THE NATIONAL POLICY STATEMENT FOR NATIONAL NETWORKS

APPRAISAL OF SUSTAINABILITY

THE NATIONAL POLICY STATEMENT FOR NATIONAL ROAD AND RAIL NETWORKS
APPRAISAL OF SUSTAINABILITY

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1. INTRODUCTION

1.0.1 This report constitutes the Appraisal of Sustainability (AoS) for the National Policy Statement for National Networks (hereafter referred to as the NN NPS). Ramboll has undertaken the AoS on behalf of the Department for Transport (DfT), which has prepared the NN NPS[1]. The AoS has been undertaken in parallel with the development of the NN NPS. The AoS incorporates a Strategic Environmental Assessment (SEA)[2].

1.0.2 This AoS has been undertaken at the same high level as the NN NPS and does not seek to appraise specific schemes in specific locations. The conclusions it draws are therefore generic in nature and should not be interpreted as being the Government's view on the sustainability or otherwise of particular transport projects. Impacts have not been weighted and no assessment has been made of their relative importance. Detailed appraisal will take place in respect of individual road, rail and Strategic Rail Freight Interchange (SRFIs) developments, where this is required.

1.0.3 This AoS Report has been structured as follows:

i. Section 1 – Introduction (this section): introduction to the AoS Report;
ii. Section 2 – Background: the NN NPS including its objectives and, the purpose of the AoS;
iii. Section 3 – Appraisal Methodology: approach adopted for undertaking the AoS;
iv. Section 4 – Consultation to Date: summary of consultation that has been undertaken to date;
v. Section 5 - Sustainability Context: links to other strategic documents, the sustainability baseline, key sustainability issues;
vi. Section 6 - The AoS Framework: the AoS objectives and, a compatibility assessment of the AoS Framework against the NN NPS objectives;
vii. Section 7 – Predicting the Effects of the NN NPS and Alternatives: appraisal of sustainability of the NPS and the strategic alternatives;
viii. Section 8 – How the AoS process has informed the development of the NPS;
ix. Section 9 – Monitoring and Mitigation: suggested measures to monitor sustainability impacts of the NN NPS and identification of proposed mitigation measures;
x. Section 10 – Opportunities for improvement;
xi. Section 11 – Next Steps: what will happen next in the NN NPS process;
xii. Section 12 – Limitations and Assumptions: difficulties encountered during the appraisal process and assumptions made during the assessment.

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[1] The report has been produced on behalf of the Department of Transport but it is an independent appraisal of the National Policy Statement as it stands at the time of writing this report and does not necessarily represent the views of the Department for Transport.

[2] Pursuant to Directive 2001/42/EC as transposed by SI 2004/1633 'The Environmental Assessment of Plans and Programmes Regulations 2004'

1.0.4 The AoS Report and the NN NPS were published for consultation in December 2013. This version of the AoS Report has been updated following the consultation comments and should be read in conjunction with the Post Adoption Statement and the final NN NPS all published in parallel.

2. BACKGROUND

2.1 The National Networks National Policy Statement

2.1.1 The NPS sets out the need for and Government's policies for development of nationally significant infrastructure projects on the national road and rail networks. It provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State. The thresholds for nationally significant road, rail and strategic rail freight infrastructure projects are defined in the Planning Act 2008 ("the Planning Act") as amended (for highway and railway projects) by The Highway and Railway (Nationally Significant Infrastructure Project) Order 2013 ("the Threshold Order"). For the purposes of this report these developments are referred to as national road, rail and SRFI developments.

2.1.2 The Secretary of State will use the NN NPS as the primary basis for making decisions on development consent applications for national networks NSIPs in England.[3] Under Section 104 of the Planning Act the Secretary of State must decide an application for a national networks NSIP in accordance with the NN NPS unless it is satisfied that to do so would:

- lead to the UK being in breach of its international obligations;
- be unlawful;
- lead to the Secretary of State being in breach of any duty imposed by or under any legislation;
- result in adverse impacts of the development outweighing its benefits; and
- be contrary to regulations about how the decisions are to be taken.[4]

2.1.3 The NPS sets out the policy for the future development of nationally significant infrastructure projects (NSIPs) on the road and rail networks. As well as covering policy around the development of NSIPs, it also covers the Government's broader policies relating to the national networks, in particular improvements and enhancements below the NSIP thresholds and environmental and sustainable transport policies. These broader policies are an integral part of the Government's overall approach to developing NSIPs.

2.1.4 The NN NPS does not cover High Speed Two. The High Speed Two Hybrid Bill will seek the necessary legal powers to enable the construction and operation of Phase 1 of High Speed Two (HS2), including the powers to acquire the necessary land and undertake the works required. A Hybrid Bill process will also be used for Phase 2 of HS2. The NN NPS sets out the Government's policy for development on the national

[3] In Scotland, Wales and Northern Ireland, the authorisation of all national networks projects are devolved to the Scottish Government, Welsh Government and Northern Ireland Assembly.
[4] Planning Act 2008 Section 104 - Decisions in cases where national policy statement has effect.

road and rail networks and SRFIs, taking into account the capacity and connectivity that will be delivered through HS2.

2.2 The Government's strategic objectives for the National Networks and the policy set out in the NN NPS

2.2.1 The Government's strategic objectives for the national networks are set out in the box below.

Government's vision and strategic objectives for the national networks

The Government needs to deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.
- Networks which support and improve journey quality, reliability and safety.
- Networks which support the delivery of environmental goals and the move to a low carbon economy.
- Networks which join up our communities and link effectively to each other.

2.2.2 In broad terms, the policy in the NN NPS is for a significant and balanced package of improvements and enhancements across the road and rail networks, targeting key pressure points and transforming the networks for the longer term. This sits alongside a significant package of measures to protect the environment and support sustainable transport on the national networks.

2.2.3 Across the modes Government's policy is:

- **Roads –** reduce congestion and unreliability by focusing on improving and enhancing the existing national road network, including through enhancements beyond the existing highway boundary. However, in some cases, to meet the demands on the national road network it will not be sufficient to simply expand capacity on the existing network and so some new road alignments and corresponding links will be needed.

- **Rail –** improve the capacity, capability and reliability of the rail network at key locations for both passenger and freight movements to improve journey times, and to maintain or improve operational performance. Where this incremental approach is not sufficient, new or re-opened alignments to improve capacity, speed, connectivity and reliability should be considered. Where major new inter-urban alignments are required, high speed rail alignments are expected to offer the most effective way to provide a step change in inter-city capacity and connectivity, as well as helping to deliver long term sustainable economic growth.

- **Strategic Rail Freight Interchanges –** support the transfer of freight from road to rail and facilitate sustainable rail freight growth. To this end, there is a need for an

expanded network of SRFIs to serve regional, sub-regional and cross-regional markets providing good connectivity with both the road and rail network. These will be private sector, commercial developments that need to be located near the business markets they will serve – major urban centres, or groups of centres – and be linked to key supply chain routes. Given the need for effective connections for both rail and road, the number of locations suitable as SRFIs will be limited, which will restrict the scope for developers to identify viable alternative sites.

2.2.4 Whilst most schemes will be brought forward primarily for economic reasons, Government policy is also to bring forward schemes to improve safety, enhance the environment and improve accessibility for pedestrians and cyclists.

2.3 Purpose of the AoS and the AoS Report

2.3.1 The Planning Act requires Government Departments to assess the social, economic and environmental sustainability of a policy stated within an NPS through the production of an AoS[5].

2.3.2 The AoS assesses the environmental, social and economic impacts of the NPS. The AoS incorporates a Strategic Environmental Assessment (SEA), as discussed in Section 2.5.

2.3.3 The AoS also uses many of the principles of 'Sustainability Appraisal' (SA). SA aims to promote sustainable development through the integration of environmental, social and economic considerations.

2.3.4 The AoS for the NN NPS was undertaken at the same time as the drafting of the NN NPS. This ensured that findings from the AoS were taken into account and influenced the NN NPS, where practicable, prior to the public consultation stage.

2.3.5 The definition of sustainable development that underpins the AoS is "development that meets the needs of the current generation without undermining the ability of future generations to meet their own needs" (WCED, 1987[6]). This definition is brought together under what is often referred to as the three pillars of sustainability: economic, social and environmental development.

2.4 Spatial Scope of the AoS

2.4.1 The spatial scope of the AoS is broadly the same as that of the NN NPS, which covers England. However, it is considered that the NN NPS could result in some intra-UK impacts (on Scotland and Wales) and these are discussed in Section 7.8.

2.5 Strategic Environmental Assessment

2.5.1 SEA provides the basis for, and is integrated into the wider SA process. This AoS fulfils requirements set out in the SEA Directive and the transposed SEA Regulations. The elements of an 'Environmental Report', which are required by the SEA Directive and the Regulations, are therefore incorporated within this AoS Report. Table 1 indicates

[5] The 2008 Planning Act Part 2 Section 5(3)
[6] WCED (1987) *Our Common Future*, World Commission on Environment and Development

how this AoS report complies with the SEA Directive, and Appendix A provides an SEA Quality Assurance Checklist.

Table 1: Compliance with the SEA Directive

The SEA Directive's Requirements	Where this has been Addressed in the AoS
Preparation of an environmental report in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and geographical scope of the plan or programme, are identified, described and evaluated. The information to be given is (Art. 5 and Annex I):	This AoS Report constitutes the SEA Environmental Report.
a) An outline of the contents, main objectives of the plan or programme, and relationship with other relevant plans and programmes;	Section 2.1 and 2.2. Section 5.1 and 5.2
b) The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme;	Section 5
c) The environmental characteristics of areas likely to be significantly affected;	Section 5
d) Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC;	Section 5
e) The environmental protection objectives, established at international, Community or national level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation;	Section 5
f) The likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors. (Footnote: These effects should include secondary, cumulative, synergistic, short, medium and long-term permanent and temporary, positive and negative effects);	Section 7
g) The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme;	Section 9
h) An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;	Section 7.1, 7.5 and 12
i) a description of measures envisaged concerning monitoring in accordance with Article 10;	Section 9
j) a non-technical summary of the information provided under the above headings.	See separate Non-Technical Summary
The report shall include the information that may reasonably be required taking into account current knowledge and methods of assessment, the contents and level of detail in the plan or programme, its stage in the decision-making process and the extent to which certain matters are more appropriately assessed at different levels in that process to avoid duplication of the assessment (Art. 5.2).	It is considered that this report includes the information that may reasonably be required.
Consultation: • authorities with environmental responsibility, when deciding on the scope and level of detail of the information to be included in the environmental report (Art. 5.4). • authorities with environmental responsibility and the public shall be given an early and effective opportunity within appropriate time frames to express their opinion on the draft plan or programme and the accompanying environmental report before the	Section 4

The SEA Directive's Requirements	Where this has been Addressed in the AoS
adoption of the plan or programme (Art. 6.1, 6.2). • other EU Member States, where the implementation of the plan or programme is likely to have significant effects on the environment of that country (Art. 7).	
Taking the environmental report and the results of the consultations into account in decision-making (Art. 8).	Section 8
Provision of information on the decision: When the plan or programme is adopted, the public and any countries consulted under Art.7 shall be informed and the following made available to those so informed: • the plan or programme as adopted; • a statement summarising how environmental considerations have been integrated into the plan or programme and how the environmental report pursuant to Article 5, the opinions expressed pursuant to Article 6 and the results of consultations entered into pursuant to Article 7 have been taken into account in accordance with Article 8, and the reasons for choosing the plan or programme as adopted, in the light of the other reasonable alternatives dealt with; and • the measures decided concerning monitoring (Art. 9 and 10).	Section 11
Monitoring of the significant environmental effects of the plan's or programme's implementation (Art. 10).	Section 9
Quality assurance: environmental reports should be of a sufficient standard to meet the requirements of the SEA Directive (Art. 12).	See Appendix A

2.6. Habitats Regulations Assessment

2.6.1 The main objectives of the Habitats Directive are:

> *"to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies", Article 2(1); and*
>
> *"to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest", Article 2(2).*

2.6.2. Article 6 of the Habitats Directive, a Habitats Regulations Assessment (HRA) is required where a plan or project is likely to have significant effects upon a Natura 2000 site. This must be interpreted as meaning that any plan or project is to be subject to an assessment if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site. It is recognised that there may be limitations or uncertainties in predicting effects on European sites at the NPS level. The requirement, where uncertainty exists, is to ensure the precautionary approach is applied, and if necessary, that the plan accounts for and directs the continuation of the HRA process.

2.6.3. Natura 2000 is a network of sites designated to conserve natural habitats and species that are rare, endangered, vulnerable or endemic within the European Community. This includes Special Areas of Conservation (SAC) designated under the Habitats Directive for their habitats and/or species of European importance and Special Protection Areas (SPA) designated under the Conservation of Wild Birds Directive for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands.

2.6.4. The requirements of the Habitats Directive are transposed into UK law by means of the Conservation of Habitats and Species Regulations 2010 and the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended). The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007(as amended) transpose the Habitats Directive in the UK offshore marine area (beyond 12 nautical miles). In addition, it is a matter of UK law that candidate SACs (cSACs) are considered in this process and Government policy is that sites designated under the 1971 Ramsar Convention for their internationally important wetlands and potential SPAs (pSPAs) are also considered. Natura 2000 sites, Ramsar sites and sites protected by UK law and as a matter of government policy are collectively referred to as "European sites" hereafter.

2.6.5. The Habitats Regulations Assessment (Report reference 61032285/ENV/R02) has concluded that the NN NPS, in combination with a range of other plans and projects, has the potential for significant effects on European sites. Examples of impacts include habitat loss, habitat fragmentation, changes to hydrology and pollution to air.

2.6.6. Whilst mitigation steps might avoid or reduce damage to protected sites in some cases, in advance of considering specific proposals at individual sites, the possibility that the integrity of one or more European sites will be adversely affected by a national networks development at some point cannot be excluded.

2.6.7. The HRA concludes that there is a case for Imperative Reasons of Overriding Public Interest (IROPI) to justify adopting the NPS. As the IROPI case exists, the NPS does not rule out development that may affect a European site. However, making an IROPI case for the NN NPS should not be taken to mean that IROPI has been established for each individual road, rail and rail freight interchange infrastructure scheme that will come forward under the new planning regime. The impacts on protected sites or species of any individual development proposal should be assessed through project-level HRAs on a case-by-case basis and individual schemes will need to be considered on their own merits.

2.6.8. The HRA also identifies that for some development applications, it may be necessary to provide compensatory measures. These measures will be identified and addressed under the project-level HRA process.

3. APPRAISAL METHODOLOGY

3.1. Approach Adopted to the AoS

3.1.1 The AoS methodology consists of the following stages:

- Stage A Scoping
- Stage B Developing and refining alternatives and assessing impacts
- Stage C Preparing the AoS Report
- Stage D Consulting on the NN NPS and the AoS Report
- Stage E Monitoring the significant impacts of implementing the NPS (in accordance with established NPS processes)

3.1.2 These stages are discussed further below. This AoS report documents Stages A-C and constitutes the report produced at Stage C. The relationship between these AoS stages and the stages involved in developing the NN NPS is shown in Figure 1.

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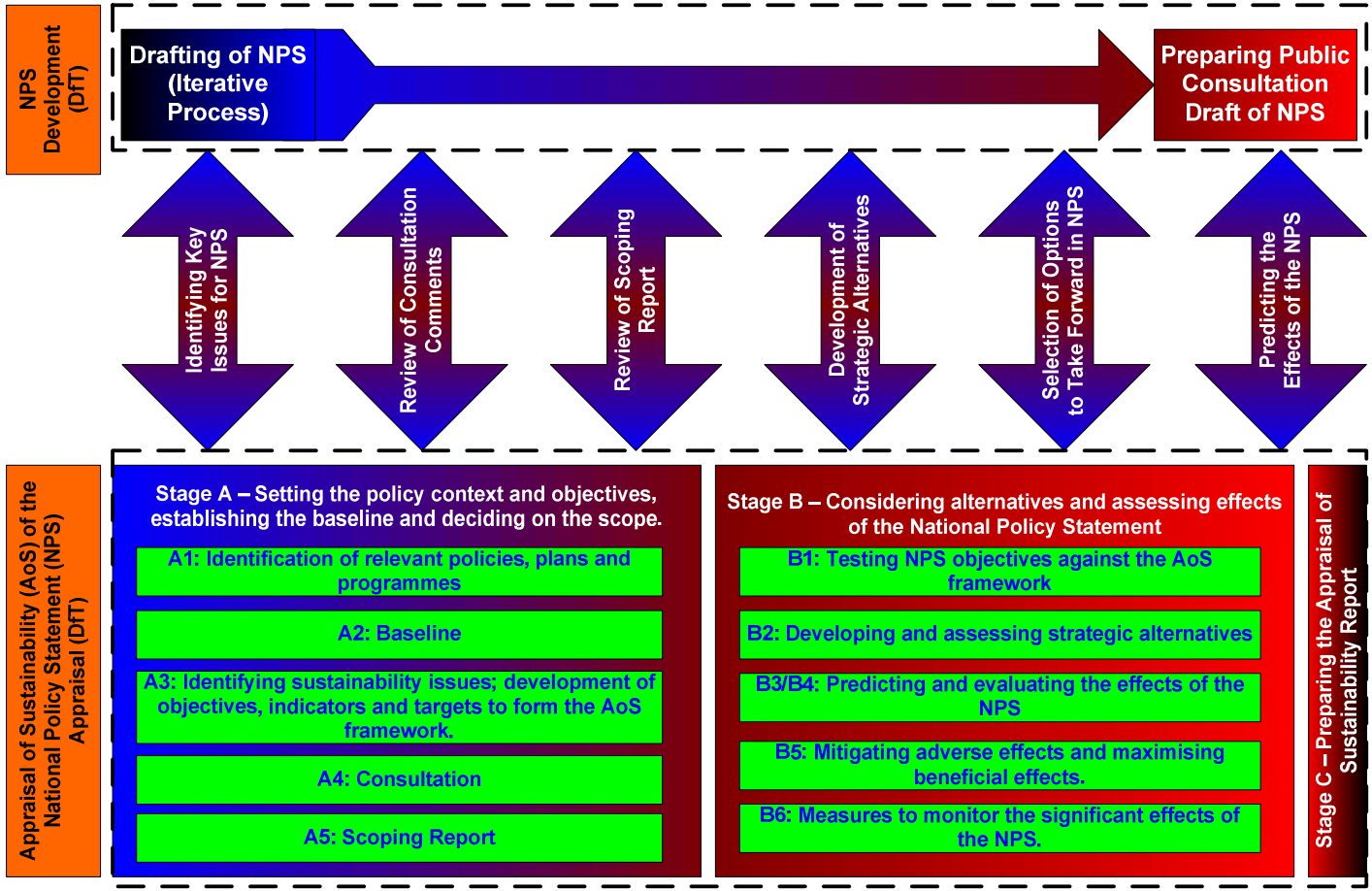
Figure 1 – The AoS Process



Stage A – Scoping

3.1.3 Scoping was reported upon in the AoS Scoping Report (Report No. ED45683, March 2009 – See Annex A). In summary, Scoping consisted of the following elements:

A1 - Identify other relevant policies, plans, programmes and sustainability objectives

3.1.4 A review of relevant legal plans, policies and programmes (PPPs) that have the potential to influence the development of the NN NPS was undertaken. This has been updated during the preparation of this AoS Report to ensure all PPPs contained within the report are up-to-date and still relevant. The PPP table is presented in Annex B.

A2 - Collect baseline information

3.1.5 Data relating to environmental, social and economic issues were identified and collated. This baseline data has been updated during the preparation of this AoS Report to ensure all the data was up-to-date and still relevant. Where possible, only baseline data relating specifically to national networks has been presented. The updated baseline information is presented in Annex C.

A3 - Identify key sustainability issues

3.1.6 Through the review of relevant plans, policies and programmes (PPP) and the collation of sustainability baseline data, a range of key sustainability issues that could be addressed by, or affect, the content of the NN NPS were identified.

A4 - Develop the AoS Framework

3.1.7 An AoS Framework was developed, which sets out the structure for the assessment, and includes a set of sustainability objectives that will be used within the appraisal process to assess the NN NPS. The wording of the sustainability objectives was agreed through the engagement process with the SEA Consultation Bodies. This Framework was updated slightly following the Scoping process in conjunction with consultation with the SEA Consultation Bodies. The AoS Framework is presented in Section 6.[7]

A5 - Consult on the scope of the AoS

3.1.8 Several scoping workshops were held with the SEA Consultation Bodies and other key stakeholders. In addition to this, stakeholders were given the opportunity to comment on the AoS Scoping Report, via a formal 5 week consultation period, in line with the requirements of the SEA Directive. For more details on consultation, please see Section 4. Consultee responses were used to help inform the on-going AoS. Appendix B documents the stakeholder comments received and how they have been taken account of.

Stage B - Developing and Refining Alternatives and Assessing Impacts

B1 – Test the NN NPS objectives against the AoS Framework

3.1.9 The high-level NN NPS objectives were tested against the AoS Framework, via use of a compatibility matrix, in order to test compatibility between the objectives/purpose of the AoS and the NN NPS. This compatibility matrix is presented in Appendix C.

[7] The principles of WebTAG Unit 2.11 (which is in the process of being withdrawn) were taken account of when developing the AoS Framework. However, due to the high level strategic nature of the NN NPS it was considered that a bespoke appraisal framework was more appropriate to this appraisal.

B2 – Develop the NN NPS strategic alternatives

3.1.10 The SEA Directive states that in addition to the appraisal of the plan or programme, the appraisal must be carried out on "reasonable" alternatives. The development of strategic alternatives to the NN NPS was guided by DfT. The alternatives are described further in Section 7.

B3/B4 – Predicting and evaluating the effects of the NN NPS and strategic alternatives

3.1.11 The appraisal of the NPS and the strategic alternatives was undertaken following a two stage process. Firstly, individual impacts were identified against each of the AoS objective topics. Then the overall significance of the impacts of the NPS (or strategic alternative) was determined by considering the collective impacts of the interventions against the AoS objective. This was presented in a summary table so that the overall impact can be easily seen. Further details of the two stages are provided below.

Impact Prediction

3.1.12 Likely impacts of the individual interventions contained within the NPS (and strategic alternatives) were predicted relating to the issue addressed by the AoS objective (e.g. air quality, safety). A number of key considerations per objective (as are outlined in Section 6) were taken account of when identifying the impacts. The identification of impacts included consideration of both the construction and operational phases of any interventions contained within the policy.

3.1.13 It was possible to predict some impacts quantitatively, but many impacts were only predicted on a qualitative basis using professional judgement and therefore a mix of quantitative and qualitative approaches was used in the prediction of impacts.

3.1.14 The temporal scale of predicted impacts was considered, using the following categories:

i. Short term (0-5 years);
ii. Medium term (5-10 years);
iii. Long term (10-20 years); and
iv. Longer term (20 years+).

3.1.15 In addition, the magnitude of impact, spatial extent, the probability of the impact occurring, the permanence and the reversibility of the impact was considered and outlined in the Impact Assessment Tables. Definitions used to categorise the individual impacts are outlined in Appendix D.

3.1.16 Evidence to support the identification of impacts was sought and provided in the Impact Assessment Tables. This was obtained from a variety of sources, such as DfT modelling data, research reports, scheme level appraisals[8].

Appraisal of Significance

3.1.17 The significance of the impacts of the NPS (or strategic alternative) taken collectively was determined at an AoS objective level using the following scale:

Significantly supports AoS objective – is considered significant, e.g. positive impacts are substantial, significantly accelerates an improving trend, significantly decelerates a declining trend, significantly supports delivery of a declared objective.

[8] For an explanation of the limitations and relating to the evidence sources cited, please see Section 12.

Supports AoS objective - but not to a significant extent, e.g. positive impacts are not substantial, does not significantly accelerate an improving trend, does not significantly decelerate a declining trend, does not significantly support delivery of a declared objective.
Neutral contribution to AoS objective – either no impacts, or on balance (taking account of positive and negative impacts) a neutral contribution.
Detracts from AoS objective - but not to a significant extent, e.g. negative impacts are not substantial, does not significantly decelerate an improving trend, does not significantly accelerate a declining trend, does not significantly detract from delivery of a declared objective.
Significantly detracts from AoS objective – is considered significant, e.g. negative impacts are substantial, significantly decelerates an improving trend, significantly accelerates a declining trend, significantly detracts from delivery of a declared objective.

3.1.18 The extent to which an objective will be supported or detracted from was determined based upon professional judgement, taking account the nature of the impacts as outlined in the Impact Assessment Tables, as well as the receptors being impacted upon, e.g. in the case of impacts on biodiversity, impacts on protected habitats are considered to be of greater magnitude than impacts on non-protected habitats. Where an AoS objective had a variety of impacts with different magnitudes (both large and small, negative and positive) a judgement call was required as to the significance of the overall impact, and explanation has been given as to how the overall score had been arrived at.

Summary Tables

3.1.19 The overall assessment of significance for each AoS objective is presented in a summary table so that the overall impact can be easily seen. An example of the summary table is given below:

Overall, to what extent does the [NPS/alternative] support the AoS objective?

Significantly supports AoS objective		Summary and overall consideration – focus on magnitude and spatial extent of impacts
Supports AoS objective		
Neutral contribution to AoS objective	✓	
Detracts from AoS objective		
Significantly detracts from AoS objective		

3.1.20 The appraisal of the NN NPS and the alternatives was used throughout the AoS process to inform the NPS. Changes were made to the NPS wherever possible to ensure the best possible overall balanced sustainability score could be achieved. Where elements within the alternatives scored better than the NPS for certain objectives, consideration was given as to how the NPS could be altered and enhanced to improve its sustainability performance on that objective, without compromising performance on the other AoS objectives. This was an iterative process. The changes to the NPS as a result of this process are documented in Section 8.

