capacity

20.2.5 Information on the availability of waste management infrastructure will be identified as part of the baseline data gathering from published sources of information and in consultation with the relevant waste disposal authorities. Sources of information that will be used to provide this information include, but will not be limited to:

[265] Local Government Boundary Commission for England; Available online at: www.lgbce.org.uk

- Defra Waste and Recycling Statistics[266];
- Department of Energy and Climate Change Renewable Energy Statistics (RESTATS) online database[267];
- Environment Agency Waste Data and Information[268]; and
- various waste disposal authority Waste and Minerals Development Plan Documents (e.g. Staffordshire Waste Core Strategy Staffordshire Mineral Core Strategy, Cheshire East Core Strategy).

20.2.6 Waste and minerals plans, together with any relevant supporting evidence and up to date waste capacity information held by the Environment Agency, will be used to indicate where and how much landfill void space is likely to be available during construction (2020 to 2026) and operation (2027) of the Proposed Scheme. This information will be used to assess whether or not there is likely to be a shortfall of suitable landfill void space for the management of waste requiring off-site disposal to landfill.

20.3 Consultation and engagement

Consultation on the Sustainability Statement

20.3.1 Consultation responses on the Phase Two Sustainability Statement were reviewed and none were considered to alter the scope and methodology for waste and material resources for the Proposed Scheme.

Consultation on the draft SMR

20.3.2 Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for waste and material resources.

Engagement as part of the EIA process

20.3.3 Consultation will be undertaken primarily with the Environment Agency to confirm the previously agreed approach for reuse of excavated material and other materials resulting from construction is applicable to the Proposed Scheme, for example, in scheme-wide landscaping works such as construction of noise and landscape bunds.

20.3.4 Consultation will also be undertaken with county and district councils (including Waste Planning Authorities) to identify and confirm the following:

- local and regional waste arisings used to inform the baseline and assessment of the likely significant environmental effects of waste;
- availability of local and regional waste infrastructure to be used to inform the baseline and assessment of the likely significant environmental effects of

[266] Department for Environment, Food and Rural Affairs (Defra); Statistics; Environment and wildlife statistics; Waste and recycling. Available online at: www.defra.gov.uk/statistics/environment/waste/

[267] Department of Energy and Climate Change; Planning Database; Renewables Map. Available online at: http://restats.decc.gov.uk/app/pub/map/map/

[268] Environment Agency; Planning & research; Our library; Data & statistics; Waste data and information. Available online at: www.environment-agency.gov.uk/research/library/data/34169.aspx - now archived

waste; and

- planning, development management and waste management policies to be considered during the assessment process; and particularly with respect to defining any mitigation measures required.

20.3.5 This information will be used to establish the baseline waste quantities, understand the future regional disposal capacity and to identify opportunities for reuse and recovery of excavation and demolition materials from the Proposed Scheme.

20.4 Key aspects of the Proposed Scheme for the topic

20.4.1 The construction of the Proposed Scheme will generate large quantities of excavated material and other aggregate materials mainly associated with the excavation of cuttings, cut and cover tunnels, bored tunnels, foundations and drainage. In addition, the demolition of existing commercial and residential buildings within the line of the route of the Proposed Scheme will generate demolition materials such as steel, broken concrete, timber and brick. The rebuilding of highways and bridges and the construction of stabling and maintenance depots will also generate construction waste.

20.4.2 Waste may also arise from the interaction with operational and closed landfill sites, removal of fly-tipped waste, and management of contaminated land where present along the route Section 14 (Land quality).

20.4.3 Waste will be generated during the operation of the Proposed Scheme by passengers, railway staff and maintenance activities. Environmental effects associated with the management of this waste are likely to be relatively small compared with the management of excavated material that is surplus to the requirements of the Proposed Scheme.

20.5 Scope of assessment

20.5.1 The likely significant environmental effects of solid waste management associated with the Proposed Scheme will be assessed with respect to both the construction and operational phases. These effects may be beneficial or adverse dependent on the measures employed to prevent and/or manage the waste generated.

Construction

20.5.2 Construction effects will address the permanent, indirect impacts of solid waste that will be generated by earthworks, demolition and construction activities and that will require off-site disposal during the proposed construction period. The scope of the assessment of construction effects will also include waste generation and its off-site disposal to landfill associated with the worker accommodation sites during the same time period. Demolition materials will be generated as a result of site clearance works and from the demolition of buildings and other structures currently in existence along the route of the Proposed Scheme. Natural, uncontaminated and contaminated excavated material is likely to be generated as a result of construction of the Proposed Scheme. It is likely that the majority of the excavated material will comprise natural and inert soils.

20.5.3 The assessment of contaminated soils and materials is addressed in Section 14 (land quality) of this SMR. The quantity and type of waste likely to be generated from contaminated land after remedial measures have been applied will be determined and the impacts and effects assessed in the formal EIA Report.

20.5.4 Solid waste is likely to be generated during the construction and fit-out of above ground structures such as stabling and infrastructure maintenance depots. Waste would also be generated by the construction and installation of rail infrastructure components, including tunnelling sections, the laying of new tracks and installation of line-side equipment, including new power supply connections and sub-stations.

20.5.5 Excavated material that can be used, in its natural state, for site engineering and restoration purposes will be excluded from the assessment of likely significant environmental effects of construction. This is in accordance with the scope of the revised EU Waste Framework Directive and should reflect the measures taken during the design phase to prevent waste[269]. It is also assumed that such materials will meet the requirements of The Definition of Waste: Development Industry Code of Practice[270]. This industry Code of Practice has been developed to enable the transfer or reuse of excavated material, and provides a framework for proactively managing contaminated materials on the sites of production or their movement between sites. As stated in Section 20.3 (consultation and engagement), consultation will be undertaken with the Environment Agency to confirm the approach adopted for Phase One, for the reuse of materials resulting from construction, is applicable to the Proposed Scheme.

Operation

20.5.6 Operational effects will address the permanent, indirect impacts of solid waste that will be generated and require off-site disposal to landfill during the first full year operation of the Proposed Scheme. This includes solid waste that will be generated by passengers and staff at redeveloped stations, and at staff depots and rail maintenance facilities. Waste will also be generated by passengers and staff on trains whilst these are in use along the route of the Proposed Scheme and from track maintenance works.

Spatial scope

20.5.7 Waste and material resources will be assessed on a route-wide basis having regard to the local (i.e. counties or unitary authorities) and regional (i.e. former regional planning jurisdictions) areas along the route. The latter is significant with respect to historical methods of waste infrastructure planning and capacity reporting.

[269] The scope of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives excludes 'uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated'

[270] Contaminated Land: Applications in Real Environments (CL:AIRE), 2011, The Definition of Waste: Development Industry Code of Practice, CL:AIRE

Temporal scope

20.5.8 The temporal scope of the assessment shall be 2020 to 2026, including commissioning, for construction (i.e. the proposed construction period) and 2027 for operation (i.e. the first full year of operation of the Proposed Scheme).

20.6 Assessment methodology

20.6.1 There is no recognised methodology or waste significance criteria to assess the likely significant environmental effects of solid waste generation from either construction or operation. The proposed assessment methodology is, therefore, based on EIA practitioners' professional judgement and experience with the application of EIA to rail-related and other large scale transport infrastructure projects such as Phase One of HS2.

20.6.2 The assessment will consider the types and quantities of solid waste that will be generated during construction and operation, and the severity of the likely significant environmental effects that may arise from the quantity of waste requiring disposal to landfill (this being the least preferred waste management option, with a finite usable capacity). The assessment will consider waste arisings and waste infrastructure capacity in local and regional areas through which the route of the Proposed Scheme will pass.

Legislation and guidance

20.6.3 The assessment will consider relevant waste management legislation, policies and guidance applicable to all buildings and infrastructure components along the route of the Proposed Scheme. This will include, but will not be limited to the legislation, policy and guidance set out within this section.

Legislation

20.6.4 The Waste (England and Wales) Regulations 2011 SI No. 988[271] (as amended), which transpose the provisions of the 'EU Waste Framework Directive' (2008/98/EC)[272] into England and Wales. The Controlled Waste (England and Wales) Regulations 2012 SI No. 811[273] (as amended), which sets out the definition of controlled waste to which regulatory waste management controls apply.

20.6.5 The Environmental Permitting (England and Wales) Regulations 2010 SI No. 675[274] (as amended), which provide a consolidated system for permitting of waste operations.

20.6.6 The Hazardous Waste (England and Wales) Regulations 2005 SI No. 894[275] (as amended), which sets out the regime for the control and tracking of the movement of hazardous waste.

[271] The Waste (England and Wales) Regulations 2011 (SI 2011 No. 988). London, Her Majesty's Stationery Office
[272] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives
[273] The Controlled Waste (England Wales) Regulations 2012 (SI 2012 No. 811). London, Her Majesty's Stationery Office
[274] The Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675). London, Her Majesty's Stationery Office
[275] The Hazardous Waste (England and Wales) Regulations 2005 (SI 2005 No. 894). London, Her Majesty's Stationery Office

20.6.7 The List of Wastes (England) Regulations 2005 SI No. 895[276] (as amended), which provides for the classification of wastes and determination of hazardous wastes.

20.6.8 The Site Waste Management Plans Regulations 2008 SI No. 314[277] have been repealed as part of the Defra Red Tape Challenge[278]. The purpose of the site waste management plan was to identify opportunities to design out waste; as well as identifying the types and quantities of waste likely to be produced during construction; the opportunities for sustainable management of the waste to be identified; and to monitor and report on the actual management of these wastes throughout the construction period. HS2 Ltd will apply these principles to the construction of the Proposed Scheme ensuring an integrated approach to the design of the Proposed Scheme, aiming to maximise the beneficial reuse of excavated material where possible, and minimise the generation of waste, which will be facilitated through the implementation of the CoCP for the Proposed Scheme.

Policy

20.6.9 The Government Review of Waste Policy in England 2011 sets out the Government's long-term strategy for the prevention and management of waste in England. It follows the waste hierarchy approach set out in the EU Waste Framework Directive.

20.6.10 National Planning Policy for Waste[279] along with the National Waste Management Plan for England[280] sets out Government policy on waste planning, which is of relevance to the management strategy for solid waste generated during the construction and operation of the Proposed Scheme.

20.6.11 Regional and local planning policy, such as Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010-2026[281], which sets out strategic planning policies for the management of waste generated in Staffordshire and elsewhere along the route of the Proposed Scheme. Specifically, these policies seek to minimise the amount of waste generated, increase the reuse and recycling of waste and reduce waste to landfill.