B5 – Consider ways of mitigating adverse impacts and maximising beneficial impacts

3.1.21 Annex I of the SEA Directive requires the Environmental Report to include measures to prevent, reduce or offset any significant adverse effects on the environment of implementing the plan or programme. No significant detractions from the AoS objectives were identified for the NN NPS, and therefore no mitigation and enhancement measures

have been identified. However, Section 10 presents a range of measures that offer the opportunity for further enhancement of the sustainability performance of the NN NPS which could be considered in the future.

B6 – Propose measures to monitor the significant impacts of implementing the NN NPS

3.1.22 Monitoring is required for any significant impacts identified of the plan or programme. As no significant detractions from the AoS objectives were identified for the NN NPS, no monitoring measures have been identified as being required to address specific impacts of the NN NPS.

Stage C - Preparing the AoS Report

3.1.23 This report constitutes Stage C: The AoS Report is intended to provide a detailed description of the AoS process and its outcomes.

Stage D - Consulting on the NPS and the AoS Report

3.1.24 The NPS, AoS Report and HRA report were consulted upon in the following ways:

- The reports were placed on the DfT website and there was an online consultation document and questionnaire;
- Consultees could choose to respond by post, online or email;
- Specific stakeholders, including the SEA Consultation Bodies and statutory consultees under the Planning Act, were contacted and invited to comment on the documents; and
- The National Policy Statement was also subject to Parliamentary scrutiny.

4. CONSULTATION TO DATE

4.0.1 SEA Consultation Bodies have been consulted throughout the AoS process which commenced in 2008 with the first drafting of the NPS and initiation of the AoS Scoping process. This consultation process is summarised below.

4.0.2 A scoping workshop was held at DfT offices on the afternoon of 3 December 2008 (joint workshop for the National Networks and Ports NPSs). Representatives from the SEA Consultation Bodies and other key stakeholders were invited to attend. The purpose of the workshop was to consult with key stakeholders at an early stage in the scoping process to aid the identification of key sustainability issues relevant to the NN NPS. Representatives from the Environment Agency, English Heritage, Natural England and the Sustainable Development Commission attended the workshop. In addition, written comments were received from the Environment Agency, English Heritage and Natural England following the workshop.

4.0.3 The AoS Scoping Report was issued to the Environment Agency, English Heritage, Natural England, the Sustainable Development Commission and the Department of Health. All of these organisations provided written comments on the Scoping Report. It was considered that the Scoping Report remained valid for the subsequent consultation in 2009, 2011 and 2013.

4.0.4 Further workshops were held on 7 May 2009 and 1 October 2009. These were attended by the Environment Agency, English Heritage, Natural England, the Highways Agency and the Sustainable Development Commission. These organisations were provided with an update of the NN NPS and AoS at each workshop and were given an opportunity to comment on progress and on specific issues.

4.0.5 On 13 September 2011, the SEA Consultation Bodies (Environment Agency, English Heritage and Natural England) attended a meeting in the DfT offices to revisit the appraisal process and be provided with an update of progress relating to the revised AoS and NN NPS. The attendees indicated during the meeting that they were content with the proposed approach to the appraisal.

4.0.6 In September 2013, further workshops were held with the Environment Agency, Natural England, English Heritage, Natural Resource Wales, and the Scottish Government. The following bodies were invited to attend but declined the invitation: Welsh Government, Scottish Natural Heritage, Scottish Environmental Protection Agency and Historic Scotland. Following the September 2013 workshop, the SEBs (including those that did not attend the workshops) were issued with a package of information which contained updated PPP and baseline tables, a note on the AoS appraisal methodology and a document outlining how stakeholder comments previously provided had been taken on board.

4.0.7 Comments from stakeholders consulted to date have been considered when producing both the NN NPS and AoS. A summary of the comments and how these have been addressed is provided in Appendix B.

4.0.8 This AoS Report was subject to public consultation from 4th December 2013 until 26th February 2014. These consultations provided an opportunity for a wide audience to provide comments on the NPS and AoS. Where appropriate, comments from consultees

have been taken into account (see accompanying Post Adoption Statement) in this revised, final version of the AoS Report.

5. SUSTAINABILITY CONTEXT

5.1 Links to other Strategies, Plans, Programmes and Sustainability Objectives

5.1.1 A review of relevant legal Plans, Policies and Programmes (PPPs) that have the potential to influence the development of the NN NPS was undertaken at the Scoping stage and was added to following stakeholder comments on the AoS Scoping Report. In addition, a further review was undertaken in September 2013 to ensure the list remained up-to-date and relevant and captured any changes in policy since the Scoping Report.

5.1.2 Such PPPs can potentially act as constraints, for example where formal limitations, policy contexts or requirements are stated. Through undertaking the review, these constraints can be identified, as well as establishing any sustainability objectives they may contain, identifying synergies and opportunities or potential conflicts between aims, objectives and policy details. The review was used to inform the consideration of key sustainability issues and development of the AoS Framework.

5.1.3 This review, updated since the Scoping Report as appropriate, is provided in Annex B. PPPs have been categorised into overarching, environmental, economic, social, and transport-specific documents. Within each category, the spatial level of relevance of the document has also been identified (International, Europe, UK, England).

5.2 Common Themes/Objectives from the PPPs

Overarching PPPs

5.2.1 The overarching PPPs have the following common themes and objectives:

i. Delivering sustainable development;

ii. Promoting sustainable economic growth and high levels of employment;

iii. Protection of the environment and countryside;

iv. Improving quality of life for all, including future generations;

v. Tackling climate change (both mitigation and adaptation);

vi. Promoting sustainable consumption and production including prudent use of natural resources;

vii. Supporting vibrant, healthy, sustainable and inclusive urban and rural communities; and

viii. Ensuring that communities and members of the public can make their views heard.

Environmental PPPs

5.2.2 The common objectives and themes that are found within the environmental PPPs are as follows:

i. Protecting and preserving the environment as a whole for today and the future;

ii. Protecting the environment as a whole and human health, by reducing emissions of atmospheric pollutants;

iii. Promoting the Polluter Pays Principle;

iv. Reducing greenhouse gas emissions;

v. Tackling climate change through mitigation and adaptation;

vi. Protecting and enhancing biodiversity and geological diversity in the terrestrial and marine environments;

vii. Working towards sustainable waste management including more efficient use of natural resources;

viii. Promoting the use of renewable energy;

ix. Promoting the protection and improvement of landscape character;

x. Protecting soil, including the identification and remediation of contaminated land;

xi. Avoiding, preventing or reducing the harmful impacts, including annoyance, due to exposure to noise;

xii. Protecting and improving water quality and increasing efficiency of water use;

xiii. Reducing and managing flood risk; and

xiv. Protecting archaeological heritage.

Economic PPPs

5.2.3 The common objectives and themes that are found within the economic PPPs are as follows:

i. Delivering strong and sustainable economic growth;

ii. Full employment and greater economic productivity;

iii. Promoting economic competitiveness;

iv. Maintenance of high and stable levels of economic growth and employment;

v. Promoting a low carbon economy;

vi. Achieving better energy security;

vii. Increase UK's international competitiveness; and

viii. Promoting sustainable tourism.

Social PPPs

5.2.4 The common objectives and themes that are found within the social PPPs are as follows:

i. Promoting better health and well-being for all (especially vulnerable persons e.g. children and the elderly);

ii. Promoting physical activity;

iii. Tackling discrimination;

iv. Promoting equality and social inclusion;

v. Improving accessibility;

vi. Increasing opportunities for all;

vii. Making communities safer through reduction of crime and reduction of risk from terrorism;

viii. Building more cohesive, empowered and active communities;

ix. Increasing long term housing supply and affordability; and

x. Ensuring that communities and members of the public can make their views heard.

Transport-Specific PPPs

5.2.5 The common objectives and themes that are found within the transport-related PPPs are as follows:

i. Providing a modern, safe, integrated, efficient, reliable and sustainable transport system;

ii. Supporting national and local economic growth;

iii. Improving quality of life for transport and non-transport users;

iv. Reducing the environmental impacts of transport;

v. Promoting the efficient and sustainable distribution of goods;

vi. Tackling congestion, crowding and improving reliability;

vii. Strengthening the safety and security of transport in the UK;

viii. Enhancing access to jobs, services and social networks, including for the disadvantaged; and

ix. Improving our local and national infrastructure.

5.3 Sustainability Baseline and Key Issues

5.3.1 Figures 2 to 5 below summarise the sustainability baseline and key sustainability issues (as originally defined in the AoS Scoping Report) that are considered relevant to the NN NPS, as well as showing how the AoS objectives that have been developed link to this baseline and key sustainability issues[9]. The key sustainability issues have not changed following the review of PPPs. The baseline provides a broad overview of sustainability aspects in England and further detail is provided in the AoS Scoping Report (Annex A) and the updated Baseline Tables (Annex C).

[9] Sources of baseline information are taken from the updated Baseline Tables (see Annex C)

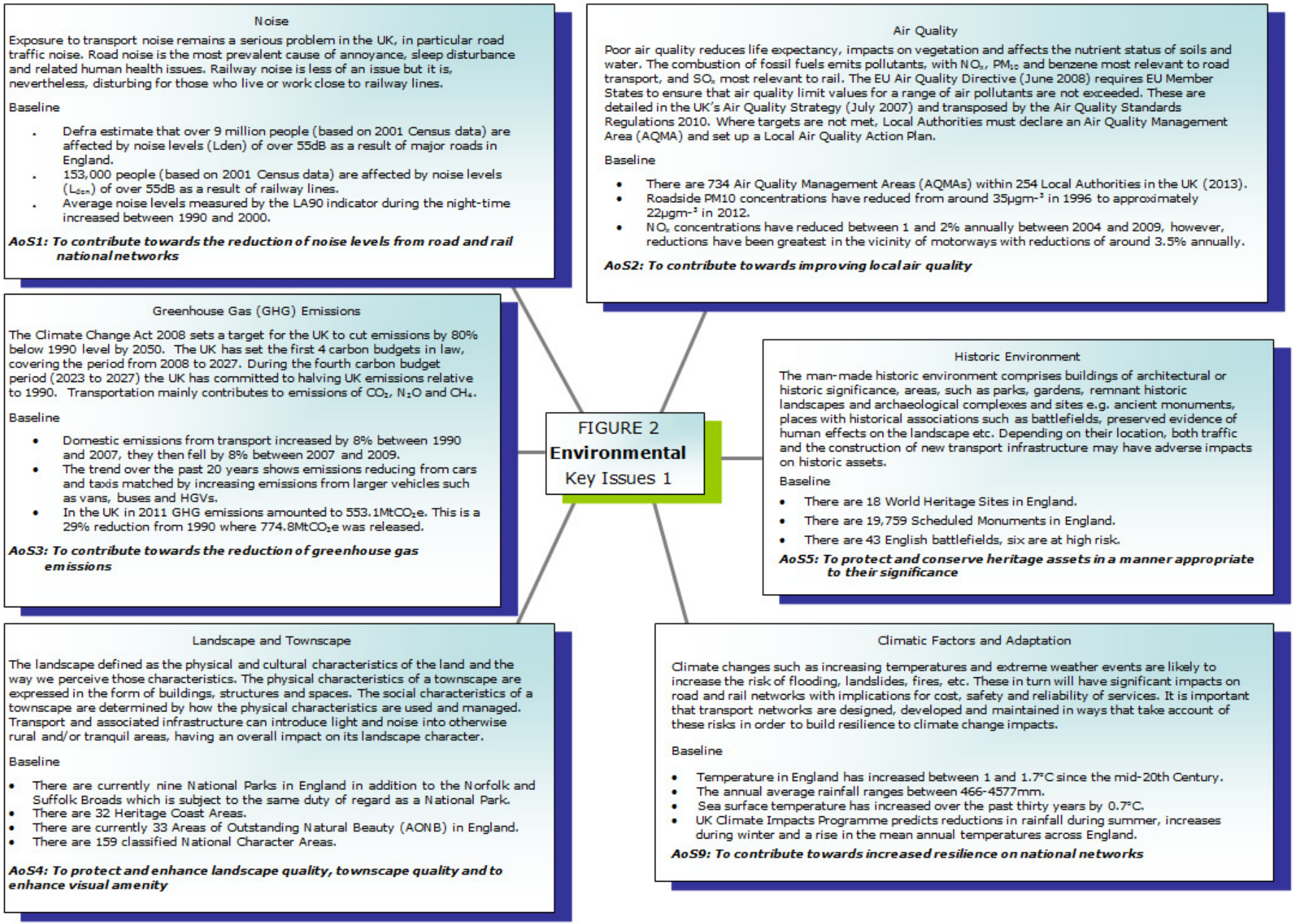
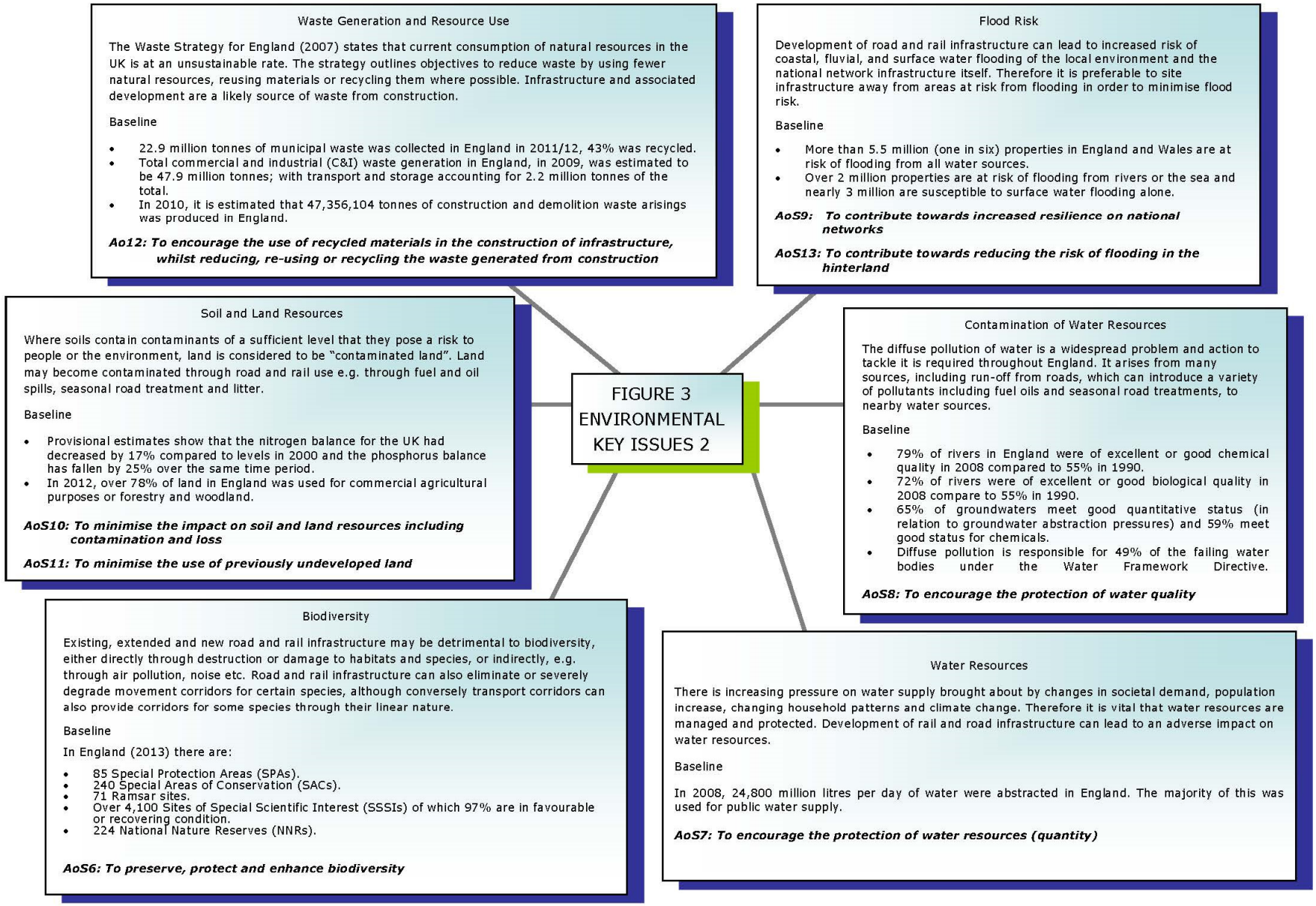
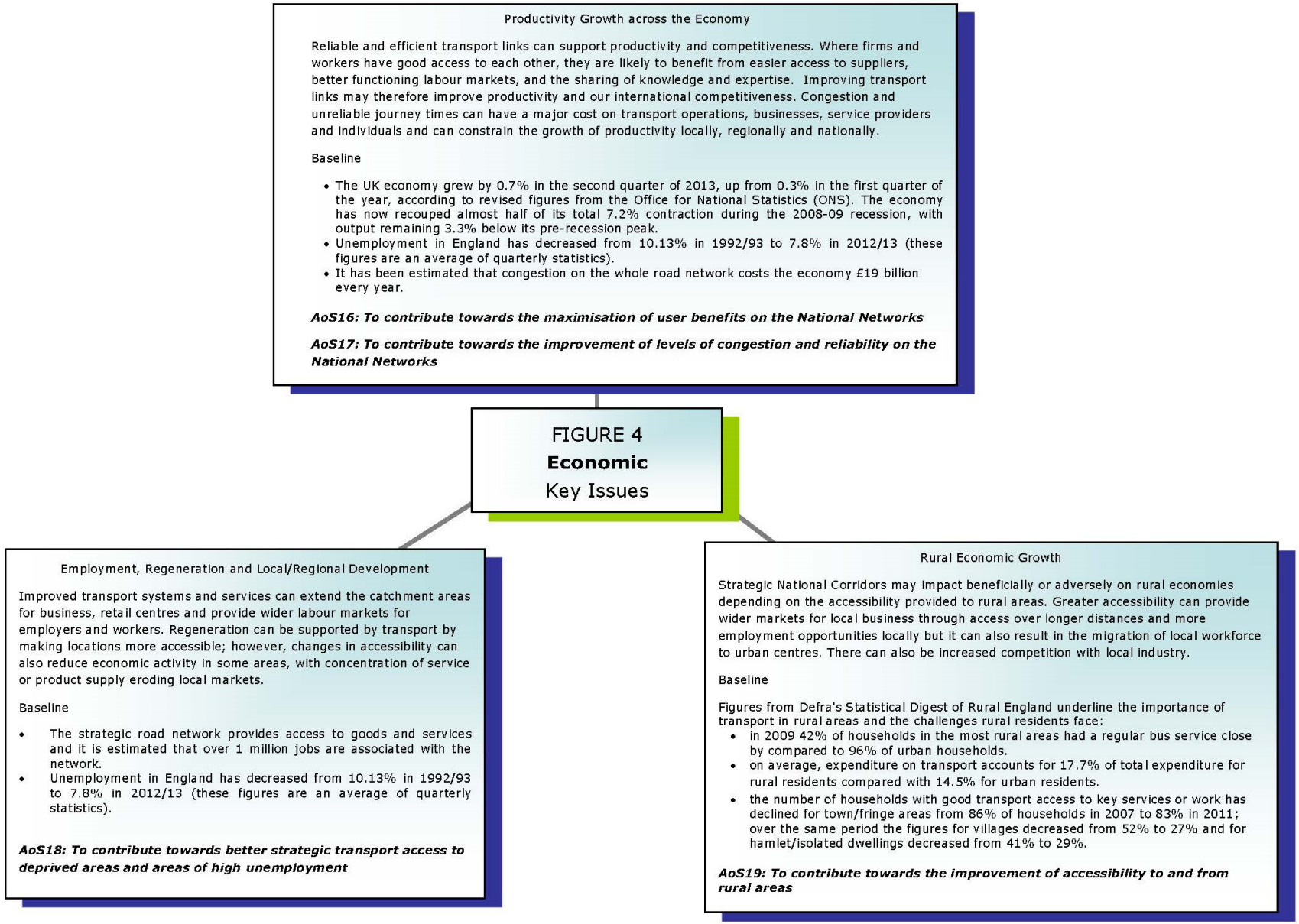
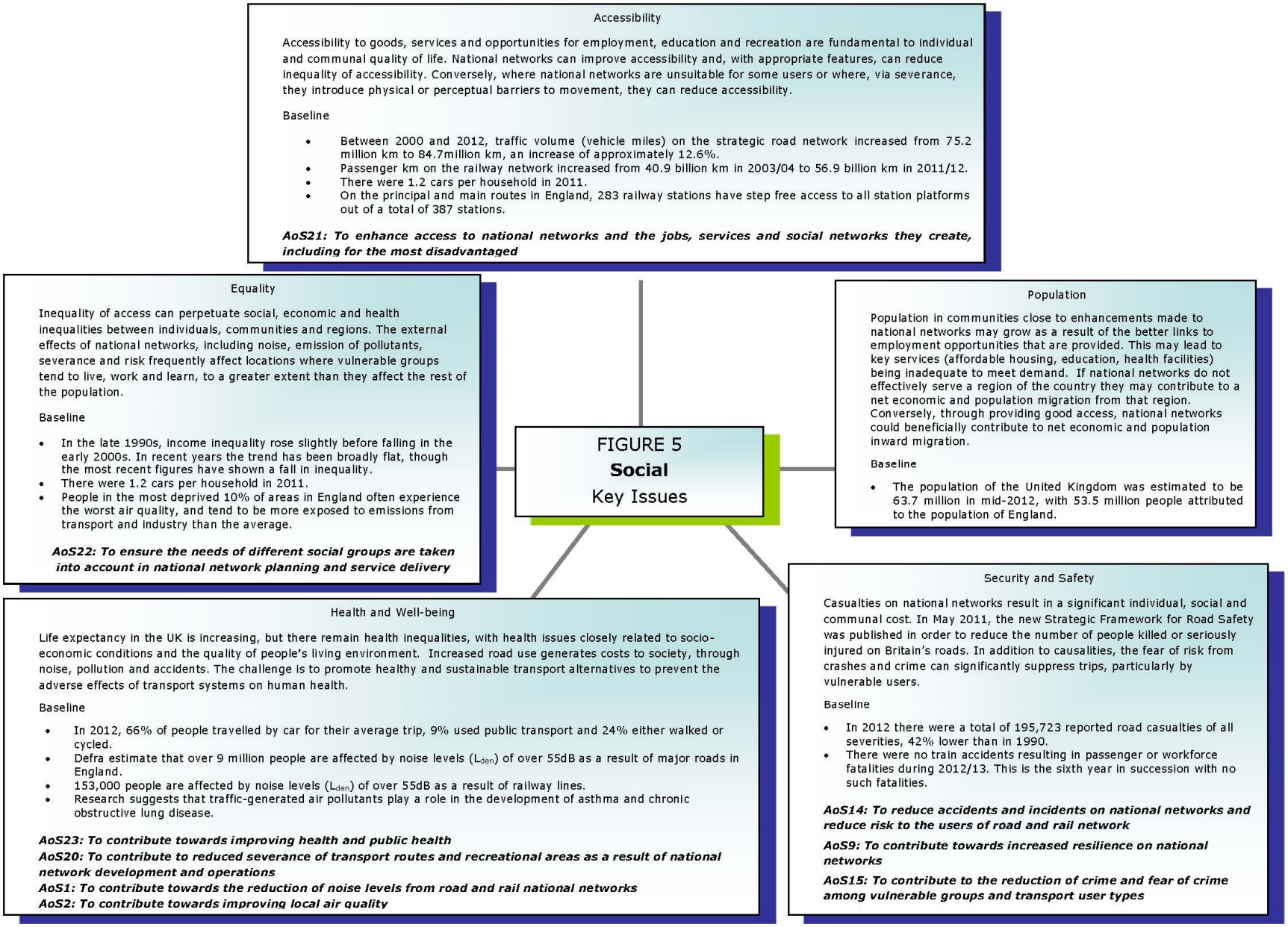


FIGURE 2
Environmental
Key Issues 1
Noise
Exposure to transport noise remains a serious problem in the UK, in particular road traffic noise. Road noise is the most prevalent cause of annoyance, sleep disturbance and related human health issues. Railway noise is less of an issue but it is, nevertheless, disturbing for those who live or work close to railway lines.
Baseline
Defra estimate that over 9 million people (based on 2001 Census data) are affected by noise levels (Lden) of over 55dB as a result of major roads in England.
153,000 people (based on 2001 Census data) are affected by noise levels (L_{den}) of over 55dB as a result of railway lines.
Average noise levels measured by the LA90 indicator during the night-time increased between 1990 and 2000.
AoS1: To contribute towards the reduction of noise levels from road and rail national networks
Air Quality
Poor air quality reduces life expectancy, impacts on vegetation and affects the nutrient status of soils and water. The combustion of fossil fuels emits pollutants, with NO_x, PM_{10} and benzene most relevant to road transport, and SO_x most relevant to rail. The EU Air Quality Directive (June 2008) requires EU Member States to ensure that air quality limit values for a range of air pollutants are not exceeded. These are detailed in the UK's Air Quality Strategy (July 2007) and transposed by the Air Quality Standards Regulations 2010. Where targets are not met, Local Authorities must declare an Air Quality Management Area (AQMA) and set up a Local Air Quality Action Plan.
Baseline
There are 734 Air Quality Management Areas (AQMAs) within 254 Local Authorities in the UK (2013).
Roadside PM10 concentrations have reduced from around 35µgm^{-3} in 1996 to approximately 22µgm^{-3} in 2012.
NO_x concentrations have reduced between 1 and 2% annually between 2004 and 2009, however, reductions have been greatest in the vicinity of motorways with reductions of around 3.5% annually.
AoS2: To contribute towards improving local air quality
Greenhouse Gas (GHG) Emissions
The Climate Change Act 2008 sets a target for the UK to cut emissions by 80% below 1990 level by 2050. The UK has set the first 4 carbon budgets in law, covering the period from 2008 to 2027. During the fourth carbon budget period (2023 to 2027) the UK has committed to halving UK emissions relative to 1990. Transportation mainly contributes to emissions of CO_2, N_2O and CH_4.
Baseline
Domestic emissions from transport increased by 8% between 1990 and 2007, they then fell by 8% between 2007 and 2009.
The trend over the past 20 years shows emissions reducing from cars and taxis matched by increasing emissions from larger vehicles such as vans, buses and HGVs.
In the UK in 2011 GHG emissions amounted to 553.1MtCO_2e. This is a 29% reduction from 1990 where 774.8MtCO_2e was released.
AoS3: To contribute towards the reduction of greenhouse gas emissions
Historic Environment
The man-made historic environment comprises buildings of architectural or historic significance, areas, such as parks, gardens, remnant historic landscapes and archaeological complexes and sites e.g. ancient monuments, places with historical associations such as battlefields, preserved evidence of human effects on the landscape etc. Depending on their location, both traffic and the construction of new transport infrastructure may have adverse impacts on historic assets.
Baseline
There are 18 World Heritage Sites in England.
There are 19,759 Scheduled Monuments in England.
There are 43 English battlefields, six are at high risk.
AoS5: To protect and conserve heritage assets in a manner appropriate to their significance
Landscape and Townscape
The landscape defined as the physical and cultural characteristics of the land and the way we perceive those characteristics. The physical characteristics of a townscape are expressed in the form of buildings, structures and spaces. The social characteristics of a townscape are determined by how the physical characteristics are used and managed. Transport and associated infrastructure can introduce light and noise into otherwise rural and/or tranquil areas, having an overall impact on its landscape character.
Baseline
There are currently nine National Parks in England in addition to the Norfolk and Suffolk Broads which is subject to the same duty of regard as a National Park.
There are 32 Heritage Coast Areas.
There are currently 33 Areas of Outstanding Natural Beauty (AONB) in England.
There are 159 classified National Character Areas.
AoS4: To protect and enhance landscape quality, townscape quality and to enhance visual amenity
Climatic Factors and Adaptation
Climate changes such as increasing temperatures and extreme weather events are likely to increase the risk of flooding, landslides, fires, etc. These in turn will have significant impacts on road and rail networks with implications for cost, safety and reliability of services. It is important that transport networks are designed, developed and maintained in ways that take account of these risks in order to build resilience to climate change impacts.
Baseline
Temperature in England has increased between 1 and 1.7°C since the mid-20th Century.
The annual average rainfall ranges between 466-4577mm.
Sea surface temperature has increased over the past thirty years by 0.7°C.
UK Climate Impacts Programme predicts reductions in rainfall during summer, increases during winter and a rise in the mean annual temperatures across England.
AoS9: To contribute towards increased resilience on national networks


Waste Generation and Resource Use
The Waste Strategy for England (2007) states that current consumption of natural resources in the UK is at an unsustainable rate. The strategy outlines objectives to reduce waste by using fewer natural resources, reusing materials or recycling them where possible. Infrastructure and associated development are a likely source of waste from construction.
Baseline
• 22.9 million tonnes of municipal waste was collected in England in 2011/12, 43% was recycled.
• Total commercial and industrial (C&I) waste generation in England, in 2009, was estimated to be 47.9 million tonnes; with transport and storage accounting for 2.2 million tonnes of the total.
• In 2010, it is estimated that 47,356,104 tonnes of construction and demolition waste arisings was produced in England.
Ao12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction
Flood Risk
Development of road and rail infrastructure can lead to increased risk of coastal, fluvial, and surface water flooding of the local environment and the national network infrastructure itself. Therefore it is preferable to site infrastructure away from areas at risk from flooding in order to minimise flood risk.
Baseline
• More than 5.5 million (one in six) properties in England and Wales are at risk of flooding from all water sources.
• Over 2 million properties are at risk of flooding from rivers or the sea and nearly 3 million are susceptible to surface water flooding alone.
AoS9: To contribute towards increased resilience on national networks
AoS13: To contribute towards reducing the risk of flooding in the hinterland
Soil and Land Resources
Where soils contain contaminants of a sufficient level that they pose a risk to people or the environment, land is considered to be "contaminated land". Land may become contaminated through road and rail use e.g. through fuel and oil spills, seasonal road treatment and litter.
Baseline
• Provisional estimates show that the nitrogen balance for the UK had decreased by 17% compared to levels in 2000 and the phosphorus balance has fallen by 25% over the same time period.
• In 2012, over 78% of land in England was used for commercial agricultural purposes or forestry and woodland.
AoS10: To minimise the impact on soil and land resources including contamination and loss
AoS11: To minimise the use of previously undeveloped land
FIGURE 3
ENVIRONMENTAL
KEY ISSUES 2
Contamination of Water Resources
The diffuse pollution of water is a widespread problem and action to tackle it is required throughout England. It arises from many sources, including run-off from roads, which can introduce a variety of pollutants including fuel oils and seasonal road treatments, to nearby water sources.
Baseline
• 79% of rivers in England were of excellent or good chemical quality in 2008 compared to 55% in 1990.
• 72% of rivers were of excellent or good biological quality in 2008 compare to 55% in 1990.
• 65% of groundwaters meet good quantitative status (in relation to groundwater abstraction pressures) and 59% meet good status for chemicals.
• Diffuse pollution is responsible for 49% of the failing water bodies under the Water Framework Directive.
AoS8: To encourage the protection of water quality
Biodiversity
Existing, extended and new road and rail infrastructure may be detrimental to biodiversity, either directly through destruction or damage to habitats and species, or indirectly, e.g. through air pollution, noise etc. Road and rail infrastructure can also eliminate or severely degrade movement corridors for certain species, although conversely transport corridors can also provide corridors for some species through their linear nature.
Baseline
In England (2013) there are:
• 85 Special Protection Areas (SPAs).
• 240 Special Areas of Conservation (SACs).
• 71 Ramsar sites.
• Over 4,100 Sites of Special Scientific Interest (SSSIs) of which 97% are in favourable or recovering condition.
• 224 National Nature Reserves (NNRs).
AoS6: To preserve, protect and enhance biodiversity
Water Resources
There is increasing pressure on water supply brought about by changes in societal demand, population increase, changing household patterns and climate change. Therefore it is vital that water resources are managed and protected. Development of rail and road infrastructure can lead to an adverse impact on water resources.
Baseline
In 2008, 24,800 million litres per day of water were abstracted in England. The majority of this was used for public water supply.
AoS7: To encourage the protection of water resources (quantity)

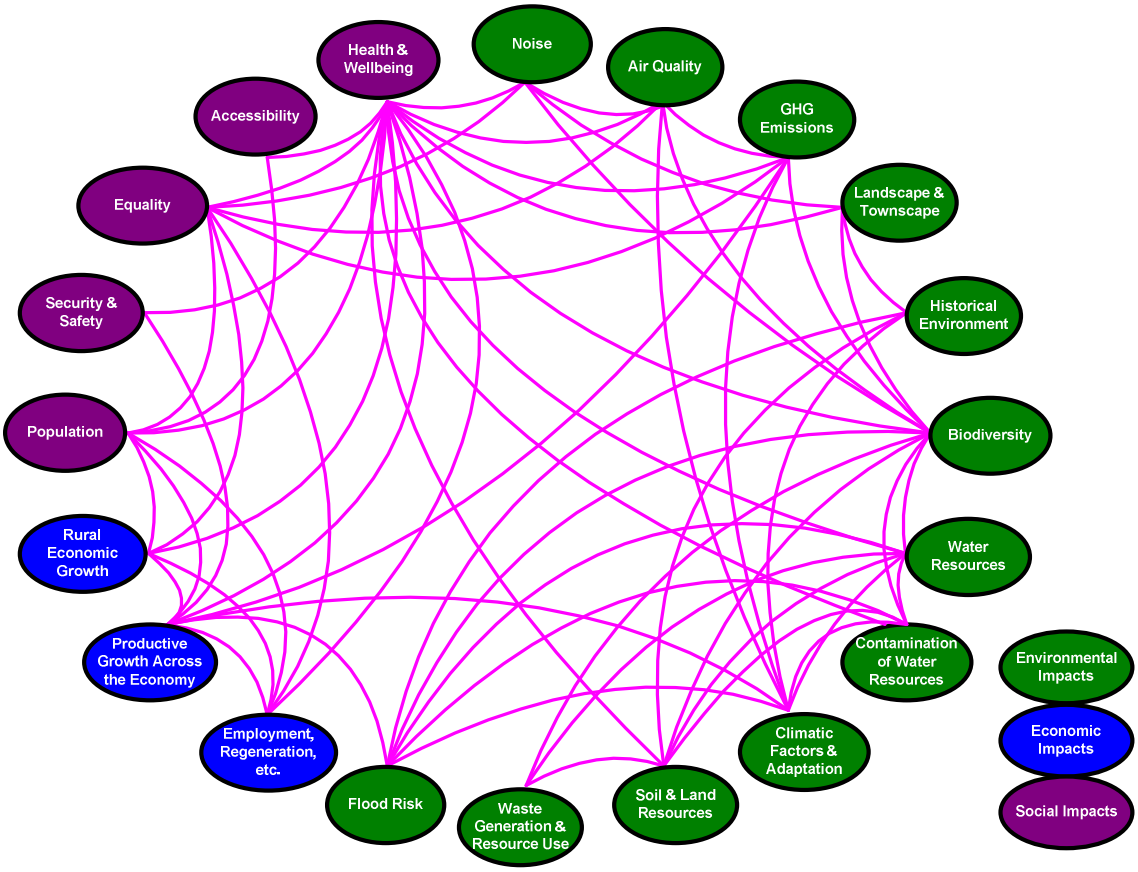

Productivity Growth across the Economy
Reliable and efficient transport links can support productivity and competitiveness. Where firms and workers have good access to each other, they are likely to benefit from easier access to suppliers, better functioning labour markets, and the sharing of knowledge and expertise. Improving transport links may therefore improve productivity and our international competitiveness. Congestion and unreliable journey times can have a major cost on transport operations, businesses, service providers and individuals and can constrain the growth of productivity locally, regionally and nationally.
Baseline
• The UK economy grew by 0.7% in the second quarter of 2013, up from 0.3% in the first quarter of the year, according to revised figures from the Office for National Statistics (ONS). The economy has now recouped almost half of its total 7.2% contraction during the 2008-09 recession, with output remaining 3.3% below its pre-recession peak.
• Unemployment in England has decreased from 10.13% in 1992/93 to 7.8% in 2012/13 (these figures are an average of quarterly statistics).
• It has been estimated that congestion on the whole road network costs the economy £19 billion every year.
AoS16: To contribute towards the maximisation of user benefits on the National Networks
AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks
FIGURE 4
Economic
Key Issues
Employment, Regeneration and Local/Regional Development
Improved transport systems and services can extend the catchment areas for business, retail centres and provide wider labour markets for employers and workers. Regeneration can be supported by transport by making locations more accessible; however, changes in accessibility can also reduce economic activity in some areas, with concentration of service or product supply eroding local markets.
Baseline
• The strategic road network provides access to goods and services and it is estimated that over 1 million jobs are associated with the network.
• Unemployment in England has decreased from 10.13% in 1992/93 to 7.8% in 2012/13 (these figures are an average of quarterly statistics).
AoS18: To contribute towards better strategic transport access to deprived areas and areas of high unemployment
Rural Economic Growth
Strategic National Corridors may impact beneficially or adversely on rural economies depending on the accessibility provided to rural areas. Greater accessibility can provide wider markets for local business through access over longer distances and more employment opportunities locally but it can also result in the migration of local workforce to urban centres. There can also be increased competition with local industry.
Baseline
Figures from Defra's Statistical Digest of Rural England underline the importance of transport in rural areas and the challenges rural residents face:
• in 2009 42% of households in the most rural areas had a regular bus service close by compared to 96% of urban households.
• on average, expenditure on transport accounts for 17.7% of total expenditure for rural residents compared with 14.5% for urban residents.
• the number of households with good transport access to key services or work has declined for town/fringe areas from 86% of households in 2007 to 83% in 2011; over the same period the figures for villages decreased from 52% to 27% and for hamlet/isolated dwellings decreased from 41% to 29%.
AoS19: To contribute towards the improvement of accessibility to and from rural areas


Accessibility
Accessibility to goods, services and opportunities for employment, education and recreation are fundamental to individual and communal quality of life. National networks can improve accessibility and, with appropriate features, can reduce inequality of accessibility. Conversely, where national networks are unsuitable for some users or where, via severance, they introduce physical or perceptual barriers to movement, they can reduce accessibility.
Baseline
• Between 2000 and 2012, traffic volume (vehicle miles) on the strategic road network increased from 75.2 million km to 84.7million km, an increase of approximately 12.6%.
• Passenger km on the railway network increased from 40.9 billion km in 2003/04 to 56.9 billion km in 2011/12.
• There were 1.2 cars per household in 2011.
• On the principal and main routes in England, 283 railway stations have step free access to all station platforms out of a total of 387 stations.
AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged
Equality
Inequality of access can perpetuate social, economic and health inequalities between individuals, communities and regions. The external effects of national networks, including noise, emission of pollutants, severance and risk frequently affect locations where vulnerable groups tend to live, work and learn, to a greater extent than they affect the rest of the population.
Baseline
• In the late 1990s, income inequality rose slightly before falling in the early 2000s. In recent years the trend has been broadly flat, though the most recent figures have shown a fall in inequality.
• There were 1.2 cars per household in 2011.
• People in the most deprived 10% of areas in England often experience the worst air quality, and tend to be more exposed to emissions from transport and industry than the average.
AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery
FIGURE 5
Social
Key Issues
Population
Population in communities close to enhancements made to national networks may grow as a result of the better links to employment opportunities that are provided. This may lead to key services (affordable housing, education, health facilities) being inadequate to meet demand. If national networks do not effectively serve a region of the country they may contribute to a net economic and population migration from that region. Conversely, through providing good access, national networks could beneficially contribute to net economic and population inward migration.
Baseline
• The population of the United Kingdom was estimated to be 63.7 million in mid-2012, with 53.5 million people attributed to the population of England.
Health and Well-being
Life expectancy in the UK is increasing, but there remain health inequalities, with health issues closely related to socio-economic conditions and the quality of people's living environment. Increased road use generates costs to society, through noise, pollution and accidents. The challenge is to promote healthy and sustainable transport alternatives to prevent the adverse effects of transport systems on human health.
Baseline
• In 2012, 66% of people travelled by car for their average trip, 9% used public transport and 24% either walked or cycled.
• Defra estimate that over 9 million people are affected by noise levels (L_{den}) of over 55dB as a result of major roads in England.
• 153,000 people are affected by noise levels (L_{den}) of over 55dB as a result of railway lines.
• Research suggests that traffic-generated air pollutants play a role in the development of asthma and chronic obstructive lung disease.
AoS23: To contribute towards improving health and public health
AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations
AoS1: To contribute towards the reduction of noise levels from road and rail national networks
AoS2: To contribute towards improving local air quality
Security and Safety
Casualties on national networks result in a significant individual, social and communal cost. In May 2011, the new Strategic Framework for Road Safety was published in order to reduce the number of people killed or seriously injured on Britain's roads. In addition to causalities, the fear of risk from crashes and crime can significantly suppress trips, particularly by vulnerable users.
Baseline
• In 2012 there were a total of 195,723 reported road casualties of all severities, 42% lower than in 1990.
• There were no train accidents resulting in passenger or workforce fatalities during 2012/13. This is the sixth year in succession with no such fatalities.
AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network
AoS9: To contribute towards increased resilience on national networks
AoS15: To contribute to the reduction of crime and fear of crime among vulnerable groups and transport user types

5.4 Inter-relationship between Key Sustainability Issues

5.4.1 Figure 6 below shows the interrelationships between the key sustainability issues; this shows that there is a high degree of interaction between these issues.

Figure 6 – Interrelationships between Key Sustainability Issues



5.5 Scoping-out of Issues

5.5.1 All of the key sustainability issues have been scoped into the AoS assessment. This is because the scale and potentially wide ranging implications of the NN NPS means that it may impact on all aspects of sustainability.

6. THE AOS FRAMEWORK

6.1. The AoS Framework and AoS Objectives

6.1.1. The AoS framework sets out the structure for the assessment, and includes a set of sustainability objectives that will be used within the appraisal process to assess the NN NPS and strategic alternatives. These sustainability objectives have been developed from the sustainability key issues identified at the Scoping stage (see Section 3.1). An initial AoS framework was provided in the AoS Scoping Report, which was subject to consultation with, and agreed by, the SEA Consultation Bodies. This initial AoS framework has been revised slightly in conjunction with the SEA Consultation Bodies. For example, there have been minor wording changes to three of the objectives (AoS 4, 5 and 6) at the request of the Consultation Bodies.

6.1.2. The AoS framework is set out in Table 2 below. This table shows the AoS objectives and the key considerations that were taken into account when undertaking the appraisal.

6.1.3. Figures 2 to 5 identify which AoS objectives are relevant to which key sustainability issues**.**

Table 2: AoS Framework

AoS Objective	Key Considerations when Appraising the NPS
AoS1: To contribute towards the reduction of noise levels from road and rail national networks	• The exposure of people and dwellings to transport noise from national networks. • The exposure of wildlife to transport noise from national networks. • Reduction of noise levels at source on national networks.
AoS2: To contribute towards improving local air quality	• Levels of air pollutant emissions from national networks. These will be influenced by levels of congestion, levels of road and rail traffic, modal split, road traffic speeds, types of vehicle that use networks (both road and rail), and operations at railway stations. • Both achieving air quality standards and improving air quality should be considered. • Impacts from national networks of poor air quality on both biodiversity and human health.
AoS3: To contribute towards the reduction of greenhouse gas emissions	• Levels of greenhouse gas emissions from national networks. These will be influenced by levels of congestion, levels of road and rail traffic, modal split, road traffic speeds, types of vehicle that use networks (both road and rail), and operations at railway stations.
AoS4: To protect and enhance landscape quality, townscape quality and to enhance visual amenity	• Impacts from national networks on landscape and townscape at a national and local level, including on nationally and locally designated landscapes. • Impacts from national networks on landscape character and views. • Levels of road traffic and levels of congestion on national networks and related impacts on landscape and townscape and tranquillity. • Opportunities to preserve, protect and where possible improve landscapes and townscapes should be considered.
AoS5: To protect and preserve heritage assets in a manner appropriate to their significance	• Impacts from national networks on sites, features and areas of historical and cultural value, including on internationally, nationally and locally designated sites and areas. • Levels of road traffic and levels of congestion on national networks and related impacts on the setting of sites, features and areas of historical and cultural value. • Opportunities to preserve, protect and where possible improve sites, features and areas of historical and cultural value should be considered.
AoS6: To preserve, protect and enhance biodiversity	• Impacts from national networks on biodiversity, including on internationally, nationally and locally designated sites and areas. • Impacts likely to be influenced by factors such as land take, emissions of air pollutants, noise generated on national networks and fragmentation of habitats. • Opportunities to preserve, protect and where possible improve biodiversity should be considered.

AoS Objective	Key Considerations when Appraising the NPS
AoS7: To encourage the protection of water resources (quantity)	• Impacts from national networks on water quantity (both surface and groundwater). • Impacts likely to be influenced by factors such as the types of drainage systems used and proximity of national networks to watercourses.
AoS8: To encourage the protection of water quality	• Impacts from national networks on water quality (both surface and groundwater). • Impacts likely to be influenced by factors such as proximity of national networks to watercourses, and levels of traffic flow. • Measures to reduce the potential for waste products draining to water and soil resources. • Water quality to be considered in terms of its chemical composition and ecological content.
AoS9: To contribute towards increased resilience on national networks	• The resilience of national networks against the impacts of climate change. • Interactions of national networks with wider infrastructure/society in terms of resilience against the impacts of climate change. • Planning and design of national networks to take account of flood risk. • Level of security risk on national networks. • Security planning to deal with incidents on national networks. • Levels of security awareness amongst staff and users of national networks. • Differing needs of all communities, e.g. deaf, disabled and older people, when incidents occur. • The speed with which national networks are re-opened after security and other incidents on them.
AoS10: To minimise the impact on soil and land resources including contamination and loss	• Impacts from national networks on soil and land resources. • Impacts likely to be influenced by factors such as use of Brownfield land for infrastructure development, environmental management measures during construction of national networks.
AoS11: To minimise the use of previously undeveloped land	• The use of previously undeveloped land for national networks.
Ao12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction	• Measures to encourage use of recycled materials. • Measures to reduce, re-use and recycle construction waste.
AoS13: To contribute towards reducing the risk of flooding in the hinterland	• The impact of national networks on flood risk in the hinterland. • This will be influenced by factors such as areas of hard standing, design standards for drainage systems, interactions of national networks with flood plains and watercourses and maintenance standards.
AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network	• Levels of accident and incident risk on national networks.
AoS15: To contribute to the reduction of crime and fear of crime among vulnerable groups and transport user types	• Measures to combat crime, fear of crime and anti-social behaviour on national networks. • Perceptions of personal security for staff and users of national networks. • Measures to design out crime.
AoS16: To contribute towards the maximisation of user benefits on the national networks	• Overall costs of travel on national networks. • Level of service on national networks.
AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks	• Journey time reliability on national networks. • Congestion, delays on national networks.
AoS18: To contribute towards better strategic transport access to deprived areas and areas of high unemployment	• Access to deprived areas and areas of high unemployment. • Opportunities for agglomeration.
AoS19: To contribute towards the improvement of accessibility to and from rural areas	• Access to rural areas and green spaces from regionally/nationally strategic locations, e.g. expressed in terms of journey times. • Access to national networks from rural communities, e.g. expressed in terms of journey times.

AoS Objective	Key Considerations when Appraising the NPS
AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations	• Ease of Non-Motorised User movements along or across national networks. • Traffic levels in urban areas.
AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged	• Levels/frequencies of public transport services. • Levels of overcrowding on public transport. • The quality of transport interchange. • The quality of public transport, such as user information, ease of access, standards of comfort. • The contribution of national networks to enhancing access to services for all, including disadvantaged sections of the community. • Levels of access to public transport.
AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery	• Benefits for equality target groups. • Disproportionate adverse impacts on particular regions, users or vulnerable social groups. • Inclusive design of national networks.
AoS23: To contribute towards improving health and public health	• Opportunities to reduce health inequalities and contributory factors to this. • Impacts of national networks on physical and mental health of communities, particularly those disproportionately affected by inequality. • Opportunities for healthy travel e.g. walking and cycling.

6.2. The Overlaps between AoS Objectives

6.2.1 The framework above contains some overlaps between objectives. This meant that there was the possibility of double-counting of impacts. Where it is considered that particular overlaps occur, a brief discussion of what is included in each AoS objective is outlined below:

- User Benefits and Congestion: For the purposes of this appraisal user benefits are considered to be a function of journey time and journey cost only whereas congestion relates to traffic flow and queuing on roads, overcrowding on trains. Journey time is considered under user benefits whereas journey time reliability is considered under congestion.
- Health, Air Quality and Noise: For the purposes of this appraisal health impacts of the NN NPS or alternatives do not include impacts relating to air quality or noise as these are considered under air quality and noise objectives.

6.3. Compatibility of AoS Framework against NPS Objectives

6.3.1 An appraisal, in the form of a compatibility matrix, has been undertaken of the AoS objectives against the objectives of the NN NPS (as listed in Section 2.2) to analyse whether there any conflicts between these two sets of objectives.

6.3.2 This compatibility matrix is provided in Appendix C and identifies a variation of compatibility and incompatibility between the two sets of objectives. This demonstrates the interactions between sustainability issues and the need for a holistic, balanced approach to be taken. Relative performance against different objectives is explored further in the appraisals within this report.

7. PREDICTING AND EVALUATING THE EFFECTS OF THE NPS AND ALTERNATIVES

7.1. Developing the NN NPS strategic alternatives

7.1.1 The SEA Directive states that in addition to the appraisal of the plan or programme, the appraisal must be carried out on "reasonable" alternatives.

7.1.2 The development of strategic alternatives to the NN NPS was guided by DfT. In developing the alternatives DfT focused on the key strategic choices the Government has in setting policy on development of the national networks to achieve its strategic objectives set out at Section 2.2. The key strategic choices in setting the policy in the NN NPS are:

- Approach to infrastructure provision – the level and nature of infrastructure provision, including choices around different approaches/technologies for delivering capacity increases and journey time savings e.g. on the road network using smart motorways rather than conventional widening.
- Modal shift/split – the balance between road and rail infrastructure provision including measures to encourage greater use of sustainable transport modes.
- Demand management – fiscal and non-fiscal measures to influence travel demand, for example changes in the cost of motoring and "softer" measures such as improvements in travel information.
- Approach to environmental standards – different approaches to environmental standards, for example "do legal minimum" versus more interventionist approaches.

7.1.3 In developing alternatives, DfT considered variations in the strategic approach to each of the choices set out above.[10] As the scope of the NN NPS is largely confined to the development of the national rail network, the strategic road network (SRN), and strategic rail freight interchanges, the alternatives focused on these networks, rather than for example, strategic choices available on urban roads that are the responsibility of local authorities.[11]

7.1.4 DfT identified two alternatives involving different emphasis on road and rail travel relative to the NN NPS policy. The objective of this was to test the sustainability of alternative options for achieving the Government's objectives set out in Section 2.2. The two alternatives are:

- Alternative 1: this alternative tests an approach that seeks to shift demand from road to rail through increased rail provision and sustainable transport measures and an increase in the cost of motoring. This package would involve a smaller roads infrastructure package than in the NPS, targeted at making best use of the existing national road network.