Guidance

20.6.12 Relevant guidance includes the Definition of Waste: Development Industry Code of Practice and the Waste and Resources Action Programme (WRAP) guidance and tools developed to achieve better resource efficiency in construction projects, such as

[276] The List of Wastes (England) Regulations 2005 (SI 2005 No. 895). London, Her Majesty's Stationery Office.

[277] The Site Waste Management Plans Regulations (SI 2008 No. 314). London, Her Majesty's Stationery Office; 2008. Accessed at: http://www.legislation.gov.uk/uksi/2008/314/contents/made

[278] Department for Environment, Food and Rural Affairs; Red Tape Challenge – Environment Theme Proposals March 2012; Accessed at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69584/pb13728-red-tape-environment.pdf

[279] Department for Communities and Local Government National Planning Policy for Waste, The Stationery Office; 2014. Accessed at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/364759/141015_National_Planning_Policy_for_Waste.pdf

[280] Department for Environment, Food and Rural Affairs, National Waste Management Plan for England, The Stationery Office; 2013. Accessed at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265810/pb14100-waste-management-plan-20131213.pdf

[281] Staffordshire County Council, Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010-2026; 2013. Accessed at: http://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-(2010-to-2026)-(adopted-March-2013).pdf

designing out waste tools (e.g. The Designing out Waste Tool for Civil Engineering Projects and Net Waste Tool)[282].

Significance criteria

20.6.13 There are no recognised significance criteria against which direct and indirect waste effects for both the construction and operational phases of the Proposed Scheme can be assessed. As such, the criteria for the assessment have been derived from professional experience previously gained from the application of EIA to large-scale infrastructure projects (including Phase One of HS2), which take into account:

- the net change in solid waste arisings overall as a result of the Proposed Scheme;
- the magnitude of the quantity of waste requiring landfill disposal; and
- the availability of landfill disposal capacity in the local and regional area.

20.6.14 Tables 46-48 set out the significance criteria to be used for the assessment of the likely significant environmental effects of solid waste generation; further details are provided in the Phase One Technical Note 'Rationale for landfill significance criteria' (as referenced in Annex A of this SMR).

Table 46 - Inert landfill significance criteria

Degree of significance	Inert landfill criteria
Major adverse	Net increase in waste arisings relative to the future baseline leading to a severe, national and regional scale reduction in inert landfill void space capacity. Need for additional large-scale waste treatment and/or disposal capacity of greater than 10,000,000 tonnes per annum. Effect may be judged to be of importance in the national planning context and, therefore, of potential concern to a project depending upon the importance attached to the issue in the decision-making.
Moderate adverse	Net increase in waste arisings relative to the future baseline leading to regional scale reduction in inert landfill void space capacity. Need for additional medium-scale waste treatment and/or disposal capacity of between 2,000,000 to 10,000,000 tonnes per annum. Effect may be judged to be of importance in the regional planning context, e.g. where effects are permanent or long-term and the effect on local waste treatment and disposal infrastructure is such that additional capacity may be required.
Minor adverse	Net increase in waste arisings relative to the future baseline leading to local scale reduction in inert landfill void space capacity. Need for additional small-scale waste treatment and/or disposal capacity of up to 2,000,000 tonnes per annum. Effect is of low importance in the decision-making process but may be of relevance to the detailed design and mitigation of a project.
Negligible	No significant increase in waste arisings relative to the future baseline or reduction in landfill void space capacity for inert waste. No appreciable adverse or beneficial effects.
Beneficial	Net reduction in waste arisings and diversion of waste from landfill relative to the future baseline resulting in an environmental improvement. Positive effect on waste arisings overall and available capacity of waste treatment and disposal infrastructure.

[282] WRAP; Designing out Waste Tool, 2016 Accessed at: http://www.wrap.org.uk/content/designing-out-waste-tool-civil-engineering; and http://www.wrap.org.uk/content/net-waste-tool-0

Table 47 - Non-hazardous landfill significance criteria

Degree of significance	Non-hazardous landfill criteria
Major adverse	Net increase in waste arisings relative to the future baseline without the Proposed Scheme leading to a severe, national and regional-scale reduction in landfill void space capacity for non-hazardous waste. Need for additional large-scale waste treatment and/or disposal capacity of greater than 250,000 tonnes per annum[283]. Effect may be judged to be of importance in the regional planning context and, therefore, of potential concern to a project depending upon the importance attached to the issue in decision-making.
Moderate adverse	Net increase in waste arisings relative to the future baseline without the Proposed Scheme leading to regional-scale reduction in landfill void space capacity for non-hazardous waste. Need for additional medium-scale waste treatment and/or disposal capacity of between 50,000[284] to 250,000 tonnes per annum. Effect may be judged to be of importance in the local planning context, e.g. where effects are permanent or long-term and the effect on local waste treatment and disposal infrastructure is such that additional capacity may be required.
Minor adverse	Net increase in waste arisings relative to the future baseline without the Proposed Scheme leading to local-scale reduction in landfill void space capacity for non-hazardous waste. Need for additional small-scale waste treatment and/or disposal capacity of up to 50,000 tonnes per annum. Effect is of low importance in the decision-making process but may be of relevance to the detailed design and mitigation of a project.
Negligible	No significant increase in waste arisings relative to the future baseline without the Proposed Scheme or reduction in landfill void space capacity for non-hazardous waste. No appreciable adverse or beneficial effects.
Beneficial	Net reduction in waste arisings and diversion of waste from landfill relative to the future baseline without the Proposed Scheme resulting in an environmental improvement. Positive effect on waste arisings overall and available capacity of waste treatment and disposal infrastructure.

Table 48 - Hazardous landfill significance criteria

Degree of significance	Hazardous landfill criteria
Major adverse	Net increase in waste arisings relative to the future baseline leading to a severe national and regional-scale reduction in hazardous waste landfill void space capacity. Need for additional large-scale hazardous waste disposal capacity of greater than 100,000 tonnes per annum. Effect may be judged to be of importance in the regional planning context and, therefore, of potential concern to a project depending upon the importance attached to the issue in the decision-making process.
Moderate adverse	Net increase in waste arisings relative to the future baseline leading to regional-scale reduction in hazardous waste landfill void space capacity or need for additional medium-scale waste hazardous waste disposal capacity of between 20,000 to 100,000 tonnes per annum. Effect may be judged to be of importance in the local planning context, e.g. where effects are permanent or long-term and the effect on local waste treatment and disposal infrastructure is such that additional capacity may be required.
Minor adverse	Net increase in waste arisings relative to the future baseline leading to local-scale reduction in

[283] Waste throughput capacity based on large-scale waste infrastructure project experience

[284] The waste throughput capacity of greater than 50,000 tonnes per annum has been selected with reference to the Department for Communities and Local Government (DCLG), 1999, Circular 02/99: Environmental Impact Assessment, DCLG; which states in Annex A: Indicative Thresholds and Criteria for Identification of Schedule 2 Development Requiring EIA, under 'Installation for the disposal of non-hazardous waste' at A36: "*…EIA is more likely to be required where new capacity is created to hold more than 50,000 tonnes per year…*"

Degree of significance	Hazardous landfill criteria
	hazardous waste landfill void space capacity or need for additional small-scale hazardous waste disposal capacity of up 20,000 tonnes per annum. Effect is of low importance in the decision-making process but may be of relevance to the detailed design and mitigation of a project.
Negligible	No significant increase in waste arisings relative to the future baseline or reduction in landfill void space capacity. No appreciable adverse or beneficial effects.
Beneficial	Net reduction in hazardous waste arisings and diversion of waste from landfill relative to the future baseline resulting in an environmental improvement. Positive effect on waste arisings overall and available capacity of hazardous waste treatment and disposal infrastructure.

Construction effects

20.6.15 The assessment will identify the types and quantities of solid waste forecast to be generated during each of the demolition, excavation and construction stages of the Proposed Scheme. It will also identify types and quantities of waste forecast to be generated by occupants of the worker accommodation sites during the overall construction programme. Quantification will be on the basis of survey information, using published waste generation rates or forecasting tools such as the WRAP Net Waste Tool.

20.6.16 Assumptions regarding the type and quantity of waste to be diverted from landfill via reuse, recycling and recovery will be applied. Following this, the type and quantity of demolition materials, excavated material, construction materials and worker accommodation site waste requiring landfill disposal will be assessed in relation to the projected quantity of landfill disposal capacity in the designated local and regional areas throughout the proposed construction period.

20.6.17 Further information regarding the waste forecasting and assessment methodology for construction effects is provided in the Phase One Technical Note 'Waste forecast and assessment methodology' (as referenced in Annex A of this SMR).

Operation effects

20.6.18 The assessment will identify the types and quantities of solid waste forecast to be generated during the first full year of operation of the Proposed Scheme. This forecast will be based on an assumption of maximum capacity of the Proposed Scheme and any effects will be assumed to be annual. Quantification may be on the basis of existing operational waste management performance data or using published operational waste generation rates for the relevant land use activities.

20.6.19 Assumptions regarding the type and quantity of waste to be diverted from landfill via reuse, recycling and recovery will be applied. Following this, the type and quantity of station and train waste, track maintenance waste and ancillary infrastructure waste requiring landfill disposal will be assessed in relation to the projected quantity of landfill disposal capacity in the designated local and regional areas throughout the proposed construction period.

Cumulative effects

20.6.20 Cumulative effects will be assessed qualitatively (based on professional judgment) taking into account other major development proposals along the route of the Proposed Scheme.

20.6.21 Further information regarding the waste forecasting and assessment methodology for operational effects is provided in the Phase One Technical Note 'Waste forecast and assessment methodology' (as referenced in Annex A of this SMR).

Mitigation, enhancement and off-setting

20.6.22 Mitigation and enhancement for waste and resources management during construction and operation will be considered in line with the waste hierarchy and residual environmental effects identified.

20.7 Assumptions

20.7.1 It has been assumed that all existing land uses along the route of the Proposed Scheme would remain unchanged should the Proposed Scheme not proceed.

20.7.2 The assessment of likely significant environmental effects resulting from waste generated due to the interaction with operational and closed landfill sites, fly-tipped waste and contaminated land present along the route will be covered in Section 14 (Land quality) of this SMR. This will also include hazardous materials.

20.7.3 Assumptions will be required as to the proportion of solid construction and operational waste that would be diverted from landfill via reuse, recycling and recovery. This will be informed by information gathered at the time of the assessment as to any waste management measures proposed to divert waste from landfill. Alternatively, landfill diversion performance for other similar rail-related projects, such as Crossrail, will be considered.