[10] Consideration of the key strategic choices is consistent with how the constituent policies in the NN NPS have developed over time. The consideration of high level strategic choices such as options to manage demand and alternative modal solutions is consistent with the European Commission's SEA Transport Manual.

[11] Note that whilst it is possible that a local road may be designated as a nationally significant infrastructure project under section 35 of the Planning Act 2008 these are likely to be a small minority of schemes.

- Alternative 2: this alternative tests an expanded infrastructure package on the national road network, accompanied by reductions in rail provision and a "do minimum" approach to environmental standards and policies.

7.1.5 In considering each alternative and the NPS it was recognised that the resources available for delivery would need to consistent with a plausible national networks budget. This precludes alternatives that involve significantly greater levels of funding than announced in the 2013 Spending Round as these would not represent feasible alternatives.[12]

7.1.6 In developing alternatives, some options were considered and dismissed on the basis that they were not consistent with the Government's objectives or were not viable:

- An alternative that sought to do less than current government policy on improving and enhancing both the road and rail networks was ruled out on the basis that it wouldn't achieve the Government's objectives to support economic growth and deliver improvements in journey quality and reliability. For the same reason "do nothing" and "business as usual" alternatives were rejected. However, the impacts of the policy set out in the NPS and Alternative 1 and Alternative 2 were measured against a "do nothing"/"business as usual" baseline.[13]
- Fiscal demand management measures – whilst Alternative 1 considers measures to reduce the demand for road travel via an increase in the cost of motoring, national road pricing was not considered in Alternative 1 as the Government has been very clear that it will not introduce or consider introducing national road pricing on the SRN. Successive Governments have ruled out national road pricing on deliverability grounds, including public acceptability and costs of implementation. On rail, using rail fares as a demand management tool was ruled out as existing research has found that very large differentials in fares (40%) are required to achieve only moderate reductions in peak demand (3%).[14]

7.1.7 The policy in the NN NPS is at a strategic level. In order to undertake an AoS on the NN NPS and the reasonable alternatives, the policy in the NN NPS and alternatives was exemplified by a series of "interventions". These are set out in Table 3 below. The approach taken was not intended to consider and estimate the impact of every single policy intervention that could be adopted within an alternative. In practice there will be many variations of policies that could be included within a particular alternative but it is not necessary to consider all these for the purpose of a strategic level appraisal. The approach taken was designed to highlight differences in the impacts of the strategic variations in policy between the NN NPS, Alternative 1 and Alternative 2. The appraisal is transparent around the impacts of each of the key interventions within the NN NPS and alternatives.

7.1.8 Alternative 1 seeks to shift demand away from road via an increase in rail provision and sustainable transport measures as well as an increase in the cost of motoring. Whilst other specific policies could have been included within the sustainable transport measures, as explained above the purpose of Alternative 1 is to consider the impacts of a strategic policy approach that had a much stronger focus on sustainable transport rather than the detail of specific polices that could be adopted within the strategic approach.

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[12] Limiting alternatives to **feasible** options for meeting the strategic objectives set out in the NN NPS is consistent with the guidance in the European Commission's SEA Transport Manual and OPDM's *A practical guide to the Strategic Environmental Assessment Directive*.

[13] A full description of the baseline against which the NPS policy and alternatives were compared is set out in Annex C.

[14] See http://www.rail-reg.gov.uk/upload/pdf/rvfm-sdq-fares-280211.pdf

Including a different mix of sustainable transport measures within Alternative 1 would not alter the overall judgements in the strategic level appraisal. In particular:

- Package of sustainable transport measures – the package of measures to support sustainable transport was exemplified by an expanded programme of rail station improvements and measures to support smart and integrated ticketing and a more interventionist approach to the development of SRFIs. Whilst other interventions such as workplace travel planning and encouraging higher vehicle occupancy could have been included within this approach there is no evidence to suggest that these measures would have a significant impact on the SRN given the nature of journeys on the SRN. Including such polices within Alternative 1 would not therefore alter the overall judgements in the AoS.
- Measures to support greater coach usage, e.g. infrastructure, subsidies – the evidence of the effectiveness of increases in coach infrastructure and increases in coach subsidies is very limited. The most recent DfT statistics on motor vehicle traffic show that buses and coaches only make up a very small amount of overall vehicle kilometres on the SRN so any measures are likely to have a negligible impact on road traffic and congestion.[15] Including measures to support greater coach usage in Alternative 1 would therefore have an uncertain, but very small impact on the SRN and not therefore alter the overall judgements in the AoS.
- Approach to rail freight interchange infrastructure – relying solely on small local terminals would not provide the scale economics, operating efficiencies and benefits of the related business facilities and linkages offered by SRFIs. In order to compete effectively with road, rail is critically dependent upon the volumes it can transport and on having the scope to operate at optimum loading levels. Having to split a train load between two or more terminals, or to run dedicated trains to smaller terminals, would undermine the economics of rail freight. Moreover, a small terminal would be less likely to be in a position to recover the investment needed in rail connections and in lifting equipment for transferring containers from rail wagons to road vehicles (and *vice versa*). Finally, the development of a network of smaller terminals would be likely to require more land acquisition in total and therefore potentially be more damaging to the environment, both in terms of land transferred to industrial use and to the lost opportunity for modal shift.

[15] In 2012 buses and coaches made up just 0.4% of overall vehicle kilometres on the strategic road network.

Table 3: Summary of interventions for NPS and Strategic Alternatives

	NN NPS: Significant and balanced package of improvements and enhancements across the road and rail networks, targeting key pressure points and transforming the networks for the longer term. This sits alongside a significant package of measures to protect the environment and support sustainable transport on the national networks.	**Alternative 1:** Package that tests an approach that seeks to shift demand from road to rail through increased rail provision and sustainable transport measures and an increases in the cost of motoring. On the national road network, there would be a smaller roads infrastructure package, focused on making best use of the existing network. This sits alongside a significant package of measures to protect the environment and support sustainable transport.	**Alternative 2:** Package that tests an expanded infrastructure package on the national road network, accompanied by reductions in rail provision and a "do minimum" approach to environmental standards and policies.
Road infrastructure	Comprehensive package of improvements and enhancements across the SRN, including: • Extensive programme of maintenance, including resurfacing SRN with low noise surfacing • Extensive programme of "pinch point" investments (small enhancements) • Extensive programme of smart motorways • Large programme to upgrade trunk road network • New road links only where necessary to fill key gaps in the SRN As part of exemplifying and understanding the impact of this policy an illustrative scenario based on £30bn of investment over 10 to 15 years was modelled.[16] This scenario represents an upgrade of 1,320 route miles of road over and above the	Smaller roads programme, focused on small enhancements and development within highway boundaries. Exemplified by: • Extensive programme of maintenance, including resurfacing SRN with low noise surfacing • Limited programme of "pinch point" investments (small enhancements) • Large programme of smart motorways • Very limited trunk road improvements • New road links only where necessary to fill key gaps in the SRN As part of exemplifying and understanding the impact of this policy an illustrative scenario was modelled.	Expanded roads programme. Exemplified by: • Extensive programme of maintenance, including resurfacing SRN with low noise surfacing • Large programme of "pinch point" investments (small enhancements) • Extensive programme of motorway widening • Extensive programme to upgrade trunk road network • Some new road links

16 . £30bn is at the lower end of the £30-50bn ambition signalled in the 2013 Spending Round.

	NPS baseline, including approximately 50 major junction improvements. This translates to increasing the SRN capacity by approximately 12%. The illustrative scenario is not intended to be the "right" option for the network – it was created for the broad strategic purpose of taking a view on the potential impacts of greater capital investment. It was not possible to include technology systems, traffic management and information services, the pinch point programme, renewals and routine maintenance in the modelled scenario.	This scenario represents an upgrade of 260 route miles of road over and above the NPS baseline, with the investment mainly focused on motorways. This translates to increasing the capacity of the SRN by approximately 2%. For the purposes of assessing the impacts of this scenario it was assumed that it was delivered over a 10 to 15 year period. It was not possible to include technology systems, traffic management and information services, the pinch point programme, renewals and routine maintenance in the modelled scenario.	
Rail infrastructure	Significant and balanced package of improvements and enhancements to the rail network, including: • Large programme to make better use of existing lines, including through provision of more trains and longer trains. Focused on routes in and out of, and between, major cities. • Extensive programme of electrification • Small number of major new links, new chords and track widening.	Expanded rail programme. Exemplified by: • Extensive programme to make better use of existing lines, including through provision of more trains and longer trains. Focused on alleviating crowding. • Very extensive programme of electrification • Large programme to provide major new links, new chords and track widening.	Smaller rail programme, focused on small enhancements and development within highway boundaries. Exemplified by: • Small programme to make better use of existing lines, including through provision of more trains and longer trains where commercially viable. • Limited programme of electrification • No major new links. Small number of new chords and track widening.
Fiscal demand management		Demand management on roads exemplified by a moderate increase in the cost of motoring. In practice a policy that increased the cost of motoring could be introduced via a number of mechanisms e.g. fuel duty, insurance, parking charges, etc.	

		As part of exemplifying and understanding the impact of an increase in the cost of motoring, a scenario was modelled to illustrate the impacts of a 25-28% increase in the cost of fuel to 2025, compared to the NPS baseline.	
Sustainable transport/"smarter choices"	Package of measures to support sustainable travel choices, including: • Measures to encourage people using national networks to make door-to-door journeys using sustainable transport. Includes improvements to quality and availability of travel information, rail station improvements and measures to support smart and integrated ticketing. • Market led approach to the development of SRFIs • Cycle proofing the SRN. Addressing the needs of cyclists and walkers in the design of new schemes and investing in infrastructure in locations where the SRN severs communities and acts as a barrier to cycling and walking.	Expanded package of measures to support sustainable travel choices, including: • Expanded measures to encourage people using national networks to make door-to-door journeys using sustainable transport. As well as improvements to quality and availability of travel information, includes expanded programme of rail station improvements and measures to support smart and integrated ticketing. • A more interventionist approach to the development of SRFIs, with the Government identifying specific sites for development • Cycle proofing the SRN as per NPS policy.	Reduced package of measures to support sustainable travel choices, including: • Package of measures to encourage people using national networks to make door-to-door journeys using sustainable transport. Includes improvements to quality and availability of information of travel information, rail station improvements and measures to support smart and integrated ticketing. • Market led approach to the development of SRFIs
Environmental standards	Package of measures to mitigate environmental impacts of new schemes and provide environmental benefits in delivering new developments and through specific works on the existing network. This covers measures to support the shift to ultra-low emission vehicles, as well as works to mitigate habitats and eco-systems, air quality, heritage, landscape, noise, water quality and flooding impacts of new	Package of measures to mitigate environmental impacts of new schemes and provide environmental benefits in delivering new developments and through specific works on the existing SRN. Exemplified by interventions in NPS policy along with biodiversity offsetting for all new developments.	Package of environment standards focused on meeting minimum legal standards. Would include development of packages of measures to accompany new road developments with potential worsening of air quality. Would not include broader package of environmental measures set out in NN NPS.

	schemes and improve environmental performance of the existing SRN. A detailed explanation of the package of measures is set out below at Section 7.1.7.		

7.1.9 As set out in Table 3, the NN NPS includes a package of environmental standards to mitigate environmental impacts of new developments on the SRN and provide environmental benefits in delivering new developments and through specific works on the existing network. These include:

- Significant measures to support the shift to ultra-low emission vehicles.
- Habitats and eco-systems – in delivery of new schemes on the SRN, works to provide links across networks to reconnect habitats and ecosystems, through techniques such as the "greening" of existing crossing points, the use of green bridges and the habitat improvement of network verges. For the existing SRN, targeted works to reconnect habitats and ecosystems where possible.
- Air quality – in delivery of new schemes on the SRN, mitigating significant increases in air pollution using techniques such as effective design, management of vehicle speed, increasing distance between live traffic and neighbouring properties, and working with local authorities and other partners to identify measures that provide benefits over a wider area. Targeted measures to reduce pollution in areas of poor air quality on the existing SRN.
- Cultural heritage – in delivery of new schemes on the SRN specific works, such as the provision of screen planting to remove views of strategic roads from heritage sites and to improve the protection of heritage features when the opportunity arises or existing problems require attention.
- Landscape – effectively integrating new schemes into the landscape as far as possible and effective design of earthworks, structures and planting. For the existing SRN targeted works where possible to address impacts that particularly affect neighbouring people or sensitive areas.
- Noise – in delivering new schemes specific works including low noise surfacing and noise barriers where appropriate. Extensive programme to resurface SRN with low noise surfacing and delivery of improvements to address problems identified through Defra's Noise Action Planning process, including noise barriers and earthworks.
- Water quality – mitigating impacts of new schemes and bringing forward specific improvements on the SRN where there are water quality problems.
- Flooding – mitigating impacts of new schemes and bringing forward specific schemes where existing sections of the SRN are vulnerable to flooding.

7.2. Prediction of impacts

7.2.1. The prediction of impacts was undertaken in a systematic way following the methodology set out in Section 3.1. The impacts identified during this process are presented in the Impact Assessment Tables in Appendix E.

7.3. Overall Significance of effects

7.3.1. The overall appraisal of the significance of effects was undertaken following completion of the Impact Assessment Tables. The overall results are presented in the Summary Tables below.

NPS Summary Tables

Key for Summary Tables

Significantly supports AoS objective – is considered significant, e.g. positive impacts are substantial, significantly accelerates an improving trend, significantly decelerates a declining trend, significantly supports delivery of a declared objective.
Supports AoS objective - but not to a significant extent, e.g. positive impacts are not substantial, does not significantly accelerate an improving trend, does not significantly decelerate a declining trend, does not significantly support delivery of a declared objective.
Neutral contribution to AoS objective – either no impacts, or on balance (taking account of positive and negative impacts) a neutral contribution.
Detracts from AoS objective - but not to a significant extent, e.g. negative impacts are not substantial, does not significantly decelerate an improving trend, does not significantly accelerate a declining trend, does not significantly detract from delivery of a declared objective.
Significantly detracts from AoS objective – is considered significant, e.g. negative impacts are substantial, significantly decelerates an improving trend, significantly accelerates a declining trend, significantly detracts from delivery of a declared objective.

AoS1: To contribute towards the reduction of noise levels from road and rail national networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and probability, in particular, due to noise sources moving closer to receptors, increased traffic movements (on both road and rail networks), and new noise sources being introduced to some new locations. However, extensive programmes of rail electrification and resurfacing the SRN with low noise surfacing, developments that move traffic away from receptors (e.g. bypasses), specific works targeted at new road developments and existing problems on the SRN and the funding of the transition to Ultra Low Emission Vehicles (ULEVs) (due to lower engine noise, are expected to result in a large number of positive impacts of varying magnitude and probability. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS2: To contribute towards improving local air quality

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of small magnitude and varying probability, in particular, due to the source of air emissions moving closer to receptors, increased traffic movements, and new sources of emissions to air being introduced to new locations. However, the extensive programme of rail electrification, the specific works targeting congestion and existing air quality problems on the SRN, the funding of the transition to Ultra Low Emission Vehicles (ULEVs), and the targeted measures to reduce pollution in areas of poor air quality, including the opportunity to manage traffic speed on Smart Motorways, are expected to result in a large number of positive impacts, or the avoidance of negative impacts, of varying magnitude and probability. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS3: To contribute towards the reduction of greenhouse gas emissions

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. There is predicted to be a large number of positive impacts of varying magnitude and probability, in particular rail electrification and the commitment to support ULEVs which is predicted to lead to a reduction in carbon emissions. The impact of development of the national road and rail networks is also expected to result in a large number of negative impacts, of small magnitude and varying probability. In particular, the interventions aimed at easing congestion on the SRN will result in a small increase in traffic and mean that traffic speeds are generally higher, leading to increased carbon emissions across the network. On balance it is considered that the expected positive impacts outweigh the predicted negative impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS4: To protect and enhance landscape quality, townscape quality, and to enhance visual amenity

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts, in particular due to the introduction of new transport infrastructure in new locations leading to loss of landscape character and visual impacts. As the probability of the majority of negative impacts occurring will greatly depend on the location of the measure being implemented (i.e. the sensitivity of the landscape or receptor being impacted upon), these impacts are considered to have a medium probability of occurring. It is not considered that the expected negative impacts are sufficiently outweighed by the predicted positive impact from implementing enhancement measures on future schemes, and also where landscape problems exist on the existing SRN.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS5: To protect and conserve heritage assets in a manner appropriate to their significance

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and probability, in particular due to the introduction of new transport infrastructure in new locations leading to the potential loss of heritage features and setting impacts. As the probability of some of the negative impacts occurring will greatly depend on the location of the measure being implemented (i.e. the existence of an important site or receptor being impacted upon), the majority of impacts are considered to have a medium probability of occurring. It is not considered that the expected negative impacts are sufficiently outweighed by the predicted positive impact (of small magnitude) from implementing enhancement measures on future schemes and also where heritage problems exist on exist on the existing SRN.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS6: To preserve, protect and enhance biodiversity

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. There are predicted to be a large number of negative impacts including some of a large magnitude and high probability, in particular, potential habitat loss due to new and upgraded infrastructure and disturbance impacts from additional traffic movements. However, there are also expected to be a small number of large magnitude positive impacts on biodiversity from enhancement measures such as green bridges and habitat improvements on network verges where existing habitat fragmentation problems currently exist, and the substantial commitment to mitigation measures for future schemes. It is not considered that the expected negative impacts are sufficiently outweighed by the predicted positive impact from implementing enhancement measures on future schemes, and also where habitat fragmentation problems exist on the existing SRN.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS7: To ensure the protection of water resources (quantity)

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of a high probability, due to the use of water in the construction of infrastructure, but in the context of water resources as a whole, it is considered that these impacts will be very small, only marginally sufficient enough for the overall consideration not to be a neutral contribution to this objective.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS8: To encourage the protection of water quality

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of small magnitude and varying probability, in particular due to the introduction of new potential sources and pathways of water pollution. However, there are also expected to be predicted positive impacts (of small magnitude) from implementing enhancement measures where historic water quality problems exist on the existing SRN. In addition, any new works will also use modern best practice techniques to ensure appropriate management and treatment of pollutant run-off. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS9: To contribute towards increased resilience on national networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the large positive impact expected due to the road infrastructure upgrades and Smart Motorways leading to an increased resilience to accidents and incidents on the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS10: To minimise the impact on soil and land resources including contamination and loss

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a small number of small magnitude negative impacts of varying probability, in particular, the potential for mobilisation of contaminants during the construction of new infrastructure.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS11: To minimise the use of previously undeveloped land

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a small number of small magnitude negative impacts of a high probability, due to the likelihood of infrastructure development requiring the use of some previously undeveloped land.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of a high probability due to the use of raw materials in infrastructure construction and the generation of construction waste having an impact on the waste infrastructure. Whilst the NPS requires consideration of waste in development of national networks, it is considered that these considerations are not sufficient for the overall categorisation to be neutral.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS13: To contribute towards reducing the risk of flooding in the hinterland

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of small magnitude and high probability, primarily through the introduction of new impermeable surfaces from new infrastructure, as well as a small number of positive impacts of large magnitude and high probability in the form of measures to address flooding problems on the existing networks. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, including the benefits from Smart Motorways and the upgraded safety standards of new infrastructure in general, including the improvements to the SRN which attract traffic from less safe lower standard roads. There is also expected to be a large number of negative impacts of small magnitude, in particular the temporary construction impacts due to additional congestion on the roads and the increased risk of accidents and incidents as a result of the overall small increase in traffic on the road network. On balance it is considered that the large number of positive impacts outweigh the predicted negative impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types

Significantly supports AoS Objective		The measures supported by the NPS are not considered likely to have any impacts in relation to this objective and therefore it is considered that overall the NPS has a neutral contribution to this objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS16: To contribute towards the maximisation of user benefits on the National Networks

Significantly supports AoS Objective	✓	Overall, it is considered that the measures supported by the NPS will significantly support this objective. The significant package of improvements and enhancements to the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, due to reductions in congestion and crowding, improvements in journey times, reliability and user benefits. These positive impacts are not considered to be sufficiently outweighed by the predicted negative impacts, in particular from congestion relating to construction works causing journey delays (which is expected to be small in magnitude) to change the overall contribution to the AoS objective.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks

Significantly supports AoS Objective	✓	Overall, it is considered that the measures supported by the NPS will significantly support this objective. The significant package of improvements and enhancements to the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability and substantially contribute to improving levels of congestion and reliability on the SRN and overcrowding and reliability on the rail network. These are not sufficiently outweighed by the predicted negative impacts resulting from congestion caused by construction works (the impacts of which are predicted to be small in magnitude and temporary in nature) to change the overall contribution to the AoS objective.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the new road and rail links, and the targeted reduction of congestion and crowding across the networks which in turn allows better access between two locations when using the road and rail network. The probability is uncertain in many impacts relating to this objective because accessibility to regeneration areas, employment centres and areas of high unemployment will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to these areas from other parts of the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS19: To contribute towards the improvement of accessibility to rural areas

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of small magnitude and varying probability, in particular the new road and rail links, and the targeted reduction of congestion and crowding across the networks which in turn allows better access between two locations when using the road and rail network. The probability is uncertain in many impacts relating to this objective because accessibility to rural areas will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to rural areas from more urban areas, and from other parts of the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of small magnitude and varying probability, in particular, due to the increased traffic movements, and new infrastructure introducing a physical barrier into communities. However, the commitment in the NPS to address the needs of cyclists and pedestrians in new schemes, as well as the specific works targeting existing severance problems on the SRN, are expected to result in a large number of positive impacts of small magnitude. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the new road and rail links, and the targeted reduction of congestion and crowding across the networks which in turn allows better access between two locations when using the road and rail network. The probability is uncertain for many impacts relating to this objective because accessibility to national networks and the jobs, services and social networks they create will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to jobs and services.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of varying magnitude and probability, in particular the impact of potential Compulsory Purchase Orders on different social groups. There is also expected to be a large number of positive impacts of small magnitude, in particular the positive benefits to disabled groups from improvements to the rail network and the door-to-door strategy measures and cycling measures aimed at improvements to modal integration and improved travel alternatives provision for non-car users. However, on balance it is considered that the negative impacts are not sufficiently outweighed by the predicted positive impacts.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS23: To contribute towards improving health and public health

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will support this objective, but not significantly. There is predicted to be a small number of small magnitude positive impacts of a high probability, in particular the interventions aimed at encouraging cycling and sustainable transport which should contribute towards improving health. It should be noted that although air quality and noise can impact on health and public health, these have been addressed in AoS1 and AoS2 solely, to avoid the double-counting of impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

Alternative 1 Summary Tables

AoS1: To contribute towards the reduction of noise levels from road and rail national networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and probability, in particular, due to noise sources moving closer to receptors, and new noise sources being introduced to new locations, although in the case of new road traffic noise, the number of new road links would be very limited. However, extensive programmes of rail electrification and resurfacing the SRN with low noise surfacing, along with specific works targeted at new road developments and existing problems on the SRN and the funding of the transition to Ultra Low Emission Vehicles (ULEVs), are expected to result in a large number of positive impacts of varying magnitude and probability. Furthermore, the increased cost of motoring means that overall traffic levels will fall. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS2: To contribute towards improving local air quality

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of small magnitude and varying probability, in particular, due to the source of pollutant emissions moving closer to receptors, and new sources of emissions being introduced to new locations, although in the case of road traffic emissions, the number of new road links would be very limited. However, the extensive programme of rail electrification, the specific works targeting congestion and existing air quality problems on the SRN, the funding of the transition to Ultra Low Emission Vehicles (ULEVs), and the targeted measures to reduce pollution in areas of poor air quality, including the opportunity to manage traffic speed on Smart Motorways, are expected to result in a large number of positive impacts, or the avoidance of negative impacts, of varying magnitude and probability. Furthermore, the increased cost of motoring means that overall traffic levels will fall, reducing the level of emissions. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS3: To contribute towards the reduction of greenhouse gas emissions

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. There is predicted to be a large number of positive impacts of varying magnitude and probability, in particular the commitment to support ULEVs and the increased cost of motoring resulting in lower overall traffic levels, is predicted to lead to a reduction in carbon emissions across the whole road network. The impact of development of the national road and rail networks is also expected to result in a large number of negative impacts, of small magnitude and varying probability. On balance it is considered that the expected positive impacts outweigh the predicted negative impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS4: To protect and enhance landscape quality, townscape quality, and to enhance visual amenity

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts, in particular due to the introduction of new transport infrastructure in locations where there was none or less previously, leading to loss of landscape character and tranquillity, and visual impacts. It should be noted that the roads programme for Alternative 1 is expected to be undertaken primarily within the existing highway boundary, which would minimise the impacts on landscape, townscape and visual amenity, when compared to developments being introduced outside of the highway boundary. However, the extensive rail programme (including a large programme to provide major new links, new chords and track widening) is likely to involve a large amount of development outside of the existing railway boundary which is likely to result in negative impacts relating to landscape, townscape and visual amenity. As the probability of the majority of negative impacts occurring will greatly depend on the location of the measure being implemented (i.e. the sensitivity of the landscape or receptor being impacted upon), these impacts are considered to have a medium probability of occurring. It is not considered that the expected negative impacts are sufficiently outweighed by the predicted positive impacts from implementing enhancement measures where landscape problems exist on the existing SRN and from the increased cost of motoring that means overall traffic levels will fall.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS5: To protect and conserve heritage assets in a manner appropriate to their significance

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and probability, in particular due to the introduction of new transport infrastructure where there was none or less previously, leading to the potential loss of heritage features and setting impacts. As the probability of some of the negative impacts occurring will greatly depend on the location of the measure being implemented (i.e. the existence of an important site or receptor being impacted upon), the majority of impacts are considered to have a medium probability of occurring. It is not considered that the expected negative impacts are sufficiently outweighed by the predicted positive impact (of small magnitude) from implementing enhancement measures on future schemes, and also where heritage problems exist on the existing SRN.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS6: To preserve, protect and enhance biodiversity

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. There are predicted to be a large number of negative impacts of varying magnitude and high probability, in particular, the habitat loss due to new and upgraded infrastructure. It should be noted that the roads programme for Alternative 1 is expected to be undertaken primarily within the existing highway boundary, which would minimise the impacts on habitat loss, when compared to developments being introduced outside of the highway boundary. However, the extensive rail programme (including a large programme to provide major new links, new chords and track widening) is likely to involve a large amount of development outside of the existing railway boundary which is likely to result in negative impacts on biodiversity in relation to habitat loss and fragmentation. This alternative includes a commitment to biodiversity offsetting where habitat is lost for new road developments which will mitigate a number of these impacts to some extent. Furthermore, the increased cost of motoring means that overall traffic levels will fall. This lower level of traffic will have a positive impact on biodiversity. The expected negative impacts are not predicted to be sufficiently outweighed by the expected positive impacts on biodiversity from enhancement measures such as green bridges and habitat improvements on network verges.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS7: To ensure the protection of water resources (quantity)

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of a high probability, due to the use of water in the construction of infrastructure, but in the context of water resources as a whole, it is considered that these impacts will be very small, and will not amount to an overall significant negative impact.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS8: To encourage the protection of water quality

Significantly supports AoS Objective		Overall, it is considered that the measures supported by the NPS will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of small magnitude and varying probability, in particular due to the introduction of new potential sources and pathways of water pollution. However, there is also expected to be predicted positive impacts (of small magnitude) from implementing enhancement measures where historic water quality problems exist on the existing SRN. In addition, any new works will also use modern best practice techniques to ensure appropriate management and treatment of pollutant run-off. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS9: To contribute towards increase resilience on national networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and high probability, in particular the large positive impact expected due to Smart Motorways and the programme of small enhancements ("pinch points") leading to an increased resilience to accidents and incidents on the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS10: To minimise the impact on soil and land resources including contamination and loss

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a small number of small magnitude negative impacts of a low to negligible probability, in particular, the potential for mobilisation of contaminants during the construction of new infrastructure.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS11: To minimise the use of previously undeveloped land

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a small number of small magnitude negative impacts of a low probability, due to the likelihood of infrastructure development requiring the use of some previously undeveloped land.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of a high probability due to the use of raw materials in infrastructure construction and the generation of construction waste having an impact on the waste infrastructure.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS13: To contribute towards reducing the risk of flooding in the hinterland

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of small magnitude and medium probability, primarily through the introduction of new impermeable surfaces from new infrastructure, as well as a small number of positive impacts of large magnitude and high probability in the form of measures to address flooding problems on the existing networks. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and high probability, including the benefits from Smart Motorways due to speed management to improve traffic, lower overall traffic levels resulting from the increased cost of motoring, and the upgraded safety standards of new infrastructure in general, as well as a large number of negative impacts of small magnitude, in particular the temporary construction impacts due to additional congestion on the roads. However, on balance it is considered that the large number of positive impacts is not sufficiently outweighed by the predicted negative impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types

Significantly supports AoS Objective		The measures supported by Alternative 1 are not considered likely to have any impacts in relation to this objective and therefore it is considered that overall this alternative has a neutral contribution to this objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS16: To contribute towards the maximisation of user benefits on the National Networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability. In particular the road network improvements focused on small enhancements and development within highway boundaries and the expanded programme of rail network improvements will contribute to improving levels of congestion and crowding, improvements in journey times and user benefits. The overall contribution to the AoS objective is a result of these positive impacts not being sufficiently outweighed by the predicted negative impacts, in particular from congestion relating to construction works causing journey delays, and by the increased cost of motoring (where the cost to the user is a fundamental consideration of user benefits).
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks

Significantly supports AoS Objective	✓	Overall, it is considered that the measures supported by Alternative 1 will significantly support this objective. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability. In particular the road network improvements focused on small enhancements and development within highway boundaries, the increase in the cost of motoring, and the expanded programme of rail network improvements will contribute to improving levels of congestion and reliability on the SRN and overcrowding and reliability on the rail network. These are not sufficiently outweighed by the predicted negative impacts resulting from congestion caused by construction works (the impacts of which are predicted to be small in magnitude and temporary in nature) to change the overall contribution to the AoS objective.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the targeted reduction of congestion and crowding across the networks, which in turn allows better access between two locations when using the road and rail network. The probability is uncertain for certain impacts relating to this objective because accessibility to regeneration areas, employment centres and areas of high unemployment will be dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to these areas from other parts of the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS19: To contribute towards the improvement of accessibility to rural areas

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the targeted reduction of congestion across the road network and the large programme of new rail links and chords, and track widening, which in turn allows better access between two locations when using the road and rail network. The probability is uncertain in many impacts relating to this objective because accessibility to rural areas will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to rural areas from more urban areas, and from other parts of the network. The positive impacts are not sufficiently outweighed by the predicted negative impacts resulting from the increased cost of motoring to change the overall contribution to the AoS objective.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will have a neutral contribution to this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and varying probability, in particular, due to the increased traffic movements, and new infrastructure introducing a physical barrier into communities. However, the commitment in Alternative 1 to address the needs of cyclists and pedestrians in new schemes, as well as the specific works targeting existing severance problems on the SRN, are expected to result in a large number of positive impacts of small magnitude. On balance it is considered that the expected positive and negative impacts balance each other out to result in an overall neutral contribution to the objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the targeted reduction of congestion and crowding across the networks which in turn allows better access between two locations when using the road and rail network. There is also expected to be a large number of negative impacts of varying magnitude, in particular the increase in the cost of motoring leading to impacts on financially disadvantaged groups. However, on balance it is considered that the large number of positive impacts is not sufficiently outweighed by the predicted negative impacts. The probability is uncertain for many impacts relating to this objective because accessibility to national networks and the jobs, services and social networks they create will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to jobs and services. On balance it is considered that the large number of positive impacts is not sufficiently outweighed by the predicted negative impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of varying magnitude and probability, in particular the impact of the increase in the cost of motoring, which is likely to affect a large number of people from different social groups. There is also expected to be a large number of positive impacts of small magnitude, in particular the positive benefits to disabled groups from improvements to the rail network. However, on balance it is considered that the negative impacts are not sufficiently outweighed by the predicted positive impacts.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS23: To contribute towards improving health and public health

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 1 will support this objective, but not significantly. There is predicted to be a small number of small magnitude positive impacts of a high probability, in particular the interventions aimed at encouraging cycling and sustainable transport which should contribute towards improving health. It should be noted that although air quality and noise impacts can impact on health and public health, these have been addressed in AoS1 and AoS2 solely, to avoid the double-counting of impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

Alternative 2 Summary Tables

AoS1: To contribute towards the reduction of noise levels from road and rail national networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and probability, in particular, due to noise sources moving closer to receptors, increased traffic movements, and a substantial number of new noise sources being introduced to new locations. However, limited programmes of rail electrification and resurfacing the SRN with low noise surfacing are expected to result in a large number of positive impacts of varying magnitude and probability. On balance it is considered that the expected negative impacts outweigh the predicted positive impacts.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS2: To contribute towards improving local air quality

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of small magnitude and varying probability, in particular, due to the source of pollutant emissions moving closer to receptors, increased traffic movements, and a new source of emissions being introduced to a substantial number of new locations. However, the limited programme of rail electrification, and the reduction in emissions from road traffic due to congestion and queuing, is expected to result in a large number of positive impacts of varying magnitude and probability. On balance it is considered that the expected negative impacts outweigh the predicted positive impacts.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS3: To contribute towards the reduction of greenhouse gas emissions

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract this objective, but not significantly. There is predicted to be a large number of positive impacts of small magnitude and high probability, in particular the limited programme of rail electrification and making better use of the existing rail network. The impact of development of the national road and rail networks is also, however, expected to result in a large number of negative impacts, of small magnitude and varying probability. In particular, the substantial number of interventions aimed at easing congestion on the SRN will mean that traffic speeds are generally higher leading to increased carbon emissions across the network. Therefore, on balance it is considered that the expected negative impacts outweigh the predicted positive impacts.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS4: To protect and enhance landscape quality, townscape quality, and to enhance visual amenity

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will significantly detract from this objective. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts, in particular due to the introduction of a substantial amount of new and expanded road infrastructure (including an extensive programme of road widening and upgrades to the trunk road network) leading to loss of landscape character and visual impacts. As the probability of the majority of negative impacts occurring will greatly depend on the location of the measure being implemented (i.e. the sensitivity of the landscape or receptor being impacted upon), these impacts are considered to have a medium probability of occurring.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective	✓	

AoS5: To protect and conserve heritage assets in a manner appropriate to their significance

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will significantly detract from this objective. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of varying magnitude and probability, in particular due to the introduction of a substantial amount of new and expanded road infrastructure leading to the potential loss of heritage features and setting impacts. As the probability of some of the negative impacts occurring will greatly depend on the location of the measure being implemented (i.e. the existence of an important site or receptor being impacted upon), the majority of impacts are considered to have a medium probability of occurring.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective	✓	

AoS6: To preserve, protect and enhance biodiversity

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will significantly detract from this objective. There are predicted to be a very large number of negative impacts including some of a large magnitude and high probability, in particular, the substantial amounts of habitat loss due to new and upgraded infrastructure (including an extensive programme of road widening and upgrades to the trunk road network) and disturbance impacts from additional traffic movements on both the road and rail networks.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective	✓	

AoS7: To ensure the protection of water resources (quantity)

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of a high probability, due to the use of water in the construction of infrastructure, but in the context of water resources as a whole, it is considered that these impacts will be very small, and will not amount to an overall significant negative impact.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS8: To encourage the protection of water quality

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of small magnitude and varying probability, in particular due to the introduction of new potential sources and pathways of water pollution.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS9: To contribute towards increase resilience on national networks

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, in particular the large positive impact expected due to the road infrastructure upgrades leading to an increased resilience to accidents and incidents on the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS10: To minimise the impact on soil and land resources including contamination and loss

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of varying probability, in particular, the potential for mobilisation of contaminants during the construction of new infrastructure.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS11: To minimise the use of previously undeveloped land

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a medium number of small magnitude negative impacts of a high probability, due to the likelihood of infrastructure development requiring the use of some previously undeveloped land.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of small magnitude negative impacts of a high probability due to the use of raw materials in infrastructure construction and the generation of construction waste having an impact on the waste infrastructure.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS13: To contribute towards reducing the risk of flooding in the hinterland

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of small magnitude and high probability, primarily through the introduction of new impermeable surfaces from new infrastructure.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability, including the benefits from motorway widening due to the improvement in traffic flows, and the upgraded safety standards of new infrastructure in general, as well as a large number of negative impacts of small magnitude, in particular the temporary construction impacts due to additional congestion on the roads and the increased risk of accidents and incidents as a result of the overall small increase in traffic on the road network. However, on balance it is considered that the large number of positive impacts is not sufficiently outweighed by the predicted negative impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types

Significantly supports AoS Objective		The measures supported by Alternative 2 are not considered likely to have any impacts in relation to this objective and therefore it is considered that overall this alternative has a neutral contribution to this objective.
Supports AoS Objective		
Neutral contribution to AoS Objective	✓	
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS16: To contribute towards the maximisation of user benefits on the National Networks

Significantly supports AoS Objective	✓	Overall, it is considered that the measures supported by Alternative 2 will significantly support this objective. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability. In particular the expanded programme of road network improvements and the smaller rail programme focused on small enhancements and making better use of the existing rail network will contribute to improving levels of congestion and crowding, improvements in journey times and user benefits. These positive impacts are not considered to be sufficiently outweighed by the predicted negative impacts, in particular from congestion relating to construction works causing journey delays to change the overall contribution to the AoS objective.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks

Significantly supports AoS Objective	✓	Overall, it is considered that the measures supported by Alternative 2 will significantly support this objective. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of varying magnitude and probability. In particular the expanded programme of road network improvements and the smaller rail programme focused on small enhancements and making better use of the existing rail network will contribute to improving levels of congestion and reliability on the SRN and overcrowding on the rail network. These are not sufficiently outweighed by the predicted negative impacts resulting from congestion caused by construction works (the impacts of which are predicted to be small in magnitude and temporary in nature) to change the overall contribution to the AoS objective.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of small magnitude and high probability, in particular the new road links, and the targeted reduction of congestion across the network which in turn allows better access between two locations when using the road and rail network. The probability is uncertain in many impacts relating to this objective because accessibility to regeneration areas, employment centres and areas of high unemployment will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to these areas from other parts of the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS19: To contribute towards the improvement of accessibility to rural areas

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of small magnitude and high probability, in particular the new road links, and the targeted reduction of congestion and crowding across the networks which in turn allows better access between two locations when using the road and rail network. The probability is uncertain in many impacts relating to this objective because accessibility to rural areas will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to rural areas from more urban areas, and from other parts of the network.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts, of small magnitude and varying probability, in particular, due to the increased traffic movements, and new infrastructure introducing a physical barrier into communities. The reduction in severance in existing communities by the construction of bypasses is expected to result in a large number of positive impacts of small magnitude, however, on balance it is considered that the expected positive impacts are not sufficiently outweighed by the negative ones.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will support this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of positive impacts of small magnitude and varying probability, in particular the new road links, and the targeted reduction of congestion and crowding across the networks which in turn allows better access between two locations when using the road and rail networks. The probability is uncertain for many impacts relating to this objective because accessibility to national networks and the jobs, services and social networks they create will be highly dependent on the location of individual schemes brought forward, and the degree to which those schemes are likely to influence access to jobs and services.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will detract from this objective, but not significantly. The impact of development of the national road and rail networks is expected to result in a large number of negative impacts of varying magnitude and high probability, in particular the impact of Compulsory Purchase Orders on different social groups. There is also expected to be a large number of positive impacts of small magnitude, in particular the positive benefits to disabled groups from improvements to the rail network. However, on balance it is considered that the negative impacts are not sufficiently outweighed by the predicted positive impacts.
Supports AoS Objective		
Neutral contribution to AoS Objective		
Detracts from AoS Objective	✓	
Significantly detracts from AoS Objective		

AoS23: To contribute towards improving health and public health

Significantly supports AoS Objective		Overall, it is considered that the measures supported by Alternative 2 will support this objective, but not significantly. There is predicted to be a small number of small magnitude positive impacts of a high probability, in particular the interventions aimed at encouraging cycling and sustainable transport which should contribute towards improving health. It should be noted that although air quality and noise impacts can impact on health and public health, these have been addressed in AoS1 and AoS2 solely, to avoid the double-counting of impacts.
Supports AoS Objective	✓	
Neutral contribution to AoS Objective		
Detracts from AoS Objective		
Significantly detracts from AoS Objective		

7.4. Summary of Appraisal of Sustainability of NPS and Strategic Alternatives

7.4.2. Table 2 below shows the overall scores for the NPS and Strategic Alternatives in a matrix format, to allow an easy comparison to be made, although it should be noted that the table should be read in conjunction with the text in the summary tables above, as the scoring does not capture all of the differences between the sustainability performance of the different alternatives. A comparative discussion of overall performance by economic, environmental and social objectives follows the table.

Key for Sustainability Performance Matrix

Significantly supports (++)
Supports (+)
Neutral (/)
Detracts (-)
Significantly detracts (--)

Table 4: Overall Sustainability Performance Comparison of NPS and Strategic Alternatives

	NPS	Alt 1	Alt 2
AoS1 To contribute towards the reduction of noise levels from road and rail national networks	/	/	-
AoS2 To contribute towards improving local air quality	/	/	-
AoS3 To contribute towards the reduction of greenhouse gas emissions	+	+	-
AoS4 To protect and enhance landscape quality, townscape quality and to enhance visual amenity	-	-	--
AoS5 To protect and conserve heritage assets in a manner appropriate to their significance	-	-	--
AoS6 To preserve, protect and enhance biodiversity	-	-	--
AoS7 To ensure the protection of water resources (quantity)	-	-	-
AoS8 To encourage the protection of water quality	/	/	-
AoS9 To contribute towards increase resilience on national networks	+	+	+
AoS10 To minimise the impact on soil and land resources including contamination and loss	-	-	-
AoS11 To minimise the use of previously undeveloped land	-	-	-

	NPS	Alt 1	Alt 2
AoS12 To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction	-	-	-
AoS13 To contribute towards reducing the risk of flooding in the hinterland	/	/	-
AoS14 To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network	+	+	+
AoS15 To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types	/	/	/
AoS16 To contribute towards the maximisation of user benefits on the National Networks	++	+	++
AoS17 To contribute towards the improvement of levels of congestion and reliability on the National Networks	++	++	++
AoS18 To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment	+	+	+
AoS19 To contribute towards the improvement of accessibility to rural areas	+	+	+
AoS20 To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations	/	/	-
AoS21 To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged	+	+	+
AoS22 To ensure the needs of different social groups are taken into account in national network planning and service delivery	-	-	-
AoS23 To contribute towards improving health and public health	+	+	+

Environmental Performance

7.4.3. Generally the NN NPS detracts from the delivery of environmental objectives, however, no significant impacts on environmental objectives have been identified. Whilst a substantial proportion of national networks infrastructure development is likely to occur within existing highway and railway boundaries, the trunk road upgrades and pinch point investments, the conversion of significant lengths of motorway to Smart Motorways, limited new road and rail alignments, together with extensive rail electrification is likely to result in localised environmental impacts. Most environmental objectives are detracted from, but not significantly. However, the targeted measures to reduce pollution in areas of poor air quality, and this, together with commitment to tackle existing areas of the networks vulnerable to flooding ensures that for objectives relating to noise, air quality, water quality and flood risk, the NPS scores neutral. The commitment in the NPS to support the transition to ULEVs outweighs all measures that increase greenhouse gas emissions, meaning that the NPS contributes towards the objective relating to the reduction of greenhouse gases.

7.4.4. Alternative 1 commits to a similar level of environmental mitigation measures as are contained in the NPS, and therefore the environmental performance of Alternative 1 is broadly similar in terms of the scoring. However, the scale of infrastructure works is substantially lower than that proposed in the NPS. Therefore, where the scores for Alternative 1 and the NPS seem the same, it is often the case that Alternative 1 is closer to being neutral than would be the case for the NPS. In particular, the increased cost of motoring leads to a lower level of traffic which affects a number of the AoS objectives

more positively than the NPS scenario. For example, this is the case for AoS 4, 5, and 6 where large amounts of infrastructure works under the NPS will more likely lead to adverse impacts than under Alternative 1 where less construction and operational disturbance for road and rail infrastructure and traffic is likely. The greater the scale of works, the greater the likelihood that sensitive receptors will be affected. In addition, for biodiversity (AoS 6), although both detracting from the objective, Alternative 1 would detract to a lesser extent that the NPS due to the reduced scale of the works as a whole, and the commitment in Alternative 1 to a policy of biodiversity offsetting, which would help mitigate for habitat loss and disturbance impacts from any new infrastructure.

7.4.5. Alternative 2 broadly involves a greater degree of roads infrastructure, and less rail infrastructure. It also doesn't contain the proactive environmental enhancement for both existing and proposed infrastructure that is committed to in the NPS and Alternative 1. For this reason, Alternative 2 generally scores worse on environmental measures. In particular, objectives relating to air quality, noise, greenhouse gas emissions, landscape, heritage, biodiversity, water quality and flooding score worse when compared to the NPS.

Economic Performance

7.4.6. The NPS supports or significantly supports all of the objectives focused on the economy. The provision of extensive additional lane miles of new capacity, predominantly as hard shoulder running (Smart Motorways), targeted at those areas of greatest congestion, pinch point investments and trunk road upgrades, together with the relief of overcrowding on the rail network, through better use of the existing network and limited additional new links, new chords and track widening, provides for significant user benefits and journey time reliability and supports the objectives relating to access, congestion, user benefits and employment. In particular, TASM modelling of a NPS investment scenario forecasts that in the central scenario the road infrastructure measures supported by the NPS would reduce congestion on the SRN by 39.8% by 2040 (when compared to baseline 2040 levels).[17] Network resilience is also improved through the inclusion of a strong commitment to address climate change adaptation in the NPS.

7.4.7. Alternative 1 generally performs well against the economic objectives but not to the same extent as the NPS. On user benefits Alternative 1 supports the objective, but not significantly (whereas the NPS significantly supports). This is due to the smaller scale of road infrastructure measures contained in this Alternative when compared to the NPS and the moderate increase in the cost of motoring, which although is predicted to reduce congestion, is also likely to impact on user benefits due to the increased cost for road users. TASM modelling suggests that an increase in the cost of motoring would have a relatively small impact on congestion for a given increase in cost – a 25-28% increase in the cost of motoring over a 15 year period might reduce congestion on the SRN by 15.8%[18]. Although most of the interventions contained within the NPS are also contained in Alternative 1, these measures are on a much smaller scale, with TASM modelling of an Alternative 1 investment scenario forecasting that in the central scenario the road infrastructure measures supported by Alternative 1 (not including the cost of motoring measures) would reduce congestion on the SRN by 11.4% by 2040 (when compared to baseline 2040 levels).[19]

7.4.8. Alternative 2 performs well against the economic objectives, and scores the same as the NPS in all cases. Whilst it is expected that the performance of the road infrastructure measures might actually be slightly better than the NPS from an economic perspective,

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[17] Central forecast based on central estimates of population, incomes and fuel costs.

[18] Based on a "constant cost of motoring" scenario, i.e. motoring costs remaining constant in real terms rather than declining as forecasted under the Department's central scenario. This relationship is not linear and is dependent on fleet fuel efficiency.

[19] Central forecast based on central estimates of population, incomes and fuel costs.

due to a larger programme of interventions, including motorway widening rather than Smart Motorways and substantially more trunk road upgrades, this is not reflected in the overall scores. This is partly due to the fact that the NPS already scores well on the economic objectives, partly due to the reduced rail investment in Alternative 2 counterbalancing the increased roads investment, and partly due to the fact that congestion, reliability and journey time benefits are not consistently correlated with investment because there are diminishing economic returns (in respect of congestion) for expenditure on transport infrastructure if this increases beyond the expenditure already committed to in the NPS.

Social Performance

7.4.9. Overall the NN NPS supports social objectives but generally not significantly, and the performance is more mixed than for the other areas of sustainability. Positive scores are obtained for the predicted reduction of accidents and incidents, and the improvement of health. Impacts relating to severance due to the NPS are mixed, with both positive and negative impacts resulting in an overall neutral score. The NPS is likely to detract, but not significantly, from the objective relating to the needs of social groups due to the likelihood of needing to acquire land for the infrastructure measures supported by the NPS and the impacts that this will have on the people living at these locations. The objective relating to crime and fear of crime is not considered to be affected by the NPS and therefore scores neutrally.

7.4.10. Both Alternative 1 and Alternative 2 perform similarly to the NPS on the social objectives with no change in scoring for either alternative, except for on severance, where Alternative 2 detracts from the objective whereas the NPS and Alternative 1 have a neutral contribution to the objective. In addition there are differences that are not necessarily reflected in the overall scores with respect to the cost of travel that could affect different social groups. In particular, Alternative 1 proposes an increase in the cost of motoring as a way of reducing demand on the SRN.

7.5. Selection of the NPS

7.5.1 Section 7.4 above shows that if the NPS is compared against the two strategic alternatives, it is considered that the NPS gives the most balanced sustainable performance against the AoS objectives. Generally, Alternative 1 performs less well than the NPS on the economic and social objectives, and Alternative 2 performs less well environmentally than the NPS. Therefore the NPS has been chosen as the preferred policy to be taken forward to consultation stage.

7.6. Cumulative Impacts

7.6.1 The NN NPS has the potential to combine with a large number of different PPPs, resulting in cumulative sustainability impacts. Examples of these are summarised in Table 5 below. The strategic nature of the NN NPS means that is it not possible to identify such impacts in detail within this appraisal, but other opportunities exist for their consideration, for example, the cumulative impact from projects arising under different NPSs or other plans, should be reflected within project level assessments and therefore account of these can be taken when proposals are brought forward to the Planning Inspectorate.

Table 5: Example Cumulative Impacts of NN NPS

Example Plans and Projects	Potential Cumulative Impacts
Other NPSs	• Impacts on biodiversity, such as habitat loss • Impacts on air quality • Impacts on noise • Impacts on climate change
UK-Post-2010-Biodiversity Framework	

UK Low Carbon Transition Plan	adaptation • Impacts on emissions of greenhouse gases • Impacts on flood risk • Impacts on landscape character • Impacts on heritage assets • Impacts on water quality • Impacts on soil and land resources • Impacts on health and public health • Impacts on social exclusion • Impacts on regeneration • Impacts on resilience against major incidents
National Planning Policy Framework	
Local Plans	
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland	
The National Flood and Coastal Erosion Risk Management Strategy for England	
The Natural Environment White Paper	
Local Transport Plans	

7.7.1 There is, however, a further category of cumulative impact which is the in-combination effects i.e. the interactions between individual impacts from the interventions within the NN NPS on a particular receptor (e.g. the combination of air quality impacts on an ecological receptor, or a habit or species being affected by both emissions to air and noise). These in-combination effects (of the policies within the NPS) are dealt with inherently in the appraisal methodology. The impact assessment tables identify individual impacts that arise from the interventions, but also the cumulative impacts of the NN NPS as a whole against that objective, where evidence exists to support this e.g. transport modelling has been undertaken to demonstrate the impact of *all* the interventions of the NN NPS on congestion across the SRN, and this has therefore allowed for example, the identification of cumulative impacts on air quality, and noise.

7.7. Secondary and Synergistic

7.7.2 Secondary or indirect effects are impacts that are not a direct result of the NN NPS, but occur away from the original impact or as a result of the complex pathway e.g. a development that worsens air quality and thereby impacts on the ecology of a nearby protected site.