20.7.4 Waste transferred off-site would be handled by a registered waste carrier authorised by the Environment Agency and taken to a permitted or exempt facility authorised to receive and handle that waste under Duty of Care arrangements (i.e. this assessment does not consider the likely significant environmental effects of any illegal waste management and disposal). It has been assumed that all construction and operational activities will be in accordance with the relevant environmental regulatory requirements.

20.7.5 The assessment of likely significant environmental effects associated with waste-related transport, including the interactive effects of air quality, climate, sound and noise will be addressed in Section 7 (air quality), Section 8 (climate), Section 18 (sound, noise and vibration) and Section 19 (traffic and transport) of this SMR.

21 Water resources and flood risk

21.1 Introduction

21.1.1 This section of the SMR sets out the scope and methodology for assessing the likely significant impacts and effects of the Proposed Scheme on water resources and flood risk. This includes effects on all surface water and groundwater bodies, including their associated water resources, water quality, hydromorphology, hydrology and flood risk. Surface water includes natural waterbodies such as rivers, streams and lakes, and artificial waterbodies such as canals, land drainage systems, sewers (foul, surface water and combined) and reservoirs. Groundwater includes all water within soil and rock below the ground surface, within the saturated and unsaturated zones.

21.2 Establishment of baseline and definition of survey

21.2.1 The baseline conditions will be those at the time of undertaking the assessment (i.e. documented during the baseline data collection phase). Given the variable nature of the water environment through time, it is not usually feasible to set a baseline for the future (i.e. the time of construction or operation of the Proposed Scheme). Where projections of climate change effects predict a future trend, a future baseline condition will be identified based on current guidance. This future baseline is assessed as part of the in-combination climate change impacts and resilience assessments in the climate change section.

21.2.2 The Proposed Scheme passes through the catchments of the River Trent and River Weaver. It crosses the River Trent twice. Other main rivers crossed by the Proposed Scheme include Pyford Brook, the River Lea and Gresty Brook.

21.2.3 The most significant areas of floodplain include those associated with Bourne Brook, an ordinary watercourse at Kings Bromley, the River Trent, also at Kings Bromley, the River Trent at Great Haywood, Meece Brook at Whitmore and the River Lea at Madeley.

21.2.4 There are numerous crossings of ordinary watercourses. It is proposed to cross the larger of these using viaducts whilst many of the smaller ordinary watercourses are likely to be culverted beneath the route. The assessments will consider the impacts of any such viaducts and culverting operations.

21.2.5 The Proposed Scheme passes over the Trent and Mersey Canal at two locations. The crossing at Great Haywood is directly adjacent to an existing marina.

21.2.6 Parts of the Proposed Scheme cross the Triassic Sandstone Principal aquifer and through groundwater Source Protection Zones (SPZs) associated with public water supply abstractions at Swynnerton and Whitmore.

21.2.7 The Proposed Scheme is tunnelled at Madeley and Whitmore and there are long sections of cutting with potential implications for groundwater.

21.2.8 Baseline conditions will be set, where appropriate, as follows:

- floodplain extent (1 in 20, 100, 100 + climate change and 1,000 year return periods);

- floodplain depth/velocity/hazard (1 in 20, 100, 100 + climate change and 1,000 year return periods);
- surface water flood depth (1 in 30, 1 in 100 and 1 in 1,000 year);
- surface water quantity and quality and Water Framework Directive[285] (WFD) Status (physico-chemical and hydromorphology quality elements[286]);
- surface water designations, licences/consents;
- surface water / groundwater interactions;
- hydrogeology, including geology, aquifer hydraulic parameters, groundwater level and flow directions;
- groundwater quality and quantity (including WFD quantitative and chemical quality elements);
- groundwater yield, licences/consents;
- groundwater dependent terrestrial ecosystems (GWDTEs); and
- hydrometeorological conditions and variability arising from climate change.

21.2.9 The detailed field survey requirements to establish this baseline will be defined based on desk study review of all existing information held by the consultees outlined in Section 21.3 below followed by a walkover survey of key features along the route. It is foreseen that additional channel survey will be required in order to better define flood risks. Specialist WFD surveys will also be undertaken, where required and where land access is possible. These surveys will be undertaken in collaboration with ecology and biodiversity specialists.

Baseline data and sources

21.2.10 Table 49 sets out the baseline data to be collected (or generated if applicable, e.g. flood risk), along with the likely source.

[285] European Commission (EC), 2000, Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy, EC

[286] Biological quality elements are considered within the ecology and biodiversity assessments of the EIA, but consideration of all quality elements will be included in a WFD compliance assessment

Table 49 - Baseline data and sources

Baseline data	Sources
Floodplain extent, depth, velocity, hazard Surface water flood depths Groundwater level and flow directions Groundwater yield Aquifer extent (vertical and horizontal) and hydraulic parameters	Targeted hydraulic modelling, making best use of existing information held by the Environment Agency, Lead Local Flood Authorities (LLFAs), Canal & River Trust and water companies. Information contained within local planning authorities' Strategic Flood Risk Assessments and Surface Water Management Plans. Data on hydro-meteorological conditions and variability arising from climate change. Topographical surveys of the channel and WFD surveys. Site walkovers.
Surface water quality, groundwater quality	Targeted water sampling and testing at accredited laboratory. Information held by the Environment Agency including within River Basin Management Plans, Local Authorities, Natural England and water companies.
Surface water designations GWDTEs	Information held by the Environment Agency and Natural England.
Surface water licences/consents Groundwater licences/permits Unlicensed abstractions	Information held by the Environment Agency. Information held by the Environment Agency. Information held by local authorities.
Hydro-meteorological data, as needed	Met Office, Environment Agency.

21.3 Consultation and engagement

Consultation on the Sustainability Statement

21.3.1 The following key organisations responded to the consultation on the Phase Two Sustainability Statement:

- Environment Agency;
- local authorities (including LLFAs Cheshire East Council and Staffordshire County Council);
- Canal & River Trust;
- Natural England;
- the Inland Waterways Association;
- water and sewerage companies; and
- water supply companies.

21.3.2 Some of these organisations raised concerns that the Proposed Scheme would lead to an increased risk of flooding. Other comments suggested that the Proposed Scheme

would be built on areas prone to flooding or on floodplains. A number of concerns were also raised that the Proposed Scheme would give rise to pollution to watercourses and other waterbodies. The EIA will take all of these concerns into consideration as part of the impact assessment.

21.3.3 None of the Phase Two Sustainability Statement consultation responses were considered to alter the scope and methodology for water resources and flood risk for the Proposed Scheme.

Consultation on the draft SMR

21.3.4 Following review of the draft SMR consultation responses, a number of edits and alterations have been made to this section. The EIA Scope and Methodology Report: Consultation Summary Report sets out details of the consultation comments and the project's response to them.

Engagement as part of the EIA process

21.3.5 As part of the EIA process, the following organisations as a minimum will be consulted:

- Environment Agency;
- local authorities (including LLFAs Cheshire East Council and Staffordshire County Council);
- Canal & River Trust;
- Natural England;
- water and sewerage companies;
- water supply companies; and
- landowners.

21.4 Key aspects of the Proposed Scheme for the topic

21.4.1 The following aspects of the Proposed Scheme are of particular relevance to this topic:

- sections of the Proposed Scheme are located in Flood Zones 2 or 3, as well as areas at heightened risk of surface water flooding. Impacts on flood conveyance and storage will be considered for construction and operation conditions, taking account of potential climate change impacts. The proposals have potential to impact on existing surface and groundwater flood mechanisms as well as on sewerage and land drainage systems;
- the assessment will consider whether there will be any likely increase in the flood risk and/or whether existing drainage systems will be impeded. If so, the assessment will identify appropriate mitigation measures;
- the assessment will consider the likely effects of increases in impermeable area on surface water flood risks and appropriate mitigation measures will be identified;

- physical modification of some waterbodies will be required, including minor diversions, realignments and culverting operations. The assessment will incorporate summary information from a separate WFD Compliance Assessment demonstrating how any related impacts would be reduced as far as reasonably practicable;
- potential impacts on the hydrology and hydrogeology of water dependent habitats (aquatic and terrestrial) will be assessed in close consultation with the ecology and biodiversity teams and appropriate mitigation identified where necessary; and
- potential impacts on water quality within the groundwater and surface water bodies potentially affected by the Proposed Scheme will be considered, as well as the risk of pollution from the construction and operation of the Proposed Scheme. Appropriate measures will be identified to mitigate these effects. Sections planned to be in cutting or in tunnel may require temporary or permanent groundwater dewatering. The assessment will consider the likely effects on the quality and yield of the aquifers protected rights and how these can be mitigated.

21.4.2 Possible environmental benefits that may result from the Proposed Scheme include the creation of watercourse channels of higher ecological value after diversion and potential for a reduction in the flood risk associated with some adjacent properties.

21.5 Scope of assessment

Spatial scope

21.5.1 The spatial scope of the assessment will be based upon the identification of surface water and groundwater features within 1km of the centreline of the Proposed Scheme, except where there is clearly no hydraulic connectivity with the Proposed Scheme. In urban areas the distance will be 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Consideration will nevertheless be given to potential hydraulic connectivity to very high value receptors beyond these distances. Professional judgement will then be used to decide whether additional assessment of these is required.

21.5.2 Where works extend more than 200m from the centreline, for example at depots, professional judgement will be made in selecting the appropriate limit to the extension in spatial scope required.

21.5.3 Exceptions to the above will be required in some locations where:

- major groundworks are required (e.g. tunnels and associated portals);
- infrastructure is to be placed within floodplains;
- the route of the Proposed Scheme is within a groundwater Source Protection Zone (SPZ) or overlies a Principal aquifer where the abstraction may be over 1km away;
- pathways are identified to the wider environment (e.g. canal or stream routing

to distant river or highly transmissive aquifer);

- the route of the Proposed Scheme intersects the inundation area of a reservoir; and
- other scenarios, as deemed appropriate when the route is reviewed in line with data received.

21.5.4 When considering the possible effects of the Proposed Scheme on a watercourse or aquifer, the assessment will consider the possible effects throughout the catchment of the impacted watercourse or the wider aquifer extent.

Temporal scope

21.5.5 The effect of construction impacts will be assessed up to when the Proposed Scheme is due to open. The permanent effects of the scheme will be assessed for the year when the Proposed Scheme goes into operation. Where impacts are likely to vary with time, for example where features such as wetlands will take time to become fully established, the temporal scope will be adjusted accordingly.

21.5.6 The methodology and timeframes for assessing climate change impacts on flood risk will align with the latest guidance issued by the Environment Agency[287]. These assessments will inform the in-combination climate change impact and resilience assessments in Section 8, climate change.

21.6 Assessment methodology

Legislation and guidance

21.6.1 The following legislation, policy and guidance will be taken into account in the assessment of water resources and flood risk. Assessment of the Proposed Scheme and its impacts in relation to the provisions of this legislation and policy, will form an essential step in the assessment of the significance of effects associated with the Proposed Scheme.

- EU WFD[288]; EU Groundwater Directive[289]; EU Floods Directive[290] and associated UK Flood Risk Regulations 2009[291]; EU Habitats Directive;
- Flood and Water Management Act[292]; Water Act[293]; the Environmental Protection Act 1990; the Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009[294]; Land Drainage Act[295];

[287] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[288] HM Government (2003), Statutory Instrument 2003 No. 3242 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, The Stationery Office.
[289] Official Journal of the European Union, 2006, Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration, European Commission.
[290] Official Journal of the European Union, 2007, Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, European Commission.
[291] HM Government, 2009, The Flood Risk Regulations, The Stationery Office.
[292] HM Government, 2010, Flood and Water Management Act 2010, The Stationery Office.
[293] HM Government, 2003, The Water Act 2003 (Commencement No. 11) Order 2012, The Stationery Office.
[294] HM Government, 2009, Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009, The Stationery Office.
[295] HM Government, 1994, Land Drainage Act 1994, The Stationery Office.

- Water and flood risk local planning policy for local authorities along the route of the Proposed Scheme (saved local plan policies and adopted Local Development Framework policy);
- Environment Agency Groundwater Protection: Policy and Practice (GP3)[296]; and
- Non statutory technical standards for sustainable drainage systems, Defra, 2015[297].

21.6.2 The assessment will also need to have due regard to the NPPF and its Technical Guidance, and also to Environmental Permitting Regulations and amendments[298].

Significance criteria

21.6.3 The significance of an effect is defined by the magnitude of the impact and the overall value of the receiving water body or receptor (the 'attribute') (see Table 50). Tables 50 – 52 have been adapted from the tables in the DMRB (Volume 11.3.10: Road Drainage and the Water Environment). Significant effects on the water environment are those that have a moderate significance of effect or greater.

Table 50 - Significance of effects

Value of receptor	**Magnitude of impact**			
	Negligible	Minor	Moderate	Major
Very high	Negligible - not significant	Moderate adverse - significant	Major adverse - significant	Major adverse – significant
High	Negligible - not significant	Moderate adverse - significant	Moderate adverse - significant	Major adverse – significant
Moderate	Negligible - not significant	Minor adverse - not significant	Moderate adverse - significant	Moderate adverse - significant
Low	Negligible - not significant	Negligible - not significant	Minor adverse - not significant	Minor adverse - not significant

21.6.4 Table 51 provides an indication of possible impacts and their magnitude. These may be reported as either beneficial or adverse. The list is not exhaustive and is intended as a guide.

[296] Environment Agency; Planning & research; Our library; Publications and reports; Water reports; Groundwater; Management and protection; GP3 (Groundwater Protection Policy and Practice). Available online at: http://www.environment-agency.gov.uk/research/library/publications/40741.aspx

[297] Defra, 2015, Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems, 2015. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

[298] HM Government, 2012, The Environmental Permitting (England and Wales) (Amendment) Regulations 2012, The Stationery Office

Table 51 - Magnitude of possible impacts

Magnitude	Criteria	Examples
Major	Adverse: Loss of an attribute and / or quality and integrity of an attribute Beneficial: Creation of new attribute or major improvement in quality of an attribute	Adverse: Increase in peak flood level* (> 100mm); loss of a fishery; decrease in surface water ecological or chemical WFD element status or groundwater qualitative or quantitative WFD element status. Beneficial: Creation of additional flood storage and decrease in peak flood level* (> 100mm); increase in productivity or size of fishery; increase in surface water ecological or chemical WFD element status; increase in groundwater qualitative or quantitative WFD element status.
Moderate	Adverse: Loss of part of an attribute or decrease in integrity of an attribute Beneficial: Moderate improvement in quality of an attribute	Adverse: Increase in peak flood level* (> 50mm); partial loss of fishery; measurable decrease in surface water ecological or chemical quality or flow; reversible change in the yield or quality of an aquifer, such that existing users are affected, but not changing any WFD element status. Beneficial: Creation of flood storage and decrease in peak flood level* (> 50mm); measurable increase in surface water quality or in the yield or quality of an aquifer benefiting existing users but not changing any WFD element status.
Minor	Adverse: Measurable change to the integrity of an attribute Beneficial: Measurable increase, or reduced risk of negative effect to an attribute,	Adverse: Increase in peak flood level*(> 10mm); measurable decrease in surface water ecological or chemical quality or flow; decrease in yield or quality of aquifer, not affecting existing users or changing any WFD element status. Beneficial: Creation of flood storage and decrease in peak flood level* (> 10mm); measurable increase in surface water ecological or chemical quality; increase in yield or quality of aquifer not affecting existing users or changing any WFD element status.
Negligible	No change to integrity of attribute	Negligible change to peak flood level* (< +/- 10mm); discharges to watercourse or changes to an aquifer which lead to no change in the attribute's integrity.

* Peak flood level for floods up to and including a 1% annual probability event, including climate change. Where access or egress routes are affected, the magnitude of the impact will be defined by the change in the Flood Hazard Rating as defined in Defra/Environment Agency report FD2320

21.6.5 Table 52 provides an indication of the value of receiving water body or receptor. The list is not exhaustive and is intended as a guide.

Table 52 - Examples of the value of possible waterbodies or receptors

Value	Criteria	Examples
Very high	Nationally significant attribute of high value	Watercourse with a Q_{95}[299] flow ≥ 1.0 m^3/s , SPZ 1 within a Principal aquifer, essential infrastructure or highly vulnerable development*
High	Locally significant attribute of high value	Watercourse with a Q_{95} flow < 1.0m^3/s, Principal aquifer, more vulnerable development*
Moderate	Of moderate quality and rarity	Watercourses with no permanent baseflow, Secondary aquifer, less vulnerable development*
Low	Lower quality	Surface water sewer, minor pond or ditch, non-aquifer, water compatible development*

* as defined in Table 2 of the Flood Risk section of the Technical Guidance to the NPPF.

Construction effects

21.6.7 The following possible effects arising from the construction of the Proposed Scheme will be considered:

- effects on the water quality of receiving surface water and groundwater bodies due to the deposition or spillage of soils, sediment, fuels or other construction materials, or through mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site runoff;
- effects on river or stream flows during temporary disruption, discharges or diversion of surface water or groundwater flows, during adjacent works;
- effects on GDWTE and water bodies that support habitats and ecosystems;
- effects on aquifers from groundworks, abstractions/dewatering, discharges to ground, and obstructions to groundwater flow by tunnelling, cuttings, cut offs etc.;
- effects on areas with critical drainage problems (as notified by the Environment Agency to local planning authorities);
- effects of liquid wastes generated by construction activities on the environment;
- effects on flood risk receptors, flood defence assets and schemes;
- effects on water abstractors; and
- effects on local flood risk due to uncontrolled site runoff, deposition of silt, sediment in drains or ditches, temporary diversion of rivers, sewers or ditches, temporary earthworks affecting natural drainage paths.

[299] Q95 is the flow equalled or exceeded in a watercourse for 95% of a recording period - typically over several years

21.6.8 Where significant adverse effects are identified on groundwater, the design will be amended as far as is reasonably practicable to mitigate the effects, for example by reducing the effect of dewatering through use of cut off walls or by recharging water to aquifers. In some cases, groundwater sources may need to be augmented with alternative supplies or boreholes deepened, with agreement from owners.

21.6.9 Potential ecological and human health impacts associated with changes in the water environment will be considered by those undertaking the ecology and biodiversity, health and land quality assessments, see Sections 11, 13 and 14 respectively.

21.6.10 Assessment of the effects arising from construction of the Proposed Scheme will take into account the requirements of the CoCP and will include proposals for ongoing environmental monitoring.

Operational effects

21.6.11 The following examples of possible effects will be assessed:

- effects on water quality due to the contamination of groundwater or surface waters from both routine discharges from the railway or associated infrastructure and from accidental spillages;
- effects on river or stream quality and flows caused by the permanent discharge to or diversion of watercourses, and consequent effects on groundwaters;
- effects on water bodies that support habitats and ecosystems;
- effects on flood risk receptors, flood defence assets and schemes; and
- effects on water abstractors.

21.6.12 When assessing the effects on the quality of surface watercourses, details of the receiving watercourse and an estimate, based on a combination of expert judgement and analysis, for the quantity of pollution that could be released during routine operations, will be used. Estimates will generally be conservative and assume little or no dispersion. An assessment will be made of the risk of accidental spillages and the possible effects on water quality.

21.6.13 The effects on groundwater, both in quantitative and qualitative terms, will be assessed using a suitable combination of professional judgement, analytical calculation and computational modelling. This will include the impacts of any contaminated land causing an effect on groundwater quality; see Section 14 land quality.

21.6.14 The assessment of flood risk will be made using the Planning Practice Guidance[300] and associated Environment Agency guidance, and undertaken using analytical calculation, computational and procedural best practice. Flood risk assessments will also be prepared as separate, stand-alone documents, but these will similarly inform the EIA and mitigation proposed.

[300] Planning Practice Guidance, Flood Risk and Coastal Change, 2015. Available at: http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change

21.6.15 Effects on surface waters could be mitigated as far as reasonably practicable by the use of sustainable drainage systems. Pollution risk could similarly be mitigated through pollution prevention measures.

21.6.16 The assessment will include recommendations for ongoing environmental monitoring of measures designed to mitigate the impacts of significant effects.

21.6.17 A separate assessment will be made of the implications of the relevant aspects of the proposals covered by WFD legislation. This will inform the assessment of effects related to water quantity and quality, as well as hydromorphology. Biological effects will be reported in the ecology and biodiversity assessment. EIA and the mitigation proposed will be undertaken in accordance with current guidance and practice. Where a non-compliance is identified as part of the WFD compliance assessment it will be reported as a significant effect within the EIA. The WFD compliance assessment will outline the measures that would be taken in these circumstances to ensure the scheme achieves compliance with the WFD.