7.7.3 Synergistic impacts are whereby two or more impacts combine together, resulting in an impact on a receptor, which is more than the simple sum of the impacts acting alone.

7.7.4 The approach taken in this AoS to appraisal, whereby broad impacts were predicted relating to the issues addressed by the AoS objectives (e.g. air quality, congestion, resilience), mean that secondary/indirect and synergistic impacts have been identified within this appraisal wherever possible. Indirect effects are explicitly identified within the Impact Assessment Tables in Appendix E.

7.8. Transboundary and Intra-UK Impacts

7.8.1 The NN NPS applies only to England. However, both the English SRN and rail network link directly with the networks in Wales and Scotland. As a consequence, changes in the use of the English networks could have consequential impacts within Wales and Scotland (i.e. intra-UK impacts). For example, if a car journey runs through both England and Scotland/Wales, any impacts on user benefits for the English portion of the journey will impact on the overall journey. Similarly, impacts that are related to changes in traffic volumes (such as air quality and noise), may also lead to intra-UK impacts in Wales and Scotland, as a result of changes in England due to the NN NPS. See Section 12 for a discussion of the difficulties posed for the appraisal due to the high level nature of the NN NPS and lack of spatial specificity.

8. HOW THE AOS PROCESS HAS INFORMED THE DEVELOPMENT OF THE NPS

8.0.1 The AoS process has informed the development of the NPS and resulted in a number of changes within the NPS itself. The first draft of the NPS was used to undertake an initial appraisal, and the first draft of the Impact Assessment Tables was created. These Tables formed the basis of discussions between the NPS team and the AoS team, it was identified that Alternative 1 showed a stronger commitment to environmental mitigation than the NPS which meant that Alternative 1 scored substantially better against the environmental objectives.

8.0.2 The NPS team considered the environmental mitigation measures contained within Alternative 1, and identified where elements of this mitigation could be incorporated into the NPS. The NPS policy was amended and then the Impact Assessment Tables were rescored for the amended NPS. It is considered that the NPS is now introducing measures relating to environmental mitigation which up until now have not been fully articulated or set out in transport policy in the UK. The measures that are now part of the NPS as a result of the AoS process are as follows:

- Targeted measures to reduce pollution in areas of poor air quality, including the opportunity to use speed management on Smart Motorways to reduce emissions;
- Use of measures to address biodiversity fragmentation as a result of existing road and rail infrastructure;
- Proactive commitment to addressing existing noise issues on the networks through the implementation of mitigation measures, rather than a policy of primarily addressing noise problems opportunistically as part of measures implemented for other reasons, such as safety;
- Commitment to implementing enhancement measures for both existing identified problems and for future schemes in the areas of flood risk, water quality, air quality, noise, heritage, landscape and biodiversity.

9. MONITORING AND MITIGATION

9.1. Proposed Mitigation Measures

9.1.1 The SEA Directive requires that the Environmental Report includes measures to prevent, reduce or offset any significant adverse effects of the plan or programme, i.e. the NPS. Such measures are termed mitigation measures.

9.1.2 The high level nature of the NN NPS means that it has been necessary to consider its effects at a strategic level. At this strategic NPS level, mitigation of adverse sustainability impacts (and enhancement of beneficial impacts) has been achieved via the policy making process. As discussed in this AoS Report (Section 8), development of the NN NPS has been informed by the AoS process, with the aim of enhancing the sustainability "performance" of the NPS. The approach to appraising alternatives has helped optimise and balance the NPS across all aspects of sustainability.

9.1.3 At a project level, the Impacts section of the NN NPS identifies mitigation measures that should be included in NSIPs on National Networks. In general, mitigation measures will be identified through the Environmental Impact Assessment (EIA) process.

9.1.4 As no significant adverse effects of the NN NPS have been identified, no further discussion of mitigation measures is provided in this report.

9.2. Proposed Monitoring Measures

9.2.1 The SEA Directive requires that any significant effects of the plan or programme, i.e. the NPS, be monitored, in order that they can be tested against those predicted. As no significant adverse effects of the NN NPS have been identified, no further discussion of monitoring measures is provided in this report. However, appropriate monitoring and evaluation of network level and scheme level impacts already takes place. At a network level the Highways Agency and Network Rail already monitor environmental and other impacts of the networks. For individual schemes appropriate evaluation takes place, for example the Highways Agency has an established process of Post Opening Project Evaluation (POPE) covering a wide range of economic, environmental and social impacts to understand whether the scheme has brought the benefits anticipated and whether the other impacts of the scheme were as predicted.

10. OPPORTUNITIES FOR IMPROVEMENT

10.0.1 The NN NPS identifies a number of measures that aim to enhance the sustainability "performance" of the NPS and mitigate the impacts of any adverse impacts. However, it is considered that there are a number of opportunities that could be given future consideration for further improvements to the sustainability of the national networks. These recommendations are as follows:

- The Government is currently undertaking a consultation on biodiversity offsetting in England. It is recommended that, depending on the response to this consultation, and as part of wider Government policy, a biodiversity offsetting policy should be considered for national networks infrastructure development. Implementation of such a policy could, on an individual scheme level, potentially off-set biodiversity impacts to a significant extent, by, for example the provision of compensatory habitat that matches or more than matches the value of habitat lost. The value of off-setting could potentially be further increased by adopting a strategic regional or national level approach that seeks to consolidate areas of high value habitat. However, care should be taken to avoid a situation whereby a habitat off-setting approach is used as justification for habitat loss, and compensation measures should only be sought as a last resort where significant harm cannot be avoided or mitigated (i.e. in line with the mitigation hierarchy[20]).
- Implementation of a policy that seeks to manage and enhance National Networks as ecological networks, at a strategic national level could significantly improve strategic level ecological connectivity in England. Such a policy could be effectively be coordinated with the implementation of biodiversity off-setting approaches.
- Enhancement of green infrastructure to manage climate change adaptation and increase resilience of the national networks to climate change.
- Consideration of utilising the national networks for renewable energy generation, with the target of becoming self-sufficient in energy.

10.0.2 The absence of any significant adverse impacts negates the need for monitoring under the SEA Directive. However, in addition to the opportunity for mitigation measures discussed above, there is also the opportunity to implement monitoring of the environmental mitigation measures at a network level in order to gain valuable data relating to overall impacts of the NPS. Such a programme could build upon scheme level evaluations already undertaken, and could most effectively be managed via use of Geographic Information Systems.

[20] The mitigation hierarchy is a systematic approach to addressing environmental impact and its potential compensation. This is a stepwise approach first seeking to avoid impacts, then to minimise them, then take on-site measures to rehabilitate or restore biodiversity, before finally offsetting residual, unavoidable impacts.

11. NEXT STEPS

11.1. Public Consultation

11.1.1 The NN NPS is accompanied by a consultation document. Any comments on this document should be directed to DfT via the contact details in the consultation document.

11.2. Following Consultation

11.2.1 Following the consultation period and process of Parliamentary scrutiny of the NPS, DfT will publish a response to the consultation detailing the responses received and how these have been taken into account. The Department will also undertake a review of the NN NPS and the AoS in the light of consultation replies, aiming to designate the NPS document later in 2014 and to update the AoS as necessary.

12. LIMITATIONS AND ASSUMPTIONS

12.1. Spatial specificity

12.1.1 The NN NPS sets out the Government's policy for the future development of infrastructure on the national networks in England. The existing national networks in England are extensive. The alternatives to the NN NPS and the NN NPS itself make provision for the extension and modification of existing infrastructure as well as supporting the possibility of new routes. In addition the NPS also sets policy towards the provision of SRFIs.

12.1.2. In terms of the appraisal this brings the challenge of handling the appraisal of impacts which for some aspects of policy might be quite well spatially defined, i.e. they could relate to some change on the existing networks, whereas for other aspects of policy e.g. SRFIs, there is little spatial/locational definition. Therefore the magnitude and probability of many of the impacts identified is difficult to define as it will depend on the location of the measure being implemented, and also on the existence of sensitive receptors to be affected by an impact. In addition to this there is uncertainty around the extent of mitigation measures in terms of what is practically possible at different locations.

12.1.3. To address this, the approach taken within the appraisal of the NPS has been at a strategic level and precautionary to reflect a judgement of likely risk, i.e. without making allowance for the consideration of mitigating factors which might form a part of any specific proposal, unless these are specifically identified within the NPS itself. Therefore if anything the appraisal presents a worst case scenario in terms of the impacts identified.

12.2. Overlap of objectives

12.2.1. A further appraisal challenge is to reflect adequately the interrelationship between many sustainability issues and the objectives which flow from these as defined in the scoping study. The approach taken within the appraisal process has been to guard against unjustified double counting of benefits/disbenefits where possible whilst acknowledging that some impacts can have a legitimate relevancy to multiple objectives. A discussion of what has been contained within each objective where some uncertainty or overlap is considered to exist is provided in Section 6.2.

12.3. Assumptions

12.3.1. The evidence sections of the Impact Assessment Tables (Appendix E) contain examples of readily available evidence where impacts for certain interventions have been identified. The evidence cited is for illustrative purposes only. It is given to provide some context to the impacts described, but is not considered to be an exhaustive list of examples, nor is it intended to be representative of neither all schemes nor all potential impacts, and it is acknowledged that in most cases, impacts will be highly dependent on project specific design and location. Modelling is used as evidence of examples where it is available and relevant. In many cases it is considered that the impact is self-evident.

12.3.2. For the vast majority of AoS objectives, multiple interventions have a variety of impacts against the objective, which may be of varying magnitude, scale and probability. Therefore professional judgement was relied upon to weigh up the combination of impacts against an objective to determine an overall significance score for that objective. Where uncertainty as to the overall score existed, a precautionary approach was taken.

12.3.3. As discussed in paragraph 3.1.16 a variety of different evidence sources have been used to provide evidence and examples of the impacts. Each of these have limitations:

- TASM road modelling evidence – this has been used to provide a sense of scale of the impacts of different road investment scenarios on traffic, emissions, congestion and an increase in the cost of motoring. Uncertainty is inherently part of forecasting and predicting future behaviour and trends. Traffic trends and outcomes depend on a large number of variables, economic (GDP, oil prices) and behavioural (people preferences, trends and social habits). As these drivers are not certain and could be subject shifts in trends or shocks in the future, forecasting is a highly uncertain exercise that must be interpreted as best estimates given current state of information and assumptions. Whilst there is uncertainty around road traffic forecasts, this has been mitigated by considering low and high demand scenarios.
- POPE meta-analysis report and LMNS annual report – the Highways Agency publishes meta-analysis reports covering major schemes (>£10m) and smaller schemes (<£10m). These have been used as a source of evidence of impacts of road infrastructure measures. These reports are based on the impacts of previous schemes, and the impacts of future schemes will depend on location and the mitigations that are practically possible.
- Rail modelling evidence – to provide a sense of scale of the impacts of rail investment scenarios, some of the modelling evidence for HLOS 2 was used:
  - The modelling evidence for the HLOS schemes is based on best practice rail modelling embedded in the Network Modelling Framework (NMF). This model incorporates the latest evidence on parameters and values to use for estimating demand impacts from rail schemes and from factors such as GDP, employment, population and other forecasts. To account for uncertainty in the estimation, a range is provided for the forecasts. Some of the HLOS interventions, such as for large infrastructure changes, were modelled separately by Network Rail, and incorporated and published in Network Rail's strategic business plan. The modelling of freight traffic was also conducted by Network Rail as they have the required data and modelling suite to estimate the future level of demand of commercial freight operators.
  - The Rail Emissions Model (REM) was used to estimate the impact of the HLOS schemes based on NMF. This model estimates the energy consumption on the basis of which calculations of emissions of carbon and air quality is based. The majority of the impacts on rail emissions come from electrification schemes, as the incremental impacts on emissions from train lengthening schemes are small.

APPENDIX A SEA QUALITY ASSURANCE CHECKLIST

Objectives and Context	
• The plan's or programme's purpose and objectives are made clear	**See Section 2.1 and 2.2**
• Environmental issues and constraints, including international and EC environmental protection objectives, are considered in developing objectives and targets	**See Section 5**
• SEA objectives, where used, are clearly set-out and linked to indicators and targets where appropriate	**See Section 6**
• Links with other related plans, programmes and policies are identified and explained	**See Section 5**
• Conflicts that exist between SEA objectives, between SEA and plan objectives and between SEA objectives and other plan objectives are identified and described	**See Section 6.2, 6.3 and Appendix C**
Scoping	
• Consultation bodies are consulted in appropriate ways and at appropriate times on the content and scope of the Environmental Report	**See Section 4**
• The assessment focuses on significant issues	**See Section 3.1**
• Technical, procedural and other difficulties encountered are discussed; assumptions and uncertainties are made explicit	**See Section 12**
• Reasons are given for eliminating issues from further consideration	**N/A**
Alternatives	
• Realistic alternatives are considered for key issues and the reasons for choosing them are documented	**See Section 7.1**
• Alternatives include 'do minimum' and/or 'business as usual' scenarios wherever relevant	**Not applicable/suitable as not consistent with Government's strategic objectives.**
• The environmental effects (both adverse and beneficial) of each alternative are identified and compared	**See Section 7**
• Reasons are given for selection or elimination of alternatives	**See Section 7**
Baseline Information	
• Relevant aspects of the current state of the environment and their likely evolution without the plan or programme described	**See Section 5 and Annex C**
• Environmental characteristics of areas likely to be significantly affected are described, including areas wider than the physical boundary of the plan area where it is likely to be affected by the plan	**See Section 5 and Annex C**
• Difficulties such as deficiencies in information or methods are explained	**See Section 12**

Prediction and Evaluation of Likely Significant Environmental Effects	
• Effects identified include the types listed in the Directive (biodiversity, population, human health, fauna, flora, soil, water, air, climate factors, material assets, cultural heritage and landscape), as relevant; other likely environmental effects are also covered, as appropriate	**Appendix E**
• Both positive and negative effects are considered and the duration of effects (short-, medium- or long-term) is addressed	**Appendix E**
• Likely secondary, cumulative and synergistic effects are identified where practicable	**Appendix E and Section 7.6 and 7.7**
• Inter-relationships between effects are considered where practicable	**Appendix E and Section 7.6 and 7.7**
• The prediction and evaluation of effects makes use of relevant accepted standards, regulations and thresholds	**See Section 3.1**
• Methods used to evaluate the effects are described	**See Section 3.1 and Appendix D**
Mitigation Measures	
• Measures envisaged to prevent, reduce and offset any significant adverse effects of implementing the plan or programme are indicated	**See Section 9**
• Issues to be taken into account in project consents are identified	**Addressed in detail in NPS**
The Environmental Report • Is clear and concise in its layout and presentation	**Yes**
• Uses simple, clear language and avoids or explains technical terms	**Yes**
• Uses maps and other illustrations where appropriate	**Yes**
• Explains the methodology used	**See Section 3**
• Explains who was consulted and what methods of consultation were used	**See Section 4**
• Identifies sources of information, including expert judgement and matters of opinion	**Yes**
• Contains a non-technical summary covering the overall approach to the SEA, the objectives of the plan, the frames to express their opinions on the plan and Environmental Report	**Yes**
Consultation	
• The SEA is consulted on as an integral part of the plan-making process	**Yes**
• Consultation bodies and the public likely to be affected by, or having an interest in, the plan or programme are consulted in ways and at times which give them an early and effective opportunity within appropriate time-frames to express their opinions on the plan and Environmental Report	**See Section 11**
Decision-making and Information on the Decision	
• The Environmental Report and the opinions of those consulted are taken into account in finalising and adopting the plan or programme	**This will take place in AoS Statement**
• An explanation is given of how they have been taken into account	**This will take place in AoS Statement**

• Reasons are given for choosing the plan or programme as adopted, in the light of other reasonable alternatives considered	**This will take place**
Monitoring Measures	
• Measures proposed for monitoring are clear, practicable and linked to the indicators and objectives used in the SEA	**See Section 9**
• Monitoring is used, where appropriate, during implementation of the plan or programme to make good deficiencies in baseline information in the SEA	**This will take place where deficiencies are identified**
• Monitoring enables unforeseen adverse effects to be identified at an early stage (these effects may include predictions which prove to be incorrect)	**Monitoring measures will enable this**
• Proposals are made for action in response to significant adverse effects	**See Section 9**

APPENDIX B STAKEHOLDER COMMENTS

APPENDIX B - STAKEHOLDER COMMENTS ON NN NPS AOS SCOPING REPORT

A summary of consultee responses to the AoS Scoping Report and, how these will be addressed, is given below:

Strategic Environmental Assessment (SEA)

Consultees identified that the requirements of the Strategic Environmental Assessment Directive should be met. This AoS incorporates the requirements of a SEA under the SEA Directive.

Policies, Plans and Programmes

Consultees identified a number of omissions from the list of relevant plans, policies and programmes. These have been added to the list, which will be included as an Annex to the Environmental Report.

Baseline and Key Sustainability Issues

The consultees identified a number of additional datasets that could be usefully added to the description of baseline characteristics and, additional or amended key sustainability issues. These suggestions have been considered and will be used to inform the AoS appraisal, where these are appropriate to the scale/level of detail of both the NPS and AoS.

AoS Objectives

The consultees provided comment on a number of the AoS objectives provided in the AoS Scoping Report. These objectives have been considered further, since completion of the AoS scoping stage and a number of objectives have been amended slightly, mainly to remove duplication. These were discussed at the SEA Consultation Bodies workshop, held on 1 October 2009 and also at the subsequent meetings held with SEBs in September 2011 and September 2013.

Further detail as to how comments have been considered is provided in the table below:

Scoping Report Comments Register (2009)

Environment Agency
April 2009

Ref	Scoping Response/Issue	How this was taken account of
1	We welcome and agree with the approach to adopt Sustainability Appraisal (SA) and Strategic Environmental Assessment (SEA) principles. Ensuring compliance with the SEA Directive requirements will reduce the likelihood of any successful future challenge to the NN NPS on the grounds of non-compliance with the SEA Directive.	We have prepared the AoS to meet the standards set out in the SEA Directive.
2	We would like some clarification on the strategic alternatives DfT plan to assess. We would like to see more focus on demand management measures in order to reduce the need for new national network infrastructure. The AoS should encourage the NPS options to include cross-government policies and DfT's 'Towards a Sustainable Transport System' strategy to reduce the demand for travel.	This point was considered in the formulation of the alternatives. Further details on the alternatives were provided to SEBs during the AoS process; however, demand management is one of the core principles of one of the alternatives that has been assessed. It should be noted that Towards a Sustainable Transport System is no longer a current government policy document.

Ref	Scoping Response/Issue	How this was taken account of
3	We welcome the strong links made with ports in terms of freight entering and leaving the country by sea that the networks need to link to. Climate change, flood risk and coastal erosion issues need particular consideration where infrastructure routes meet the coast.	This point has been considered, however, due to the high level strategic nature of the NPS and corresponding AoS, there are no spatially specific considerations. Climate change and flood risk are addressed by the AoS Objectives. Coastal erosion was considered but the high level strategic nature of the NPS means that it is unlikely that potential impacts will be identified.
4	We are concerned that some of the appraisal objectives and recommendations within the AoS Framework are not strong enough, particularly with regard to greenhouse gas emission reduction. As this is the main mechanism by which the NN NPS will be appraised, we would like to see the AoS Framework strengthened to include more specific goals and targets.	This point has been considered, however, due to the high level strategic nature of the NPS and corresponding AoS, specific goals and targets have not been included in the appraisal framework. The AoS Framework has been developed in agreement with SEBs (stakeholder workshops were held in October 2009, September 2011 and September 2013).
5	The scoping report contains several lists of topics and datasets. We recommend providing an executive or non-technical summary and summarising the main themes or conclusions of some of the sections in the body of the AoS scoping report. This would help the reader to understand the outcomes of that section and then refer to the appendices as necessary.	Summary sections are provided in this AoS Report.
6	We recommend using consultation questions to direct consultees to the areas that DfT would most like input or advice. Statutory bodies and government departments are then less likely to focus their response on their area of expertise without providing wider more general comments.	Such an approach is adopted in the consultation document accompanying the NPS.
General	Acronyms are used throughout the document so a glossary would be a useful addition.	A glossary is provided in this AoS Report.
1.1 P1	We recommend including a non-technical summary or an executive summary to summarise and quickly get across the main points of the scoping report.	The scoping report forms the basis for the AoS report, which effectively supersedes the scoping report. As such, it is not considered necessary to retrospectively produce a non-technical summary/executive summary for the scoping report. However, a non-technical summary has been prepared for the AoS report and summary sections relating to the baseline and PPPs are provided in this AoS report.

Ref	Scoping Response/Issue	How this was taken account of
1.2.2 P6	We are pleased that the AoS process will be undertaken at the same time as the drafting of the NPS. We agree that findings from the scoping exercise and AoS must be taken into account and should influence the amendments in the NPS prior to the public consultation stage.	The preparation of the AoS and NPS has been closely integrated.
1.2.2 P6	We welcome and agree with the approach to take on board the principles from DfT's 'Towards a Sustainable Transport System' October 2007 publication, particularly the goal to reduce transport's emissions of CO_2 and other greenhouse gases, with the desired outcome of avoiding dangerous climate change.	Noted.
1.3.1 P7	We appreciate that the scoping report has been written in the absence of a fully worked up NPS and, in developing the AoS, and agree that the approach outlined will probably need to be refined and revised to ensure that it is appropriate to the NPS. We would like to be consulted again if the AoS approach is altered. We support the use of a framework against which the impact of policy options can be forecast in order to assess the sustainability of NPS policies and their alternatives. We would like some clarification on the alternatives to be assessed. We would like to see more focus on demand management measures in order to reduce the need for new national network infrastructure. The AoS should consider how the NPS can use DfT's 'Towards a Sustainable Transport System' strategy and the 'supporting growth in a low carbon world' to assess alternatives which can reduce the demand for travel.	Stakeholder workshops were held in December 2008 and in May 2009, SEBs were consulted on the Scoping Report. The AoS framework in the Scoping Report was revised slightly between 2009 and 2011. The key change was some relatively small changes to the sustainability objectives to remove overlap/duplication. These changes were made in consultation with the SEA Consultation Bodies and taking account of the key sustainability issues identified in the Scoping Report. Additional stakeholder workshops were held in October 2009, September 2011 and September 2013. We have used the AoS framework in the Scoping Report, as revised slightly with SEA consultation bodies between 2009 and 2011, for the 2013 AoS. This point was considered in the formulation of the alternatives. Further details on the alternatives were provided to SEBs during the AoS process and, demand management was part of Alternative 1 in this AoS.
1.3.2 P7	The purpose of the scoping report should be to scope out the whole AoS process, including the selection of options and not just to report on the scope and level of information which will be included in the AoS report.	This point is noted, however, the scoping report was written in the absence of a fully worked up NPS and this was required in order to develop "reasonable" alternatives. Additional

Ref	Scoping Response/Issue	How this was taken account of
		stakeholder workshops were held in October 2009, September 2011 and September 2013 to ensure the SEBs were fully informed of the development of alternatives.
P7 Figure 4	We suggest including all the stages/tasks relating to development of the NPS within figure 4, to illustrate the interrelationships between the NPS and AoS processes more clearly.	We have included a more detailed process diagram in this AoS Report.
1.3.4 P9	We are pleased to see that the AoS will consider short term (0-5 years), medium term (5-10 years) and long term (10-20 years) environmental effects. We suggest that longer term (20 years +) also be included in the AoS as national networks and their related infrastructure will have environmental impacts well beyond 20 years.	Impacts of the NPS are considered over a range of timescales, including in the longer term (20+ years).
2 P10	We recommend adding a summary of the common themes in the Plans, Policies and Programmes reviewed and the potential influence they will have on the NN NPS.	A summary of the common themes of the PPPs are provided in this AoS Report.
Table 2 P10-12 Annex A	We recommend adding the following to the list of relevant plans, policies and programmes: Floods and Water Bill (currently being prepared) Flood and Coastal Defence Appraisal Guidance FCDPAG3 Supplementary Note to Operating Authorities – Climate Change Impacts October 2003. Environmental Quality Standards Directive 2008/105/EEC (daughter directive to the Water Framework Directive) for chemical pollution of surface waters including priority and priority hazardous substances Local Development Documents Food and Environmental Protection Act Coastal Protection Act London Dumping Convention 1972/1996 Dangerous Substances Directive 2006/11/EEC	Where considered relevant and current these PPPs have been added.
3 P15-17	We recommend adding a summary of the main themes or conclusions of each of the main datasets to provide a high level overview of the baseline.	A high level overview of the baseline is provided in this AoS Report.
3 P15	The UK Climate Projections (UKCP09) will be launched in early summer. The UK climate projections should be included in the list of greenhouse gas/climatic factors baseline characteristics and taken into account when undertaking the AoS.	The UK Climate Projections have been referred to in the baseline and were considered when undertaking the appraisal.
3 P16	The list of biodiversity baseline characteristics should include the Air Pollution Information System as a source of data on acid and nitrogen deposition on conservation sites.	It is considered that this level of detail for the baseline information is too specific and not applicable to an appraisal at this level.
3 P16	We recommend adding the National Flood Risk Assessment to the list of general baseline characteristics for Flooding to show the broad brush likelihood of flooding across the country. We recommend adding a reference to National Flood and Coastal Defence Database for flood defence systems and flood	The National Flood Risk Assessment has been referred to in the revised baseline. The National Flood and Coastal Defence Database has not been included due to the high

Ref	Scoping Response/Issue	How this was taken account of
	storage areas. We recommend removing the reference to flood levels as this information may not add value.	level strategic nature of the NPS and corresponding AoS.
3 P16	Under the "Water" heading in Section 3 there should be a bullet reference to Water Framework Directive River Basin Planning analysis of Pressures on the Water Environment. We have developed a "Water Cycle Studies" methodology to facilitate regional, local and individual development planning. We can provide more information on request.	The Water Framework Directive has been referred to in the revised baseline.
4 P18	We would like clarification on whether any key issues have been scoped out at this stage, and if so what and why.	No key issues were scoped out at this stage.
4.1.1 P18	The number of Air Quality Management Areas which have been declared should be corrected from 200 to 500.	This number has been updated to reflect 2013 data.
4.1.2 P18	The carbon budget targets should be referenced as they will be accepted shortly by government alongside the budget.	The carbon budgets have been referred to in the revised baseline.
4 4.1.3	Further guidance on SEA and Climate Change can be found by following the link, http://www.environment-agency.gov.uk/static/documents/Research/seaccjune07_1797458.pdf	Noted.
4.1.4 P19	Development of rail and road infrastructure can lead to increased risk of coastal, fluvial and surface water flooding of the local environment and the national network infrastructure itself. This risk is likely to increase over time with the expected impacts from climate change. Therefore such infrastructure should strive to be resilient to the effects of flooding and to reduce flood risks where possible. It is particularly important to site national network infrastructure away from areas at risk from flooding (of all sources) in order to minimise flood risk, and put measures in to place to adapt to the probable impacts of climate change. Although national networks have the potential to increase flood risk (e.g. through using cuttings, increases in hard standing, earthworks), their ability to potentially reduce flood risk, for example, with embankments, should also be acknowledged. We recommend that Key Issue 4 is expanded to *"Flood Risk and Coastal Erosion"* and a new paragraph is added as follows: *"Road and rail infrastructure may also be sited in areas of coastal erosion. This risk is likely to increase over time with the expected impacts from climate change. It is particularly important to site national network infrastructure away from areas at risk from coastal erosion in order to minimise flood risk, and put measures in to place to adapt to the probable impacts of climate change."*	The AoS objective relating to flood risk is worded as follows: "To contribute towards reducing the risk of flooding in the hinterland". Therefore, the ability of measures contained within the NPS (or alternatives) to reduce flood risk was captured during the appraisal. This point was considered, however, due to the high level strategic nature of the NPS and corresponding AoS, there are no site specific considerations. Coastal erosion would be considered at a spatially specific level in an Environmental Statement should any national networks measures have the ability to impact on this issue.
4.1.4 4.1.5 4.1.6 P19	We expect the forthcoming consultation on the Floods and Water Bill to make provisions for all new road drainage to be via sustainable drainage systems (SUDS), which will be constructed to national standards (to be set by Secretary of State for Environment/ Welsh Minister) and approved and adopted by Upper Tier Local Authorities.	Noted.
4.1.4 4.1.5 4.1.6 P19	Within the context of Key Issues 4, 5 and 6 on flood risk, contamination of water resources and water resources, the roles of the following organisations should be considered: The Highways Agency who play a key role in surface water	The Highways Agency and Network Rail are being consulted during the preparation of the NPS.