Cumulative effects

21.6.18 Cumulative effects may occur due to the combination of one or more separate impacts. These may be due to the coincidence of impacts or the cumulative impact of separate events occurring at different times. The following are examples of possible cumulative effects that may be assessed:

- impacts from the Proposed Scheme will be assessed together with impacts from adjacent development, such as flood defence schemes, to derive an assessment of the cumulative effects from all the schemes;
- accumulation of minor, moderate or major impacts on a river or aquifer that, when considered together, constitute a major impact leading to a significant effect; and
- a minor impact on river hydrology which, together with a minor impact on the riparian habitat (an ecological impact), when considered together, constitute a major impact leading to a significant effect.

21.7 Assumptions

21.7.1 The assessment will assume that track drainage will, wherever reasonably practicable, be kept separate from existing land drainage that crosses the route.

21.7.2 Discharges of surface water from the new infrastructure will, wherever reasonably practicable, be managed in accordance with the principles of the non-statutory technical standards for sustainable drainage systems (Defra, 2015) and reference to CIRIA C753v2 'The SuDS Manual'.

21.7.3 Effects on watercourses that are affected by third party abstractions and discharges will be taken into consideration where records are available.

21.7.4 The assessment of the ecological effects on riparian and other habitats, that are dependent on surface or groundwater flows, are included in the ecology and biodiversity assessment; see Section 11.

Part C

22 Structure of the formal EIA Report

22.1.1 There is no legally prescribed form or structure for the contents of an EIA Report. The structure of the formal EIA Report is currently under consideration. The intention is that it will provide an assessment of the environmental impacts of the Proposed Scheme in accordance with the requirements of the EIA Regulations, incorporating the requirements of the 2014 EIA Directive. The formal EIA Report will be structured in a logical and comprehensible manner, taking account of the need for the information to be accessible, understandable and readable to a broad audience. It is intended that it will contain appropriate signposting and web-links (in the case of the electronic version) to make navigation through the document easier for those seeking information relevant to their needs.

22.1.2 It is anticipated that the formal EIA Report will comprise several volumes dealing with the following matters:

- description of the HS2 project, the need for the project and the reasonable alternatives studied;
- the EIA processes and the consultation that has been carried out;
- description of the environmental baseline, environmental effects and mitigation, set out in a number of sections (anticipated to comprise five community areas) along the route;
- project-wide and cumulative effects assessment;
- non-technical summary; and
- environmental mapping, Proposed Scheme drawings, and other illustrations.

22.1.3 Further documents will be produced to meet hybrid bill requirements and to support the formal EIA Report including:

- SMR (this document);
- Environmental Minimum Requirements; and
- CoCP.

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Glossary of terms

Air quality exceedance	A period of time (defined for each standard) where the concentration is higher than that set out in the Standard
Air quality limit values	Legally binding EU parameters that must not be exceeded. They are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved
Air Quality Management Area (AQMA)	Air Quality Management Area. Designated under the Local Air Quality Management regime for areas currently, or forecast, to exceed National Air Quality Strategy objectives
Air quality objective	The target date on which exceedances of a Standard must not exceed a specified number
Air quality standard	Concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment
Air quality limit values	Values used in some EU Directives and are set out in the same way as limit values. They are to be attained where possible by taking all necessary measures not entailing disproportionate costs
ALARP principle	As low as reasonably practicable – A rule which involves weighing a risk against the time and money needed to control it
Ambient	Totally encompassing sound at a given location and time, usually composed of sound from many sources both near and far
Ancient woodland	Land that has been continually wooded since at least 1600 AD
Appraisal of Sustainability (AoS)	Appraisal of impact of plans or policies from environmental, economic and social perspective and against objectives of sustainable development
Aquifer	A below ground, water bearing layer of soil or rock
Area of Outstanding Natural Beauty (AONB)	Area designated under section 82 of the Countryside and Rights of Way Act 2000 for the purpose of conserving and enhancing its natural beauty
Auger	An auger is a drilling device, or drill bit, that usually includes a rotating helical screw blade. The rotation of the blade causes the material to move out of the hole being drilled
Baseline	Existing environmental conditions present on, or near a site, against which future changes can be measured or predicted
Biodiversity Action Plan	A Biodiversity Action Plan (BAP) is an internationally recognised programme addressing threatened species and habitats and is

	designed to protect and restore biological systems. The original impetus for these plans derives from the 1992 Convention on Biological Diversity
Birmingham Interchange	A proposed interchange station on HS2 Phase One which would allow access to Birmingham International railway station, the National Exhibition Centre and Birmingham Airport
Borehole	A deep hole bored into the ground as part of intrusive investigations typically to test depth and quality of groundwater
Built heritage	A heritage asset that is a structure or building visible above the land surface
Central Association of Agricultural Valuers	A specialist professional body representing, qualifying and briefing members practicing a diverse range of agricultural and rural work throughout England, Wales, Scotland, and Northern Ireland
Classic compatible	High speed trains designed to European legislation on interoperability and also to be capable of operating services to destinations north of HS2 through connections with the existing GB rail network
Classic rail	The existing GB inter-city rail network
Climate change adaptation	The term used to describe responses to the effects of climate change. The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.' Adaptation can also be thought of as learning how to live with the consequences of climate change The process that a receptor or project has to go through to ensure it maintains its resilience to climate change. In the case of a development, project adaptation can be embedded in the design to account for future climate conditions, or the project can introduce measures to ensure it retains it resilience (i.e. the project adapts) to future climate conditions. Environmental receptors will adapt to climate change in varying degrees, depending on how vulnerable they are to climate One of the aims of climate change adaptation is to improve resilience to a changing climate
Climate change mitigation	Measures included in a project to reduce the emissions of greenhouse gases Not to be confused with uses of the term mitigation within EIA
Climate change projections	Projections of changes in climate variables expressed in terms of the difference between the absolute future climate and a baseline climatology for a given location, time period and

	emissions scenario of greenhouse gases
Climate change resilience	The ability of a social or ecological system to absorb disturbances, while retaining the same basic structure and ways of functioning, as well as its capacity to self-organise and adapt to stress and change Climate change resilience involves minimising exposure to climate risks, reducing the consequences of resulting impacts, and/or facilitating earlier and less costly recovery following exposure A measure of ability to respond to changes that something experiences. If a receptor or project has good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and form. A receptor or project that has poor climate change resilience will lose much of its original function or form as the climate changes
Code of Construction Practice	The Code of Construction Practice sets out the standards and procedures to which a developer or contractor must adhere to when undertaking construction of major projects thus managing the environmental impacts. It also identifies the main responsibilities and requirements of developers and contractors in constructing their projects
Committee on Climate Change	Established under the CCA, the Committee on Climate Change is an independent advisory body tasked with helping the UK Government set and meet carbon budgets and adapt to climate change
Concentration response	A known functional relationship between exposure to a stressor (i.e. a pollutant or chemical) and the effect on a biological receptor (i.e. number of people who experience ill health or death)
Conservation	The preservation or enhancement of a species or building/structure
Conservation area	An area designated under section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990 as being of special architectural or historic interest the character or appearance of which it is desirable to preserve or enhance
Conurbation	A region comprising a number of cities, large towns and other urban areas that, through population growth and physical expansion, have merged to form one continuous urban and industrially developed area
Country Land and Business Association	A membership organization for owners of land, property and business in rural England and Wales
Crossrail	A new east-west railway linking Maidenhead and Heathrow

	Airport in the West via tunnels under Central London to Shenfield and Abbey Wood in the East
Department for Transport (DfT)	Government department responsible for transport policy in the UK (where not devolved)
Directive	European Commission Directives impose legal obligations on European Member States. They are binding as to the results to be achieved, but allow individual states the right to decide the form and methods used to achieve the results. An example of this is the EC Air Quality Framework Directive 96/62 that is brought into legal effect in the UK by the Air Quality (England) Regulations (2000)
Displacement	The extent to which the benefits of a project are offset by reductions of output or employment elsewhere
Dust	Defined as all particulate matter up to 75 micrometre in diameter (according to BS6069) and comprising both suspended and deposited dust
East Coast Main Line (ECML)	Intercity railway route in the UK connecting London, Peterborough, Doncaster, Wakefield, Leeds, York, Darlington, Newcastle and Edinburgh
EMC zones	A bounded area in which specific levels of elecromagnetic energy exist. It follows that some EMC zones contain higher levels of elecromagnetic energy than others. In the railway environment the zone containing most energy in these EMC zones exists on the trackside of the railway (where traction power is returned to the running rails) and close to traction or non-traction power distribution equipment
Environmental impact assessment (EIA)	Assessment of environmental effects of certain public and private projects under Directive 2014/52/EU
Environmental Impact Assessment Report (EIA Report))	The formal document or suite of documents reporting the requisite environmental information in respect of a project in accordance with EC Directive 2014/52/EU. Includes all such information that is reasonably required to assess the environmental effects of a development
Environmental Stewardship and Countryside Stewardship	A scheme run by the Department for Environment, Food, and Rural Affairs in England which aims to promote responsible use and protection of the natural environment through conservation and sustainable practices
Floodplain	Land adjacent to a watercourse over which water flows, or would flow but for defences in place, in times of flood
Grade I building	A listed building of exceptional interest, sometimes considered to be internationally important

Grade II* building	A listed building of particular importance, of more than special interest
Grade II building	Nationally important buildings that are of special interest
Green tunnel	Where earth is built up around and over a section of the rail line to reduce its environmental impacts
Greenhouse gases	Gases that trap thermal radiation in the atmosphere; examples include: carbon dioxide, water vapour, methane and nitrous oxide
Groundwater	Water associated with soil or rocks below the ground surface but is usually taken to mean water in the saturated zone
Habitat	The living place of an organism characterised by its physical or biotic properties
Habitat Suitability Index (HSI)	An HSI is a numerical index evaluating habitat quality and quantity for a particular species, where a value of 1 represents optimum habitat and 0, habitat of no value. The HSI for great crested newt incorporates 10 suitability indices, all of which are factors know to affect this species
Heritage asset	A building, monument, site, place, area or landscape positively identified as having a degree of significance meriting consideration in planning decisions. Heritage assets are the valued components of the historic environment. They include designated heritage assets and assets identified by the local planning authority during the process of decision-making or through the plan-making process (including local listing)
High Speed One (HS1)	The existing Channel Tunnel Rail Link from St Pancras International station to the Channel Tunnel
Historic England	The Government's statutory advisor on the historic environment. Officially known as Historic Buildings and Monuments Commission for England, Historic England is an executive Non- Departmental Public Body sponsored by the Department for Culture, Media and Sport
HS2 Ltd	The company set up by the Government to develop proposals for a new high speed railway line between London and the West Midlands and to consider the case for new high speed rail services linking London, northern England and Scotland
Hybrid bill	A public bill which affects a particular private interest in a manner different from the private interest of other persons or bodies of the same category or class
Hydrogeology	The study of geological factors relating to the Earth's water
Hydromorphology	The physical characteristics of the shape, boundaries and content of a water body

In-combination climate change effects	The combined significant effects of the Proposed Scheme and potential climate change impacts on the receiving environment and community Not to be confused with uses of the terms 'combined effects' and 'cumulative effects' in EIA
In-combination climate change impacts	The combined effect of the impacts of the Proposed Scheme and potential climate change impacts on the receiving environment and community Not to be confused with uses of the terms 'combined effects' and 'cumulative effects' in EIA
Inert waste	The EU Landfill Directive 1999/31/EC in Article 2(e) defines 'inert waste' as follows: Waste is considered inert if: • it does not undergo any significant physical, chemical or biological transformations; • it does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health; and • its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water and/or groundwater
Infrastructure maintenance depot	Base for maintenance of infrastructure associated with the proposed high speed rail line, including track, signalling equipment, cuttings and embankments
Institute of Environmental Management and Assessment	Professional membership organisation for environmental practitioners
Intergovernmental Panel on Climate Change	A scientific intergovernmental body, tasked with the production of assessments of overall understanding of the scientific, environmental, technical and socio-economic risks from and likely responses required to climate change
Intrusive investigation	An in-depth investigation involving further sampling and analysis, such as the gathering of samples from the ground, walls, ceilings for the detection of contamination, asbestos and or archaeological remains
Light Detecting and Ranging (LiDaR)	A remote sensing technology that measures distance by illuminating a target with a laser
Listed buildings	Buildings of special architectural or historic interest listed by the Secretary of State for Culture, Media and Sport on the advice of

	Historic England. Buildings are graded to indicate their relative importance
Mitigation	The measures put forward to prevent, reduce and where possible, offset any significant adverse effects on the environment
National Farmers Union	Member organisation/industry association for Welsh and English farmers
National Forest Inventory	A record of the size and distribution of forests and woodlands in Great Britain and information on key forest attributes run by the Forestry Commission
National Trust	A UK conservation charity protecting historic places and green spaces and opening them up for everyone
National Vegetation Classification	The National Vegetation Classification (NVC) is a comprehensive classification and description of the plant communities of Britain
Natural England	The Government's advisor on the natural environment who provides practical advice, grounded in science, on how best to safeguard England's natural wealth for the benefit of everyone
Net	After all deductions have been made
NO_2	Nitrogen dioxide. Road transport and the burning of fossil fuels for power are the main sources of Nitrogen dioxide. In addition to being a greenhouse gas it also contributes to photochemical smog formation. It is an irritant to the respiratory system
Non-governmental organisation	Legally constituted organisation, which is independent of government. It is ordinarily non- profit and may be organised at a local, national or international level
Non-hazardous waste	The EU Landfill Directive in Article 2 defines 'non-hazardous waste' as follows: • 'non-hazardous waste' means waste which is not covered by Article 2 paragraph (c); • Article 2 paragraph (c) states 'hazardous' waste means any waste which is covered by Article 1(4) of Council Directive 91/689/EEC of 12 December 1991 on hazardous waste
NO_X	Nitrogen oxides. NO_X is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. NO_X is typically comprised largely of nitric oxide (NO) and nitrogen dioxide (NO_2). Many of the nitrogen oxides are colourless and odourless, although NO_2 can often be seen as a reddish- brown layer over many urban areas when present alongside particulates NO_X form when fuel is burned at high temperatures, as in a

	combustion process. Consequently, these emissions occur almost exclusively from the combustion of fossil fuels for industry and transport, and from the burning of biomass
Palaeo-environmental remains	The remains and past environment of an area during a given period of history
Particulate matter	Discrete particles in ambient air, sizes ranging between nanometres (nm, billionths of a metre) to tens of micrometres (µm, millionths of a metre)
Pathways	The routes by which impacts are transmitted through air, water, soils or plants and organisms to their receptors
Phase One	Phase One of HS2 - a high speed railway between London and the West Midlands with a connection via the West Coast Main Line at conventional speeds to the North West and Scotland. Phase One includes four high speed rail stations at London Euston, Old Oak Common (West London), Birmingham Airport (Birmingham Interchange) and Birmingham (Curzon Street)
Phase 1 habitat survey	The Phase 1 habitat classification and associated field survey technique provides a relatively rapid system to record semi-natural vegetation and other wildlife habitats. Each habitat type/feature is defined by way of a brief description and is allocated a specific name, an alpha-numeric code, and unique mapping colour. The system has been widely used and continues to act as the standard 'phase 1' technique for habitat survey across the UK
Phase Two	Phase Two of HS2 - extending the high speed railway beyond the West Midlands to Manchester and Leeds with connections at conventional speeds via the West Coast and East Coast Main Lines
Proposed Scheme	Proposals for a high speed railway from West Midlands to Crewe announced by the Government in High Speed Two: East and West
Public realm	The space between and within buildings that are publicly accessible, including streets, squares, forecourts, parks and open space
Pylon	A tall lattice like structure (usually made of steel) which is to support overhead power lines
Receptor	A component of the natural, created or built environment such as human being, water, air, a building, animal or a plant that is affected by an impact
Registered Historic Battlefields	A national record of significant historic battlefield sites for the protection, preservation and enjoyment of these landmarks

Registered Parks and Gardens	A national record of historic parks and gardens, which make a rich and varied contribution to the landscape
Residual impacts	Those impacts of the development that cannot be mitigated following implementation of mitigation proposals
Riparian habitat	The interface between land and a river or stream
Risk assessment	An assessment of the likelihood and severity of an occurrence
River Corridor Survey	Field mapping vegetation and physical features along the watercourse corridor using standard symbols, with cross-sections of channel form
River Habitat Survey	A method designed to characterise and assess, in broad terms, the physical structure of watercourse habitats
Rolling stock and traction depot	Depot used to service and maintain trains operating on the proposed route
Scheduled Monument	Important sites and monuments are given legal protection by being placed on a schedule by Historic England
Scoping	An initial stage in determining the nature and potential scale of environmental impacts arising as a result of a development, and an assessment of what further studies are required to establish their significance
Setting (Heritage asset)	The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral
Site of Special Scientific Interest (SSSI)	Area of land notified by Natural England under section 28 of the Wildlife and Countryside Act 1981 as being of special interest by reason of its flora, fauna or geological or physiological features
Source Protection Zone (SPZ)	A defined area within which groundwater is extracted for potable water supply. The area is defined by the Environment Agency on the basis of the length of time taken for groundwater to migrate from the potable source
Threshold	A level of effect above which an assessment will be taken of whether any changes to procedures need to be made
Topography	The natural or artificial features, level and surface form of the ground surface
Transport for London (TfL)	TfL was created in 2000 and is the integrated body responsible for London's transport system
Tunnel boring machine (TBM)	A machine that excavates tunnels
UK Climate Change Risk	Research into the anticipated impacts of climate change on the

Assessment	UK and its economy
UK Climate Projections	Information on the projected evolution of climate change in the UK explored through three possible scenarios: High, Medium and Low greenhouse gas emissions levels
Utility	A commodity or service, such as electricity, gas or fuel that is provided by a public or private service provider. These are often delivered to customers via pipes, cables etc. under the ground. They can also be delivered above the ground, for example, via overhead power lines
Utility diversion	Where the current alignment of utilities, either above or below ground, would prevent the construction of certain components of the Proposed Scheme, they may be re-routed, or the height or depth altered to facilitate construction. For example, raising the height of the existing pylons to provide clearance over the proposed HS2 route
West Coast Main Line (WCML)	Existing intercity railway route in the UK connecting London, Birmingham, Manchester, Liverpool and Glasgow
World Heritage Site	A natural or man-made site, area, or structure recognised as being of outstanding international importance and therefore deserving special protection. Sites are nominated to and designated by the World Heritage Convention

Annex A – List of Technical Notes

The following table sets out the Technical Notes that were prepared for Phase One. Technical Notes for Phase 2a will be based on those prepared for Phase One and updated to take into account any changes in proposed methodology as appropriate.

Technical Note title	Published	Amended	Document locations
Air quality assessment for construction issues NB This has been superseded by Technical Note 'Air quality guidance on assessment methodology'	November 2013	SES and AP2 ES[301] – July 2015 SES2 and AP3 ES[302] – September 2015	Scope and methodology addendum Scope and methodology addendum 2 Scope and methodology addendum 3
Air quality guidance on assessment methodology	November 2013	SES and AP2 ES[301] – July 2015 SES2 and AP3 ES[302] – September 2015	Scope and methodology addendum Scope and methodology addendum 2 Scope and methodology addendum 3
Community and socio-economics – Further assessment guidance	November 2013		Scope and methodology addendum
Cultural heritage – Risk based approach to archaeological assessment	November 2013		Scope and methodology addendum
Cultural heritage – Fieldwalking	November 2013		Scope and methodology addendum
Cultural heritage – Geophysical survey	November 2013		Scope and methodology addendum
Ecological field survey methods and standards	November 2013	SES3 and AP4 ES[303] – October 2015	Scope and methodology addendum Scope and methodology addendum 4
Ecological assessment method	November 2013		Scope and methodology addendum
Methodology for demonstrating no net loss in biodiversity	November 2013		Scope and methodology addendum

[301] Supplementary Environmental Statement and Additional Provision 2, July 2015
https://www.gov.uk/government/collections/supplementary-environmental-statement-and-additional-provision-2-july-2015

[302] Supplementary Environmental Statement 2 and Additional Provision 3, September 2015
https://www.gov.uk/government/collections/supplementary-environmental-statement-2-and-additional-provision-3-september-2015

[303] Supplementary Environmental Statement 3 and Additional Provision 4, October 2015
https://www.gov.uk/government/collections/supplementary-environmental-statement-3-and-additional-provision-4-october-2015

Technical Note title	Published	Amended	Document locations
Ecological principles of mitigation	November 2013		Scope and methodology addendum
Electromagnetic interference	November 2013		Scope and methodology addendum
Introduction to land quality assessments	November 2013		Scope and methodology addendum
Detailed methodology for land contamination assessments	November 2013		Scope and methodology addendum
Methodology and significance criteria for geological issues (excluding land contamination)	November 2013		Scope and methodology addendum
Land quality - Operational issues	November 2013		Scope and methodology addendum
Land quality - Potential mitigation measures	November 2013		Scope and methodology addendum
Approach to tranquillity assessment	November 2013		Scope and methodology addendum
Zone of theoretical visibility production methodology	November 2013		Scope and methodology addendum
Approach to verifiable photomontages	November 2013		Scope and methodology addendum
Traffic and transport- Guidance on further development of significance criteria	November 2013	SES2 and AP3 ES[302] – September 2015	Scope and methodology addendum Scope and methodology addendum 3
Rationale for landfill significance criteria	November 2013		Scope and methodology addendum
Waste forecast and assessment methodology	November 2013		Scope and methodology addendum
Surface water quality assessment	November 2013		Scope and methodology addendum
Ground water assessment method	November 2013		Scope and methodology addendum
Spillage risk assessment	November 2013		Scope and methodology addendum

Annex B – List of consultees

The following table sets out the list of organisations who were contacted as part of the consultation on the draft of this SMR. This includes statutory consultees as well as non-statutory organisations.