Ref	Scoping Response/Issue	How this was taken account of
	management for example, through management of assets. The Highways Authorities who play a key role in managing the strategic and local road network. Network Rail also have a significant part to play because they have access to land that no one else has e.g. access to culverts running through embankments.	
4.1.5 P19	Section 4.1.5 is slightly misleading. Run-off from roads is mostly via road drains - point sources, not diffuse. However, the law is currently structured so that the discharges do not require consent unless the Environment Agency requires it. We expect the Floods and Water Bill to change this.	Noted.
4.1.7 P20	We note that the last sentence of the first paragraph cites a potential benefit of transport networks as wildlife corridors. There is little evidence of this and no cited studies in the scoping report. We suggest that here or elsewhere in the report the potentially negative effects that transport networks may play in facilitating the movement of invasive species is included as a key issue. Excessive acid and nitrogen deposition should be specifically mentioned under Key Issue 7 on biodiversity.	In the appraisal impacts identified have been supported by appropriate evidence.
P25, KI 1	Key Issue 1: Air Quality References to the Air Quality Framework Directive 96/62/EC need to be replaced by Air Quality Framework Directive 2008/50/EC.	The PPP table has been amended to reflect this comment.
Table 3 P26	Key Issue 4: Flood Risk We suggest that Key Issue 4 is expanded to "Flood Risk and Coastal Erosion". We would like to see the middle bullet point amended to read: "Is at risk of flooding and remain operational in times of flood". Remaining operational is an important principle for essential infrastructure projects such as these.	Due to the nature of the national networks and their limited interaction with coastal areas, it was considered more relevant to retain Flood Risk as the baseline/key issue topic heading. In terms of networks remaining operational, this was considered both under the AoS Objective concerning flood risk and also the Objective relating to resilience.
Table 3 P26	Key Issue 5: Contamination of Water Resources Consideration should be given to application of Article 4.7 of the Water Framework Directive (WFD). The Common Implementation Strategy for WFD have produced guidance on exemptions to the environmental objectives under WFD, this can be found by following the link, http://www.espo.be/downloads/archive/ae0362be-40c7-4de6-bc9e-3880b975fed6.doc. Assessment of WFD and Article 4.7 implications should be provided as part of the AoS. Reference should be made to the Pitt Review and Floods and Water Bill proposals for surface water management planning and sustainable urban drainage (SUDS).	Any impacts from the NPS or alternatives relating to the Water Framework Directive were captured more generally under the water quality AoS objective. Where considered relevant and current, reference is made to these documents.
Table 3 P26-27	Key Issue 7: Biodiversity The AoS should also specifically refer to the Countryside and Rights of Way (CROW) Act duties, particularly the effects of	Pollution, both to water, land and air, and any impacts on SSSIs were considered in the appraisal against the relevant

Ref	Scoping Response/Issue	How this was taken account of
	pollution on Sites of Special Scientific Interest (SSSIs).	AoS Objectives.
Table 4 P35	AoS2: To improve local air quality The 1st sub-objective should also include national Air Quality Objectives as well as air quality limit values as we consider that just meeting air quality limit values does not go far enough. We suggest adding another sub-objective – "use whatever opportunities arise to reduce the effects of poor air quality". The rest of the columns will then need to reflect this.	Key considerations under AoS2 include the level of air pollutant emissions from national networks, the achievement of air quality standards and also the overall improvement of air quality. We consider the above to be a comprehensive set of considerations given the high level strategic nature of the NPS and corresponding AoS.
Table 4 P36	AoS3: To contribute towards the reduction of greenhouse gas emissions We are concerned that the recommendations for the appraisal within the AoS Framework are not strong enough. The wording 'consideration should be given to' and 'will contribute to climate change' is too vague. It raises questions such as what level of contribution and what kind of measures should be considered? As this is the main mechanism by which the NN NPS will be appraised, we would like to see the AoS Framework strengthened to include more specific goals and targets.	This point has been considered, however, due to the high level strategic nature of the NPS and corresponding AoS, specific goals and targets were not included in the appraisal framework. The AoS Framework has been developed in agreement with SEBs (stakeholder workshops were held in October 2009, September 2011 and September 2013).
Table 4 P40	AoS7: To protect the water environment Other questions that should be considered by the AoS for water resources include: "Will the natural hydrology/hydrogeology in a catchment be adversely affected by a proposal? For example, diversion of a water course, incursion into an aquifer." "Will any water supply infrastructure be adversely affected by a proposal? For example impacts on reservoirs, pipelines and treatment works?" "Will the physical nature of a water course be altered? For example, a reduction in or improvement to water quality?"	AoS 7 and AoS 8 are considered to sufficiently address water environment issues at a level appropriate to an appraisal at this level.
Table 4 P43	AoS14 and AoS15: Flood risk Potential data sources column to include National Flood Risk Assessment and National Flood Coastal Defence Database.	The National Flood Risk Assessment has been referred to in the revised baseline. The National Flood and Coastal Defence Database has not been included due to the high level strategic nature of the NPS and corresponding AoS.
5.2 P54 Appendix C	We are pleased that compatibility analysis has been undertaken between the AoS objectives. We would like to see summary of common themes or conclusions of the compatibility analysis of objectives. We look forward to seeing the AoS identify in more detail how potential tensions between economic, environmental and social objectives can be resolved.	Summary sections are provided in this AoS Environmental Report.
6 P55	We recommend that a summary of the responses from the scoping workshop is included rather than a copy of the agenda used on the day as this would be more useful.	This table has been used to summarise how scoping responses have been dealt with.

Ref	Scoping Response/Issue	How this was taken account of
6 P55	Please expand on how consultation responses from this scoping consultation will be taken into consideration and used to influence the NN NPS.	This table has been used to summarise how scoping responses have been dealt with.
6 P55	Please confirm what further consultation will take place, when and with whom.	Stakeholder workshops were held in December 2008 and in May 2009, SEBs were consulted on the Scoping Report. Additional stakeholder workshops were held in October 2009, September 2011 and September 2013. Further consultation will take place during the formal public consultation period.
7 P56	CLG's recent document on AoS methodology and ODPM's 2005 Practical Guide to the SEA Directive also need to be followed in determining the process to follow for the AoS, as well as ODPM's guidance on Sustainability Appraisal.	This guidance was used to inform the AoS process.
7.1 P56-58	Transboundary effects should be given full consideration in order to be compliant with the SEA Directive. It would be useful to see if transboundary effects will be considered in the assessment stage B or if they have already been scoped out and if so why.	Transboundary impacts have been considered in this AoS.
7.1 P56	Any assumptions made in predicting and evaluating effects must be recorded.	Any assumptions that have been made are recorded in this AoS report.
7.1.2 P57	We welcome the reference to cumulative, indirect and synergistic effects. Full consideration should be given to evaluating the effects of cumulative impacts in order to be compliant with the SEA Directive. It would be reassuring to see greater consideration given to cumulative effects at this scoping stage.	Cumulative impacts have been considered in this AoS.
P34 Table 5	We agree that all of the techniques listed for assessing effects in Table 5 are useful. However, it would be reassuring to see commitment to the actual technique/s that will be used in stage B to assess effects at this scoping stage. It would be useful to see how the remaining stages of the AoS shown in Table 5 correspond with and influence the production of the final NN NPS.	Assessment methodologies are described in full in this AoS Report.
Appendix A - Review of Plans, Policies and Programmes		
General	We note that for biodiversity related plans, policies and programmes few if any specific targets and indicators of relevance have been identified. We believe that there are clear targets and indicators that are relevant to NPSs. For example: • Schedule 9 of the Countryside and Rights of Way Act 2000, Part 3 of the Natural Environment places a duty on all public bodies to further the conservation and enhancement of SSSIs. • The Birds and Habitats Directives include targets to achieve Favourable Conservation Status (FCS) of protected sites and species. Although no date was set for achieving this, the Water Framework Directive requires that, for water dependent interests, FCS is achieved by 2015.	This point has been considered, however, due to the high level strategic nature of the NPS and corresponding AoS, specific goals and targets were not included in the appraisal framework. The AoS Framework has been developed in agreement with SEBs (stakeholder workshops were held in October 2009, September 2011 and September 2013).

Ref	Scoping Response/Issue	How this was taken account of
	These are relevant because they are national targets that all public bodies have a duty to contribute to in line with their function.	
General	We would like to see Catchment Flood Management Plans (CFMPs) added to the list of relevant plans, policies and programmes on Table 2 on Page 12 and within Annex A. We suggest the following text be used within Annex A: There are 68 Catchment Flood Management Plans (CFMPs) that cover England (nine cover Wales). These high level strategic flood risk management plans identify sustainable flood risk management policies for inland flooding for the next 100 years. They include economic, social and environmental assessments of current and future flood risk. The AoS should aim to contribute to delivering sustainable flood risk management. The AoS should consider risks associated with all forms of flooding.	The PPP table has been amended to reflect this comment.
P15	International Directives 1996/62/EC and 96/62/EC are the same Directive and so do not need repeating. References to international Directives 1996/62/EC, 96/62/EC, 2000/69/EC and 2002/3/EC should now refer to Air Quality Directive 2008/50/EC. 2004/107/EC still needs a separate reference.	The PPP table has been amended to reflect this comment.
P31	For Directive 2006/7/EC Concerning the Management of Bathing Water Quality and Repealing Council Directive 76/160/EE, the AoS Framework should aim to: "*Include objectives and baseline information relating to water resources and quality to 2015 maintain no deterioration in Compliance with 76/160/EEC*".	This level of detail is considered too specific for the high level strategic nature of the NPS and corresponding AoS. Instead the PPP table reads: "Include objectives and baseline information relating to water resources and quality".
P31	The purpose of the Directive on the Assessment and Management of Flood Risk is to establish a framework for the assessment and management of flood risk, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the community. We recommend the following specific objectives being included under 'key targets and indicators relevant to the NPS'. "*The Directive establishes a timetable for the preparation and review of preliminary flood risk assessments (by 22/12/2011), flood hazard maps and flood risk maps (by 22/12/2013) and flood risk management plans (by 22/12/2015). These are then reviewed by 22/12/2018, 22/12/2019 and 22/12/2021 respectively and then every six years after that.*"	The PPP table has been amended to reflect this comment.
P33	We recommend adding the following words to the end of the bullet in the column on 'how objectives might be taken on board in the AoS and/or NPS': "*associated with storm surges and flooding are assessed, considered and mitigated".*	The PPP table has been amended to reflect this comment.
P34	For the Urban Waste Water Treatment (91/271/EEC), in some cases road drainage may discharge to urban waste water systems, which overflow to receiving waters when it rains heavily. The AoS framework should reflect this.	The PPP table has been amended to reflect this comment.

Ref	Scoping Response/Issue	How this was taken account of
P35	We note the inclusion of Water Framework Directive (WFD) objectives and targets and suggest that reference is made to Protected Areas under WFD, such as Natura 2000 sites for which WFD sets the deadline for achieving Favourable Conservation Status by 2015.	The PPP table has been amended to reflect this comment.
P36	Air Quality Regulations 2000 and the Air Quality (Amendment) Regulations 2002 have been replaced by those of 2007.	It is our understanding that the 2000 and 2002 Regulations are still current. The Air Quality Standards Regulations 2010 have been added to the PPP table.
P37	Under the Air Quality Strategy for England, Wales and Northern Ireland, reference also needs to be made to the Mayor of London's Air Quality Strategy	The PPP table has been amended to reflect this comment.
P44	A correction is needed to show that there are 22 Shoreline Management Plans (SMPs), rather than 31. We agree with the items identified that the AoS should aim to address.	The PPP table has been amended to reflect this comment.
P45	Under Water Strategy: Surface Water Drainage, we recommend the following amendments to the text in column one: Alter the text to read '*The strategy aims to improve the way that surface water is currently managed in order to resolve existing problems, inform new development and prepare for the impacts of climate change.'* Add as a second bullet *"investment strategy for surface water infrastructure"* Change current second bullet to *"promote sustainable drainage systems"*	This PPP is no longer considered current and has therefore been removed from the PPP table.
P46	Under The Pitt Review we recommend changing the final bullet in right hand column to read: "*Consider the ability of national networks to avoid, reduce and adapt to the impacts of flood risk".*	The PPP table has been amended to reflect this comment.
P49	Reference to the Pollution Prevention and Control (England and Wales) Regulations 2000 should now be to the Environmental Permitting (England and Wales) Regulations 2007	The PPP table has been amended to reflect this comment.
P53	We suggest that the explanation for the Countryside and Rights of Way Act also specifically covers duties to reduce effects of pollution on SSSIs. The government's conservation duty to protect non-statutory conservation sites should also be mentioned.	The PPP table has been amended to reflect this comment.
P61	Under Making Space for Water, we recommend expanding the first bullet point in the final column to read: *"The AoS should aim to:* *Include objectives to help manage flood and coastal erosion risk using a portfolio of measures to:* *reduce the threat to people and their property; and* *deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles."*	This was considered, however, this level of detail for the AoS appraisal is considered too specific and not applicable to an appraisal at this level.
P62	Under PPS25, we recommend changing the wording in the bullet point in the final column to read: *"The AoS should aim to:* *Include objectives for managing flood risk from all sources*	This PPP is no longer considered current and has therefore been removed from the PPP table.

Ref	Scoping Response/Issue	How this was taken account of
	through location, layout and design of the national network."	
Appendix B – Baseline Data		
General	We note the inclusion of baselines for the key biodiversity designations. The baseline data refers to the condition and extent of sites as recorded in 2008. We suggest that the baseline for protected sites and species is not the current condition or extent of sites, but the target condition, for example, Favourable Conservation Status for Special Protection Areas and Special Areas of Conservation.	This section has been updated to reflect 2013 data.
General	There are no relevant datasets for coastal erosion at the moment. An erosion risk mapping database is currently in development and anticipated to be completed in summer 2010. We suggest adding a reference to National Flood and Coastal Defence Database for flood / erosion defence systems.	The National Flood and Coastal Defence Database has not been included due to the high level strategic nature of the NPS and corresponding AoS.
General	For Catchment Flood Management Plans, baseline data is available on catchment characteristics.	This level of detail is considered too specific for the high level strategic nature of the NPS and corresponding AoS
P6-8	We suggest the UK Biodiversity Action Plan (UKBAP) habitats and species are added to the baseline characterisation. UKBAP forms a key element of the UK Government action to halt the decline in biodiversity as part of Rio commitments.	This level of detail is considered too specific for the high level strategic nature of the NPS and corresponding AoS
P11-12	There is no reference to number of properties at risk from flooding. The main report (p16) suggests that it should be included within the baseline data.	The baseline data sets have been amended to reflect this comment.
P12	We suggest removing flood levels as baseline data as they are unlikely to add value to the appraisal process. We suggest that the National Flood Risk Assessment would be a better dataset to use – showing the likelihood of actual flooding across the country – this could then be used to show how the NPS potentially effects the likelihood of flooding.	The baseline data sets have been amended to reflect this comment.
P14	We do not see a clear link between national networks and municipal waste for the baseline data on waste. We suggest considering a broader baseline that picks up waste from construction, hazardous waste and wider industrial and commercial waste. We hold some waste data, particularly relating to our permitted waste sites. This may be helpful for the AoS: http://www.environment-agency.gov.uk/research/library/data/34169.aspx	The baseline data sets have been amended to reflect this comment.
Appendix D – Consultation Responses		
General	We are pleased to see the inclusion of Appendix D on previous responses during the scoping workshop and to earlier informal consultations on previous AoS scoping documents. This is a useful table to enable us to see how our comments have been taken on board. We recommend this type of table is included in the AoS report to show how these and other suggestions over	This table is included in this AoS Report.

Ref	Scoping Response/Issue	How this was taken account of
	the next few months are taken into account.	

Department of Health

Ref	Scoping Response/Issue	How this was taken account of
General Comments	It is helpful that the scoping exercise will take place in parallel with the drafting of the NPS. This parallel approach should ensure that the appraisal of sustainability will influence the NPS document itself.	The preparation of the AoS and NPS has been closely integrated.
	Health is not mentioned as an objective by some of the frameworks which the AoS plans to use, and the definitions of health are sometimes too narrow (see below). These definitions may need refinement to ensure that the AoS captures all the important potential effects on health *and* the wider determinants of health.	This point has been considered. The AoS objectives include an objective relating to health and public health.
	The health impacts of the NPS are comprehensively set out in the Health Scotland document (Health Impact Assessment of Transport Initiatives: http://www.apho.org.uk/resource/item.aspx?RID=44167). This takes a systematic approach, listing all the health impacts of transport initiatives. We recommend that this document is used extensively, as it contains a literature review of three main areas: transport, access and health; transport and links to health and determinants of health; and health and the health-related impacts of transport interventions (such as new infrastructure, which is very relevant to this NPS).	This document was considered when undertaking the appraisal.
	Please clarify your use of the terms equality, inequality etc. These refer to very different issues, which have an impact on health (see below).	A glossary has been provided in this AoS Report.
NPS	The scoping report has taken an approach to health from a sustainability appraisal (SA) perspective. The model for this comes from *Towards a Sustainable Transport System* (TASTS). The emphasis on health TASTS is quite specific, and only touches on narrow outcomes of *health and life expectancy* as the outcomes of importance. Caution must be taken in this approach, as this definition of health is quite specific. For that reason, it would be more useful to *explicitly mention* the wider determinants of health and how they may be affected by transport policies. Wider determinants of health include personal and family environment (e.g. employment), physical environment (e.g. air quality), and public services (e.g. public transport) (Oxford Handbook of Public Health Practice, 2006: 50).	This AoS has taken a broad approach to considerations of health, appropriate to the high level strategic nature of the NPS.
	The note on Page 8 of the AoS; that DfT is 'conducting an update of the NATA appraisal framework' sounds positive, as health is unfortunately not a NATA objective. Again, the wider determinants of health need to be explicitly set out in any 'streamlined' document which combines TASTS and NATA. We recommend that health and wider determinants of health are set out as clear objectives within the NATA objectives, which we understand are used by Infrastructure Planning Commission (IPC) in all planning decisions.	This is noted.

Ref	Scoping Response/Issue	How this was taken account of
Review of plans	Key plans and targets which have not been included in the review of plans are listed in Appendix 1 – please include these in your AoS. These include the cross-government strategy Health is Global (2008), and others listed below. The global effects of this NPS of road and rail networks will have to be considered, as transport plans in England may affect the rest of the world, for example in terms of climate change.	PPPs have been updated to include current and relevant PPPs.
Baseline	Please note that for the baseline characteristics on Page 16 of the AoS, the Health Profile of England provides a valuable resource in terms of yearly health status indicators for England (Health Profile of England, 2008 http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_093465).	The baseline has been revised to ensure it is up to date and appropriate to the high level strategic nature of the NPS.
Key Social Sustainability Issues	Where appropriate, please include the concept of equity e.g. equity in employment, equity in access etc. Equity is a key concept in public health, which refers to 'the willingness to give a protected "fair share" to a particular group in society in need, even if that does not maximize total outcomes from the available resources for the population' (Oxford Handbook of Public Health Practice, 2006: 34). The headings for which equity would be useful are in the social issues category: accessibility, health and well-being.	This was considered in the appraisal process.
	4.2.1 Key Issue 13 - Employment – please note that employment is a wider determinant of health, and should also be mentioned in the health section (see wider determinants of health).	This is considered to be a too detailed consideration in the context of the high level strategic nature of the NPS.
	Key Issue 16 - Accessibility - it would be worth naming this 'access and social exclusion' instead of just 'access'. Inequalities in access to car transport, for example, can have a specific health focus – the Health Scotland report notes that 'for others, especially those without access to a car, issues of transport-related social exclusion may be compounded by their rural location' (HIA of Transport Initiatives http://www.apho.org.uk/resource/item.aspx?RID=44167: 15).	The section was not been renamed but social exclusion was considered where appropriate.
	Key Issue 18 - Equalities - we suggest that this heading be clarified. Equalities is a specific term which refers to race, disability and gender – and policies are of course subject to equality impact assessment. This is distinct from inequalities (see below). We recommend that you create another subheading of 'inequalities'. 'Inequalities' is a term which commonly refers to differences in health or wellbeing, most commonly due to income or social class differentials. This is thus is a broader term, and captures key Public Health problems (see Dahlgren and Whitehead model below), relating strongly to the wider determinants of health (as these have great impacts on inequalities).	Accepted, but this is considered to be a too detailed consideration in the context of the high level strategic nature of the NPS.

Ref	Scoping Response/Issue	How this was taken account of
	Key Issue 19 – Health and Well Being - This whole section should explicitly mention the wider determinants of health, again using a broad structure to include the following set out in the diagram below by Dahlgren and Whitehead:	This was considered but was generally thought to be too specific an issue considering the high level strategic nature of the NPS.
	Key Issue 20 – security and safety – we recommend that the inequalities in accidents between social classes are acknowledged. The NHS Scotland report cites evidence that 'disadvantaged groups are more likely to be involved in a road crash' (HIA of Transport Initiatives http://www.apho.org.uk/resource/item.aspx?RID=44167: 14).	This was considered but was generally thought to be too specific an issue considering the high level strategic nature of the NPS.
Opportunities to address key sustainability issues	Key issue 11 – Noise - please consider the effects of noise on mental health.	This was considered in this appraisal.
	Key issue 16 – Accessibility - Highlighting the accessibility and acceptability for 'disadvantaged people' is very ambiguous. We recommend that you clarify what you mean by 'disadvantaged' (i.e. disabled or socio-economically disadvantaged). For that reason, please ensure that the needs of disabled persons and also persons of lower socioeconomic status (ie inequalities issues) are addressed separately.	This level of disaggregated impact is not considered appropriate to the high level strategic nature of the NPS.
	Key issue 18 – Equalities - again please consider equalities and inequalities as two separate and distinct sub-headings. Also, the term 'disadvantaged' is also unclear – does this mean disabled or those who are economically disadvantaged? This needs to be clarified before being assessed in the AoS.	This level of disaggregated impact is not considered appropriate to the high level strategic nature of the NPS.
	Key issue 19 – Health and wellbeing - please list the wider determinants of health as described above.	This was considered but was generally thought to be too specific an issue considering the high level strategic nature of the NPS.
NATA framework	AoS 18 – please ensure that the NHS Scotland review is used as evidence for links between transport and health (Health Impact Assessment of Transport Initiatives http://www.apho.org.uk/resource/item.aspx?RID=44167: 35).	This document was considered when undertaking this appraisal.
	AoS 23 – please include Health Scotland review as this details the effects of transport on community severance (Health Impact Assessment of Transport Initiatives http://www.apho.org.uk/resource/item.aspx?RID=44167)	This document was considered when undertaking this appraisal.