The draft SMR was also made available on the Hs2 website and comments were invited from other stakeholders also. The Phase 2a EIA Scope and Methodology Report: Consultation Summary Report[304] sets out details of the consultation comments and the project's response to them.

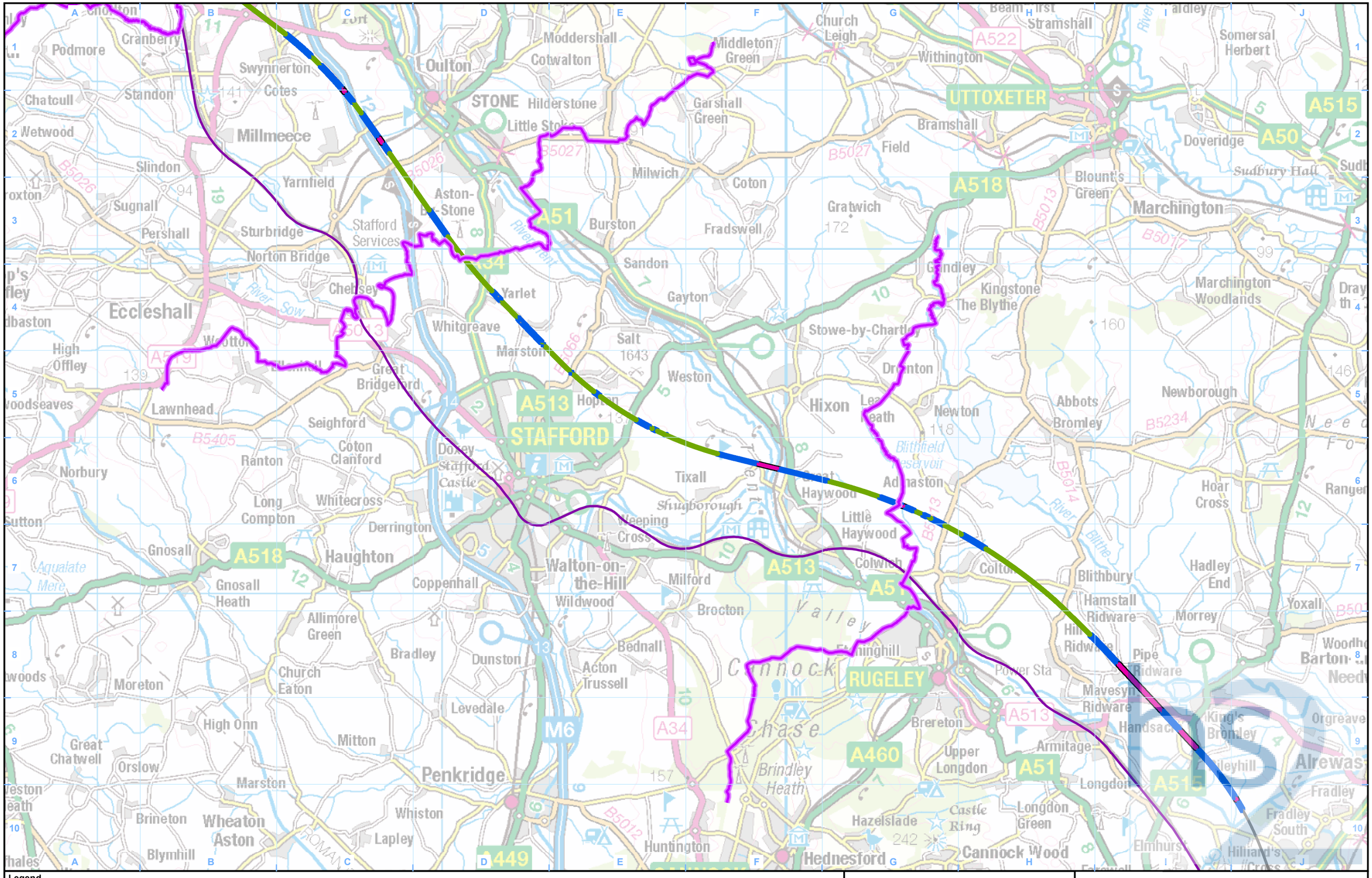
Alrewas Parish Council
Armitage with Handsacre Parish Council
Arriva
British Transport Police Authority
Campaign for Better Transport
Campaign to Protect Rural England (CPRE)
CPRE – Cheshire
CPRE – North West
Canal & River Trust
Cannock Chase AONB Unit
Central Association of Agricultural Valuers
Chapel and Hill Chorlton Parish Council
Checkley-cum-Wrinehill Parish Council
Cheshire East Council
Cheshire Fire Authority
Cheshire Police Authority
Cheshire Resilience Forum
Chorlton and Hough Parish Council
Civil Aviation Authority
The Coal Authority
Coal Pro
Colton Parish Council
Colwich Parish Council
The Commission for Rural Communities
Country Land and Business Association
Crewe Town Council
Crown Estate Commissioners
Department for Culture, Media & Sport
Department for Communities and Local Government (DCLG)
Department for Energy and Climate Change (DECC)
Department for Environment, Food & Rural Affairs (Defra)
Design Council

[304] HS2 Phase 2a West Midlands to Crewe Environmental Impact Assessment Scope and Methodology Report: Consultation Summary Report

The Disabled Persons Transport Advisory Committee
Doddington and District Parish Council
East Staffordshire Borough Council
English Heritage
Environment Agency
Equality and Human Rights Commission (EHRC)
Forestry Commission
Fradley and Streethay Parish Council
Friends of the Earth
Greenpeace
Hamstall Ridware Parish Council
Health and Safety Executive (HSE)
Heritage Alliance
Highways England
Historic Buildings & Monuments Commission for England (Historic England)
Hopton and Coton Parish Council
Ingestre and Tixall Parish Council
International Union of Railways
The Joint Nature Conservation Committee
Kings Bromley Parish Council
Lichfield City Council
Lichfield District Council
Local Government Association (LGA)
Madeley Parish Council
Marston Parish Council
Mavesyn Ridware Parish Council
Ministry of Defence
National Association of Areas of Outstanding National Beauty
National Farmers Union
National Parks England (Formerly English National Park Authorities Association)
National Trust
Natural England
Network Rail
Newcastle-under-Lyme Borough Council
NHS England Midlands & East
NHS Staffs & Surrounds CCG
The Office of Rail Regulators and Approved Operators
Public Health England (PHE)
PHE North West
PHE West Midlands
Rail Future
Ramblers Association
Royal Society for the Protection of Birds (RSPB)
RSPB Midlands
RSPB Northern England
Sports England
Stafford Borough Council

Staffordshire County Council
Staffordshire Police Authority
Staffordshire Prepared
Stoke-on-Trent and Staffordshire Fire and Rescue Authority
Stone Parish Council
Swynnerton Parish Council
Transport Focus (formerly Passenger Focus)
UK Coal
The Water Services Regulation Authority
Weston and Basford Parish Council
Whitgreave Parish Council
Whitmore Parish Council
The Wildlife Trusts
Wildlife Trust – Cheshire
Wildlife Trust – Staffordshire
Woodland Trust
Wynbunbury Parish Council

Annex C – Route maps



Legend

- HS2 Phase 1
- West Coast Mainline
- Community area boundary
- Route in embankment
- Route in bored tunnel
- Route in cutting
- Tunnel portal
- Route on viaduct
- Indicative Infrastructure Maintenance Depot location

Map Name

Annex C - Proposed route of Phase 2a

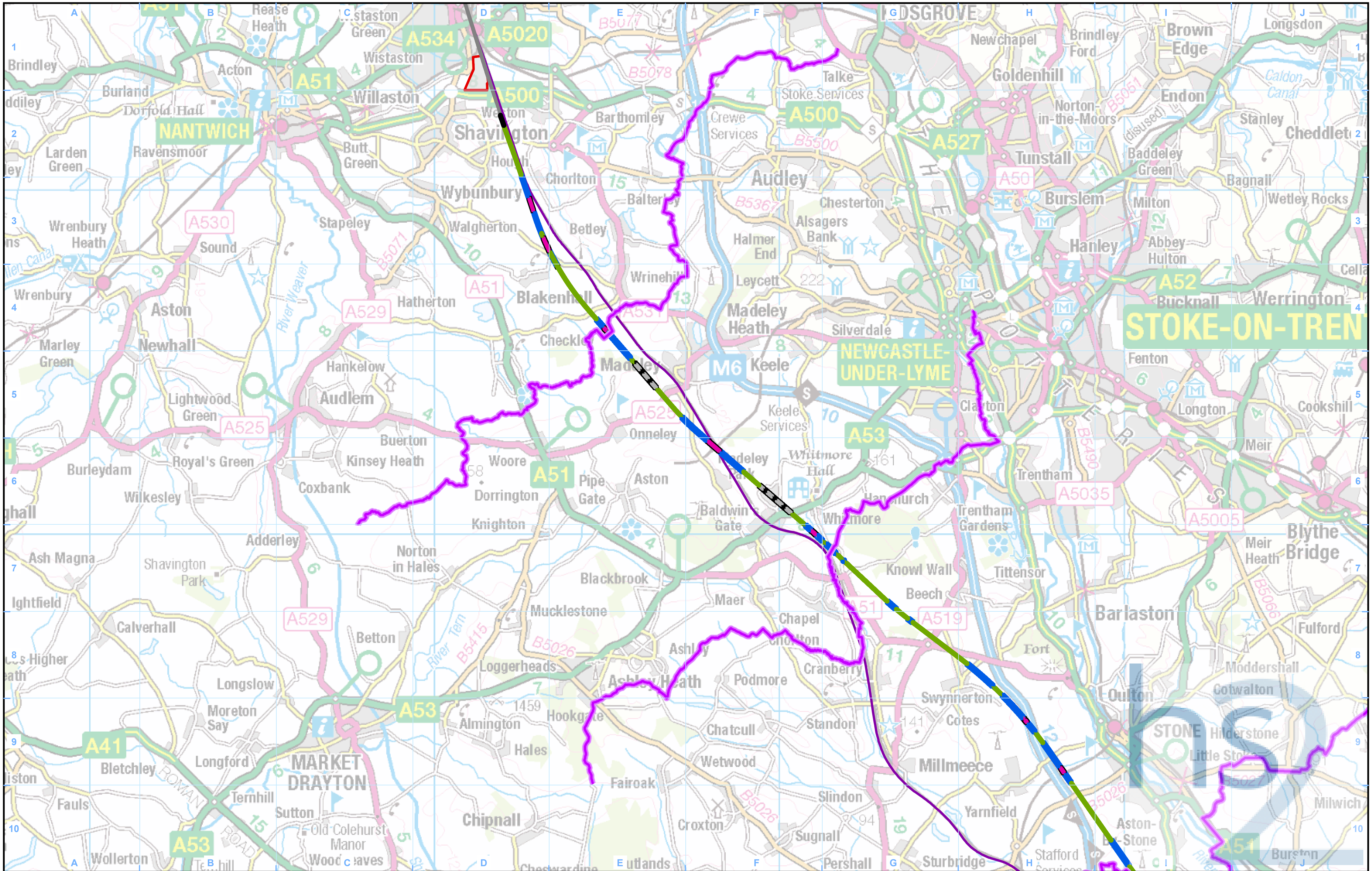
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:100,000

0 1,000 2,000 3,000 4,000 Metres

Doc Number:

Date: 06/09/16



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Annex C - Proposed route of Phase 2a

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Scale at A3: 1:100,000

0 1,000 2,000 3,000 4,000 Metres

Doc Number:

Date: 06/09/16

Annex D – List of acronyms

µT	Micro Tesla
AADT	Annual Average Daily Traffic
ADMS	Atmospheric Dispersion Modelling System
ALARP	As Low As Reasonably Practicable
ALC	Agricultural Land Classification
AONB	Area of Outstanding Natural Beauty
AoS	Appraisal of Sustainability
AP	Additional Provision
AQMA	Air Quality Management Area
BAME	Black, Asian and Minority Ethnic People
BCO	British Council for Offices
BS	British Standards
BSI	British Standards Institute
CA	Community Area
CCA+R	Climate Change Adaptation and Resilience
CCC	Committee on Climate Change
CCR	Climate Change Resilience
CIEEM	Chartered Institute of Ecology and Environmental Management
CLEA	Contaminated Land Exposure Assessment
CO_2	Carbon Dioxide
CoCP	Code of Construction Practice
DART Underground	Dublin Area Rapid Transport Underground
dB	Decibel
DCLG	Department of Communities and Local Government
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EC	European Commission

ECML	East Coast Main Line
EDI	Equality, Diversity and Inclusion
eDNA	Environmental DNA
EFA	Education Funding Agency
EHRC	Equality and Human Rights Commission
EIA	Environmental Impact Assessment
ELC	European Landscape Convention
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMF	Electromagnetic Fields
EMI	Electromagnetic Interference
EMR	Environmental Minimum Requirements
EPUK	Environmental Protection UK
EPS	European Protected Species
EQIA	Equality Impact Assessment
ES	Environmental Statement
EU	European Union
FRA	Flood Risk Assessment
FMD	Foot and Mouth Disease
FSMS	Field Survey Methods and Standards
FTA	Federal Transit Administration
GHG	Greenhouse Gases
GWML	Great Western Main Line
HCA	Home and Communities Agency
HDV	Heavy Duty Vehicle
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HS1	High Speed One (formerly Channel Tunnel Rail Link – CTRL)
HS2	High Speed Two
HSI	Habitat Suitability Index

HSR	High Speed Rail
Hz	Hertz
IAQM	Institute of Air Quality Management
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICOMOS	International Council on Monuments and Sites
IEMA	Institute of Environmental Assessment and Management
IMD	Infrastructure Maintenance Depot
IPCC	Intergovernmental Panel on Climate Change
IPCC AR5	IPCC's 5th Assessment Reports
ISO	International Organisation for Standardisation
km	Kilometre
kph	Kilometres per hour
kWh	Kilowatt-hour
LAQM	Local Air Quality Management
LGS	Local Geological Site
LiDAR	Light Detection and Ranging
LLAU	Limits of Land to be Acquired or Used
LLFA	Lead Local Flood Authority
LULUCF	Land Use, Land Use Change and Forestry
M	Metre
MAFF	Ministry of Agriculture, Fisheries and Food
mm/s	Millimetres per second
mph	Miles per hour
NO_2	Nitrogen dioxide
NOx	Oxides of nitrogen
MWIA	Mental Wellbeing Impact Assessment
NOMIS	Service provided by the Office for National Statistics to provide UK labour market statistics
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
Ofsted	Office for Standards in Education

OLE	Overhead Line Equipment
ONS	Office of National Statistics
PHE	Public Health England
PFM	Planet Framework Model
PAS	Publicly Available Specification
PLT	Permanent Land Take
PM_{10}	Particulate matter with aerodynamic diameter of less than 10 micrometres
$PM_{2.5}$	Particulate matter with aerodynamic diameter of less than 2.5 micrometres
PPG	Planning Practice Guidance
PPGN	Planning Guidance on Noise
PPS	Planning Policy Statement
PPV	Peak Particle Velocity
PRoW	Public Right of Way
PSED	Public Sector Equality Duty
RBMP	River Basin Management Plan
RESTATS	Renewable Energy Statistics
RPG	Regional Planning Guidance
RSPB	Royal Society for the Protection of Birds
RSSB	Rail Safety and Standards Board
SAC	Special Area of Conservation
SES	Supplementary Environmental Statement
SI	Statutory Instrument
SM	Scheduled Monument
SO27A	Parliament's Private Business Standing Order 27A
SPZ	Source Protection Zone
SMR	Scope and Methodology Report
SSSI	Site of Special Scientific Interest
TDM	Technical Design Manual
TGV	Train à Grande Vitesse (English: 'high-speed train') TGV is France's high-speed rail service

TIN	Technical Information Note
TLT	Temporary Land Take
TraCCA	Tomorrow's Railway and Climate Change Adaptation
TRL	Transport Research Library
UK	United Kingdom
UKCP	UK Climate Projections
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UKFS	UK Forestry Standard
VDV	Vibration Dose Value
WCML	West Coast Main Line
WebTAG	Web Transport Appraisal Guidance
WFD	Water Framework Directive
WHO	World Health Organisation
WRAP	Waste and Resources Action Programme
ZTV	Zone of Theoretical Visibility

Annex E – HS2 Sustainability policy

Sustainability Policy

Hs2's purpose is to create a world class high speed rail network to support sustainable growth in the UK. It is a major opportunity to provide greater choice in the way we travel to help deliver a sustainable transport system for the UK.

Our vision is of a high speed railway network which changes the mode of choice for inter-city journeys, reinvigorates the rail network, supports economy, creates jobs, reduces carbon emissions and provides reliable travel in a changing climate throughout the 21st century and beyond.

This policy sets out HS2 Ltd's commitment to be an exemplar project. Building this network will inevitably cause some local effects on communities, the natural and the built environment. We will strive to limit the negative impacts through design, mitigation and by challenging industry standards and we will look for environmental enhancements and benefits.
Through this policy we aim to support the following Government goals:

- Create a step change improvement in transport link between regional centres and from them to London.
- Enable more equal distribution of opportunity, connect communities and encourage regeneration.
- Stimulate sustainable economic growth through increased capacity and shorter journey times between key cities.
- Support British engineering, create job opportunities and develop skills in the UK.
- Deliver lower carbon long distance travel.
- Maximise integration of HS2 with existing UK and international transport networks.
- Encourage wellbeing and protect the environment.

What we will do

We will promote high speed rail and balance community, environmental and economy issues. We have identified key themes as a focus for our work to:

Growth and regeneration - Support sustainable economic development and the localism agenda for regeneration.

Environmental change – Commit to protection of the environment through seeking to avoid significant adverse effects on communities, businesses and the natural, historic and built environment, including the prevention of pollution. Minimise impacts where they occur and deliver enhancements as far as practicable to attain no net loss to the natural environment.

Skills and employment - Improve skills, jobs, education and the economy through our investment along the length of the route. Act as a driver for improvements in the sustainability of the engineering and construction sector by ensuring that the right workforce is available at the right time with the right skills and behaviours.

Climate change - Minimise the carbon footprint of HS2 as far as practicable and deliver low carbon long distance journeys that are supported by low carbon energy.

Resilience - Build network which is resilient for the long term and seek to minimise the combined effect of the project and climate change on the environment.

Resources and waste - Source and make efficient use of sustainable materials, maximise the proportion of material diverted from landfill and reduce waste.

Integrated transport - Engage with stakeholders to create seamless transport links with other modes and allow accessibility for all.

Equality Diversity and Inclusion (EDI) - Promote EDI in line with the HS2 EDI Policy, to ensure that it is integrated into all business processes.

How we will deliver this

To deliver our vision we will embed sustainability in our business at each phase of the project through:

A clear plan - Setting goals relevant to the stage of the project for design, through development, construction, operation, maintenance and renewal which stimulate innovation and enable long term enhancements. Our plan and this policy will be reviewed biennially.

Robust processes - Ensuring sustainability is integrated into our culture, procedures and processes. This will be managed through the implementation and continual improvement of an Environmental Management System to enhance environmental and sustainability performance. This will include development of Sustainable Design and Delivery Principles as part of a process to enable us to balance the sometimes competing elements of sustainability and to understand whole life cost. We will comply with legal and other obligations.

Procurement - Ensuring sustainability is integral in our procurement processes and is applied to our entire supply chain.

Innovation - Promoting sustainable construction practices, continually focusing ideas and technologies for improving sustainability.

Engagement and reporting - Engaging in dialogue about the project and working with local communities, key stakeholders and our supply chain. Openly reporting our progress in delivering the commitments we make on sustainability regularly and sharing what we learn.

HS2 is determined to embed sustainability in the DNA of this project and integrate it into all of our work

Chief Executive Officer HS2
Approved on: 15 September, 2015

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