Ref	Scoping Response/Issue	How this was taken account of
	AoS 27 – the needs of vulnerable social groups taken into account – please note that percentage of persons claiming disability living allowance (DLA) using data from the Department for Work and Pensions, and Census data (Census 2001) would be very useful here.	The baseline data sets have been amended to reflect this comment.
Methodology for assessing effects	Please note that quality adjusted life years (QALY) and disability-adjusted life years (DALY) evidence may be available in evidence reviews.	This is not considered appropriate to the high level strategic nature of the NPS.
HPA response	Unfortunately, the Health Protection Agency was not able to comment on this AoS document. There are significant health protection issues related to the AoS around soil, water, air quality, climate change and pollution. Please ensure that an HPA opinion is sought at all further stages of the NPS process.	The HPA will be consulted on the NPS and AoS Environmental Report.
PPP table	The following should be added: Closing the Gap: Social Determinants of Health http://www.who.int/social_determinants/en/ WHO Children's Environment and Health Action Plan for Europe (CEHAPE) http://www.euro.who.int/childhealthenv/policy/20020724_2 Transport, Health and the Environment - Pan-European Programme (THE-PEP) Health is Global; a UK Global health strategy 2008-13 http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_088702 PSA 18 Promote better health and well-being for all, which includes health inequalities. Health, work and wellbeing http://www.workingforhealth.gov.uk/ Health and Safety http://www.hse.gov.uk/	Where considered relevant and current these PPPs have been added.

Natural England

April 2009

	Scoping Response/Issue	How this was taken account of
General		
	Natural England supports the development of the National Networks NPS, in line with the DaSTS approach and supports the five goals for transport and aim to "Improve quality of life for transport users and non-transport users, and to promote a healthy natural environment".	Noted, although DaSTS is no longer an up to date government policy document.
	We welcome the consultant's use of Sustainability Appraisal / Strategic Environmental Assessment best practice to inform the process and consultation procedures; however, we would welcome further commitment to preparing the AoS to meet SA/SEA requirements and appropriate references to the CLG's recent document on AoS methodology and ODPM's Practical Guides to SEA and Sustainability Appraisal.	This AoS incorporates a SEA under the SEA Directive. These documents were used to inform the AoS process.
	We support early engagement in the process of developing the AoS for the NPS; however, without a draft NPS to assess, our comments are limited to the proposed methodology, the selection of relevant documents and the identification of potential conflicts. We will engage further at later stages in the consultation process.	This is noted. Additional stakeholder workshops were held in October 2009, September 2011 and September 2013. Further engagement will take place during the formal public consultation.
Detailed Comments		
1	The purpose of the scoping report should be to scope out the whole AoS process, including the selection of options and not just to report on the scope and level of information which will be included in the AoS report.	This point is noted, however, the Scoping Report was written in the absence of a fully worked up NPS draft and this was required in order to develop "reasonable" alternatives. Additional stakeholder workshops were in October 2009, September 2011 and September 2013 to ensure the SEBs were fully informed of the development of alternatives.
2	We consider that the Habitats Directive should be included as a relevant policy to be considered under the environmental assessment (Table 2). While we appreciate that Appropriate Assessment for the Habitats Directive will be considered separately to the AoS, we believe that the two documents should reference each other and should be developed in tandem.	Reference to the HRA is made in this AoS Report.
3	Key Issue Biodiversity (4.1.1.7) states that "Compliance with the provisions of the Habitats Directive and Wild Birds Directive will ensure that impacts on SPAs, pSPAs, SACs and are considered." However there is no further reference to the Habitats Regulations within the document, we would welcome a description of how the Habs Regs will be applied to the NN NPS. The importance of these sites should be taken into consideration at the strategic level within the AoS.	Reference to the HRA is made in this AoS Report.

4	We recommend that the "State of Countryside Report" be added to Table 2	The PPP table has been amended to reflect this comment.
5	In Table 3 Key Sustainability Issues, the reference to Biodiversity designations should be split between national designations (the current list), and an additional list of local biodiversity designations (BAP Areas, Local Nature reserves, etc.)	The baseline data sets have been amended to include reference to Local Nature Reserves.
6	The importance of Biodiversity Action Plan Areas and supporting plans and the role that the NPS can play in achieving these outcomes should be recognised and used in Table 4 and Appendix B (as baseline data).	Biodiversity Action Plans and supporting plans were considered in the development of both the NPS and AoS.
7	Under 4.1.10 Key Issue 10: Landscape and Townscape, reference should be made to the use of Landscape Character Assessment (LCA) to inform decisions on the impact and sensitivity of all landscapes at a range of levels.	It is considered that this level of detail is not appropriate to the high level strategic nature of the NPS.
8	Table 4 AoS Framework - provides an overly simplistic assessment of Landscape and the impacts that development will have on all landscapes, identify requirements of the European Landscape Convention.	The AoS has taken a broad consideration of landscape impacts.
9	Table 4 AoS Framework – Consideration should be given to the impact of transport corridors on climate change adaptation techniques that will be needed to protect biodiversity, this may also require a longer term modelling of scenarios than is currently included within the AoS (i.e. longer than 20 years).	It is considered that this level of detail is not appropriate to the high level strategic nature of the NPS.
10	Appendices – we believe that the targets, indicators and baseline data sets identified for biodiversity could be improved and we would suggest the following measures: (a) Schedule 9 of the CROW. Act places a duty on all public bodies to further conservation and enhancement of SSSIs, and Section 83 of the Act requires all public bodies to protect, conserve and enhance nationally designated landscapes (National Parks and Areas of Outstanding Natural Beauty). (b) The Birds & Habitats Directives include targets to achieve Favourable Conservation Status (FCS) of protected sites and species. These targets set a requirement for all public bodies to achieve and should therefore be used a baseline against which impacts should be measured. We believe that FCS should replace the use of current condition of sites (from 2008 stats) and the extent of the sites as currently set out in Appendix B.	The PPP table has been amended to reflect this comment.

English Heritage

April 2009

Comments/Issue	**How this was taken account of**
Page 28: Key Issue 10 should include a reference to the DaSTS challenge on streetscape: Improve the quality of transport integration into streetscapes and the urban environment.	DaSTS is no longer considered to be Government policy. However, the impacts on townscape are covered by AoS Objective 4.

Page 28: Key Issue 12: it is not clear exactly what the bullet point means. Perhaps (if this is what is intended) it should spell out more clearly that the AoS needs to look at different ways of delivering additional capacity and consider how these might impact on or enhance the historic environment.	This is noted. The AoS alternatives consider alternative ways of delivering the objectives of the NPS, which include ensuring the capacity of national networks supports economic growth. Impacts on the historic environment are assessed under AoS Objective 5.
Page 37: this section focuses on landscape and in the main overlooks townscape. It would be helpful to add some equivalent questions for townscape in the sixth column, e.g.: - Will it lead to damage to the quality of the townscape? - Is it likely to require good design to ensure the character of the townscape is maintained? - Will it lead to infrastructure that will fit in with the townscape? The final column of this section might also include comments along the following lines: - An increase in traffic levels might lead to a detrimental impact on townscape particularly if additional traffic management infrastructure is needed - There will be an opportunity through good design to improve the quality of the townscape.	This is noted, and impacts on townscape are covered by AoS Objective 4. We have ensured these questions and comments have been considered during the assessment of the NPS and alternatives.

Scoping Report Comments Register (2013)

English Heritage

September 2013

Comments/Issue	How this was taken account of
Requested change to wording of objectives to the following: AoS 4: "To protect and enhance landscape quality, townscape quality and to enhance visual amenity". AoS 5: "To protect and conserve heritage assets in a manner appropriate to their significance".	The wording of objectives has been amended as requested.

Natural England

October 2013

Ref	Comments/Issue	How this was taken account of
General	Rather than "Key considerations", we would suggest that these should be thought of as objective assessment questions, i.e. if the answer to one of these questions is no, then the objective is not being met.	This approach is not considered appropriate for the NPS because of its very high level nature, broad range of interventions and broad range of potential impacts.
	It is common within assessment matrices for SEA to have a category where the assessor feels that sufficient information isn't available to draw a robust conclusion – however this may not apply for these objectives	The high level, non-specific nature of the NPS, combined with a summary appraisal that needs to be come to an overall view on a wide range of impacts from a wide range of interventions under each objective, means that uncertainty and judgements are integral to the appraisal/assessment. In

Ref	Comments/Issue	How this was taken account of
		view of this, uncertainty has been addressed in a section on limitations and assumptions.
	The assessment of the impacts should be opened up to peer review, either through leading academics or practitioners in the field of sustainability appraisal (this is standard practice for large scale sustainability appraisals).	This is not possible given budgetary and programme constraints. However, this report has been produced by independent consultants who have expertise in sustainability appraisal. The report has undergone a full process of review in line with quality management procedures.
AoS 2 Air Quality	Air quality: Will this cover ecological impacts as well as human health impacts or is this covered in the biodiversity section?	This covers ecological impacts and this has been added to key issues table.
AoS 4 Landscape	Given the potential impacts on tranquillity and remoteness, from the National Networks, we note that this issue isn't addressed either under noise levels, or landscape. It isn't just an issue of the level of noise created – but the impacts on tranquillity (particularly National parks & AONB's). See National Character Areas for further info on tranquillity and opportunities. The revised profiles for all 159 Character Areas are due to be published by April 2014, but many of them are already from NE's website here.	This has been added to the key considerations table under landscape.
	Refer to NE's national character assessments here.	This is not considered relevant for the key considerations/ methodology.
AoS 6 Biodiversit -y	This should be "enhance" instead of "improve", to better reflect NPPF wording, (e.g. para 118).	Objective wording has been amended.
	Consider where impacts on habitats sensitive to changes in ground and surface water should sit - are they covered in the biodiversity chapter or the water quality chapter?	This is addressed under biodiversity.
AoS 8 Water Quality	This should be water quality both in terms of its chemical composition, and its ecological content.	This has been added to key considerations.
AoS 9 Resilience	Can we add in here something on the planning of Green infrastructure to manage adaptation to climate change and increase resilience, as discussed in the NPPF para 99. The work that Highways Agency, Network Rail and Natural England are doing under the Natural Environment White Paper commitment 32 is looking at the potential for enhancing transport's green infrastructure to deliver ecosystem services that increase network resilience to climate change whilst also delivering ecological connectivity.	The NN NPS text mentions the provision of green infrastructure as a suitable adaptation measure. This is also addressed under Section 10 Opportunities for Improvement.
	Climate change is covered here in terms society and infrastructure, but the current objectives do not address the impact on climate change adaptation that the NN NPS might effect through fragmentation, disturbance, land take or impact on existing habitat networks. Suggest an additional objective on climate change that covers adaptation (this would also help to meet the SEA objective on climate).	Any such impacts are addressed under biodiversity.
AoS 10 Land Resources	The loss of Best and most versatile land, both from direct land take and potential development pressure (e.g. logistics and warehousing around junctions, Park & Ride operations at rail stations) should be addressed through the assessment questions.	Loss of all land is addressed.
AoS 23 Public Health	Health - Opportunities for healthy travel e.g. walking and cycling should be considered here.	These have been considered under the health objective.

Scottish Environment Protection Agency (SEPA)

October 2013

Comments/Issue	How this was taken account of
SEPA confirm that they are happy with the proposed assessment methodology.	N/A

Scottish Natural Heritage

October 2013

Comments/Issue	How this was taken account of
SNH confirm that as the coverage of the NPS is limited to England and that the consultation emphasises that any impacts on the devolved administrations will be fully taken into account, they have no further comments at this stage.	N/A

Environment Agency

October 2013

Ref	Comments/Issue	How this was taken account of
AoS Assessment Methodology	AoS2 Air Quality: We note that the sub-objective relating to air quality limit values in Table 4 of the Scoping Report (2009) has been removed and reference has been made, in the 'Key Considerations...' column, to achieving air quality standards and improving air quality. We welcome this change which is in line with our comments on the Scoping Report. AoS3 Climate Change: The 'Recommendations for Appraisal' column which was set out in Table 4 of the Scoping Report (2009) has not been included in the AoS Assessment Methodology note. We previously raised concerns that the wording in this column was not strong enough to demonstrate that the appraisal would effectively address climate change mitigation issues. We acknowledge that this will be a high level qualitative appraisal due to the strategic nature of the NPS, but any significant impacts identified through appraisal against this objective would need to be addressed to ensure that the NPS effectively contributes to the reduction of greenhouse gas emissions in line with Government targets. AoS7 Water quantity and AoS 8 Water quality: The 'Alternative guide questions...' column which was set out in Table 4 of the Scoping Report (2009) has not been included in the AoS Assessment Methodology note. Instead much more generic 'Key Considerations...' are included against these objectives. We commented in our Scoping response in 2009 on the need to consider issues which are now required under the Water Framework Directive such as impacts on the hydrology/ hydrogeology and physical nature of water courses and may affect water quality. We also commented on the need to consider the affects of the NPS on water supply infrastructure. These are not specifically mentioned in the 'Key Considerations...' column but we trust that they will be considered as far as possible, bearing in mind the strategic nature of the NPS, under the generic bullets 'Impacts from national networks on water quantity/water quality (both surface and groundwater)'. We welcome inclusion of the Longer term (20 years+) timescale for impact prediction which is in line with our 2009 Scoping response.	This is noted. These comments have been considered and taken into account when undertaking the appraisal wherever possible.
Alternatives for NN NPS	We asked for clarification on strategic alternatives in our response to the Scoping Report in 2009. We specifically asked to	Yes, where positive impacts have been identified within

Ref	Comments/Issue	How this was taken account of
	see more focus on demand management measures in order to reduce the need for new national networks infrastructure. We welcome the additional information you have provided and the consideration of demand management. We also welcome your confirmation at our meeting on 18th September that the AoS will be undertaken at a sufficient level of detail so that impacts of different parts of the 'alternatives packages' are clear. We think this will be important as the 'alternatives packages' as they currently stand appear to be quite complicated and different environmental standards scenarios are included in Alternative 1 to Alternative 2. We trust that where significant positive impacts of an element/s within the 'alternative packages' are identified these could be recommended for inclusion in the preferred options package of measure to be included in the NN NPS. For example, the inclusion of demand management measures and higher environmental standards where the AoS shows these to have positive impacts.	the alternative packages, consideration was given as to whether these measures could be incorporated into the NN NPS.
Stakeholder Comments	Thank you for putting together the table summarising how comments from Statutory Environment Bodies were taken into account in the scoping consultation. This is really helpful in clarifying how the AoS scoping has developed since we made our initial comments.	This is noted.
Baseline	We do not currently have any further comments to make on the baseline information.	N/A
PPPs	The EC is reviewing air quality policy with the review due to be finished this autumn. EU Directives which could be added to the list of PPPs are: o the Ambient Air Quality Directive (2008/50/EC) and Directive 2004/107/EC, which set limits for concentrations of pollutants in outdoor air o the EU National Emissions Ceilings Directive (2001/81/EC), which sets limits on total annual emissions of important air pollutants for all member states to help reduce 'transboundary air pollution' (pollution that is generated in one country but has an impact in others) There is also the The National Emission Ceilings Regulations 2002 transpose into UK legislation the requirements of the National Emission Ceilings Directive (2001/81/EC).	Where considered relevant and current these PPPs have been added.

Historic Scotland

October 2013

Comments/Issue	
Historic Scotland confirm that as the coverage of the NPS is limited to England and that the consultation emphasises that any impacts on the devolved administrations will be fully taken into account, they have no further comments at this stage.	N/A

Natural Resource Wales

November 2013

Ref	Comments/Issue	How this was taken account of
Additional Plans, Policies and Programmes (PPPs).	Relevant Welsh strategic documents should be included: • The Flood and Coastal Erosion Risk Management Strategy for Wales. • The Wales National Transport Plan. • Wales Waste Strategy.	Where considered relevant and current these PPPs have been added.

Ref	Comments/Issue	How this was taken account of

	• Planning Policy Wales.
	• The Severn and Dee River Basin Management Plans.
	• Relevant Regional Plans along the Welsh Border and along the major north and south transport corridors, particularly when looking at potential cumulative impacts. These include:
	  ○ The Regional Transport Plans for SWWITCH, SEWTA, Taith and TRaCC;
	  ○ The Unitary/Local Development Plans for Monmouthshire, Powys, Wrexham and Flintshire (border) Newport, Cardiff, Vale of Glamorgan, Bridgend, Neath Port Talbot, Swansea, Carmarthenshire and Pembrokeshire (M4 corridor local authorities), Torfaen, Blaenau Gwent, Caerphilly, Merthyr Tydfil and Rhondda Cynon Taf (A465 Heads of the Valleys corridor local authorities) and Denbighshire, Conwy, Gwynedd and Anglesey (A5/A55 corridor local authorities).
	• Major strategic infrastructure plans such as: the proposals to electrify the Great Western Mainline; and Welsh Government's 'M4 Corridor Enhancement Measures (CEM)' and more recent 'M4 Corridor around Newport' proposals, available on Welsh Government's website.	

Baseline data	You should also, use Welsh data and information, where appropriate. Relevant data is likely to be contained in the in the documents mentioned above. For example, data about the ecological status of Welsh waterbodies will be contained in the Dee and Severn River Basin Management Plans. Particular topic areas which should be considered in this cross-border context include flood risk and water quality impacts on surface and ground waters, which could lead to significant 'downstream' effects in Wales. Impacts on protected or sensitive landscapes and sites in Wales and potential negative and positive impacts on ecosystem services and ecological connectivity.	It is considered that this level of detail is not appropriate to the high level strategic nature of the NPS. Welsh baseline data has been included where considered relevant.
Alternatives	We advise that the SEA explores the extent to which any potential significant environmental effects identified align with the aims of Welsh Government strategies and emerging Bills, e.g. the Environment White Paper and Future Generations Bill. This is likely to be particularly relevant to effects associated with the alternatives packages.	Where considered relevant this has been undertaken.
HRA	Finally, we would welcome the opportunity to advice on the Habitats Regulations Assessment (HRA), where it considers near and cross-border sites.	The HRA will be formally consulted upon alongside the AoS and NN NPS.

APPENDIX C COMPATIBILITY MATRIX

Compatibility Analysis

✓ Likely compatibility
? Relationship not clear
x Likely incompatibility

National Networks NPS Objectives	Networks with the capacity and connectivity and resilience to support national and local economic growth	Networks which support and improve journey quality, reliability and safety	Networks which support the delivery of environmental goals and the move to a low carbon economy	Networks which join up our communities and link effectively to each other
AoS1: To contribute towards the reduction of noise levels from road and rail national networks	?	?	✓	?
AoS2: To contribute towards improving local air quality	?	?	✓	?
AoS3: To contribute towards the reduction of greenhouse gas emissions	?	?	✓	?
AoS4: To protect and enhance landscape quality, townscape quality and to enhance visual amenity	?	?	✓	?
AoS5:To protect and conserve heritage assets in a manner appropriate to their significance	?	?	✓	?
AoS6: To preserve, protect and enhance biodiversity	?	?	✓	?
AoS7: To ensure the protection of water resources (quantity)	?	?	?	?
AoS8: To encourage the protection of water quality	?	?	✓	?
AoS9: To contribute towards increased resilience on national networks	✓	?	✓	?
AoS10: To minimise the impact on soil and land resources including contamination and loss	?	?	?	?
AoS11: To minimise the use of previously undeveloped land	?	?	✓	?
AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction	?	?	✓	?
AoS13: To contribute towards reducing the risk of flooding in the hinterland	?	?	✓	?
AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network	?	✓	?	?
AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and	?	?	?	?

National Networks NPS Objectives	Networks with the capacity and connectivity and resilience to support national and local economic growth	Networks which support and improve journey quality, reliability and safety	Networks which support the delivery of environmental goals and the move to a low carbon economy	Networks which join up our communities and link effectively to each other
transport user types				
AoS16: To contribute towards the maximisation of user benefits on the National Networks	✓	✓	?	✓
AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks	✓	✓	?	✓
AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment	✓	?	?	✓
AoS19: To contribute towards the improvement of accessibility to rural areas	✓	?	?	✓
AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations	?	?	?	?
AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged	✓	?	?	?
AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery	?	?	?	?
AoS23: To contribute towards improving health and public health	?	✓	?	?

APPENDIX D IMPACT ASSESSMENT TABLE DEFINITIONS

Appendix D - Impact Assessment Table Definitions

The Impact Assessment tables have been compiled in order to follow a clear and defined process as to how significance of impacts has been identified. Under Annex II of the Strategic Environmental Assessment Directive (2001/42/EC), the criteria for determining significance have been outlined. This criteria includes the incorporation of the probability, duration, frequency and permanence of the effects and the inclusion of magnitude and spatial extent. These have been included within the impact assessment tables to ensure that the impact assessment has been as thorough as reasonably practicable. There are additional criteria which it recommends also be taken into account such as special natural characteristics, however due to the nature of the AoS, such criteria has been assessed within individual objectives.

Direct/Indirect

An impact has been scored as direct if there is a direct causal link between the NPS/Alternative proposals and the likely impact. For example, the construction of new roads is likely to require the removal of vegetation and therefore directly impact biodiversity. An impact has been scored as indirect if there is more than one step in linking the NPS/Alternative proposals to the impact, for example, the cost of motoring is likely to discourage people from using the road network. This in turn reduces congestion – the link between the cost of motoring and reduction of congestion is indirect.

Magnitude

The magnitude of impacts has been considered on a qualitative basis, using professional judgement and readily available relevant evidence. One of the following five magnitudes has been assigned to an individual impact: Large positive (++); Small positive (+); Neutral (/); Small negative (-); or Large negative.

Temporal Scale

A temporal scale of the proposed impacts of the NPS/Alternatives proposals have been assigned dependent on what has been professionally deemed to be a realistic time frame for the impact to occur. One of these four temporal scales has been assigned to individual impacts: Short term (0-5 years); Medium term (5-10 years); Long term (10-20 years); and Longer term (20+ years). The temporal scale takes into account the entire period of the NPS/Alternative proposals and for construction, the amount of work that is likely to be required. There are likely to be some form of construction impacts throughout the whole NPS/Alternative period and therefore, it was deemed that these impacts would occur over a longer term (20+ years).

Probability

The probability of an impact occurring has been determined using professional judgement and evidence where along with readily available evidence which has shown the likelihood of the impact occurring. There are four categories of probability within the impact assessment: Negligible (<20%); Low (20-40%); Medium (40-80%); and High (>80%). Where there is previous professional experience and a strong evidence base for similar schemes to those within the NPS/Alternatives proposals having certain impacts, it has been assumed that there would be a high probability of the impact occurring. Where evidence is lacking or the impacts are uncertain, a lower probability may have been assigned. The probability score also takes into account the likelihood of the presence of a sensitive receptor within the range of an impact.

Spatial Extent

The spatial extent of potential impacts has been divided into three stages in order to fully capture the extent of the NPS/Alternative proposals. The score assigned within these three categories has been based on professional judgements. The three stages are as follows:

Number – The total number of potential individual impacts arising from proposals – small medium or large.

Footprint/Size of impact – The footprint of the individual impacts arising from proposals – small medium or large.

Distribution – This refers to the location of the individual impacts and is dependent on the proposals e.g. across the SRN, across the rail network and across England.

Permanence

Some impacts will be permanent and others will be temporary. This has been determined based upon the nature of the proposals and of the impact. For all infrastructure measures, it has been deemed that any impacts arising as a result of these would be permanent. For most instances of construction, the impacts are likely to be temporary in nature as the construction works will come to end at some point.

Reversibility

The impact of some NPS/Alternatives proposals may be reversible dependent on the nature of these. For example, for smart motorway schemes, there is the opportunity for signage to be turned off and the hard shoulder no longer used for traffic and therefore, the impacts associated with smart motorways would be reversible. However, for widening schemes as outlined in alternative 2, this would require land take and it would not be viable to remove additional lanes and it has therefore been determined that in such cases, these impacts would be permanent.

APPENDIX E Impact assessment tables

NN NPS Detailed Impact Assessment Tables

AoS1: To contribute towards the reduction of noise levels from road and rail national networks

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impacts	Distribution			
Road, rail and SRFI: impacts during construction (i.e. noise disturbance).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	The NPS support a significant package of improvements and enhancements across the road and rail networks and the development of SRFIs. Construction impacts due to noise will affect local receptors including residential areas and habitats; however these are likely to be largely mitigated by standard best practice construction and will be temporary impacts. Evidence: ESs for SRFIs, e.g. the St. Albans ES for the construction of an SRFI stated that recommended limits could be exceeded in respect of some properties for short periods of time during construction of the earth mounds, the new relief road/Radlett Road roundabout, and the rail links to the MMR. ESs for road widening schemes e.g. the ES for the A453 Widening M1 Junction 24 to A52 Nottingham stated the HA would follow a Construction Environmental Management Plan which outlined the methodology for minimising environmental impacts during works. However, the ES stated there would inevitably be localised increases in noise and dust during site clearance works, earthworks, bridge construction and the construction of the carriageway; and due to the daily movement of construction traffic around the site.
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts from noise on sensitive receptors.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand although the traffic increase is unlikely to be evenly distributed. The increase in traffic is likely to increase the exposure of people and dwellings to transport noise from national networks, although the impact on noise receptors will depend on the locations of developments, in relation to receptors. Evidence: TASM Modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.

*It should be noted that the evidence cited is for illustrative purposes only and, whilst it may not be representative of all schemes nor all potential impacts arising from these schemes, from professional judgement and experience is considered to support the general assessment of impacts made in this assessment table.

Programme of maintenance on the SRN, including resurfacing: impact on noise levels.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of road resurfacing on the SRN. The introduction of low noise road surfacing is likely to have a substantial benefit with regards to the reduction of noise levels at source on national networks and subsequently, noise on local receptors, where it is replacing existing concrete roads or previously unmodified surfaces. Evidence: Department for Transport: Guidance on Noise Nuisance from Trunk Roads and Motorways (Chapter 6: Making Life Better for Communities) states that the noise arising from the newest quieter surfaces, compared to the more traditional ones, is about the same as if the amount of traffic had been halved. The ES for the A1 Bramham to Wetherby Upgrading Scheme predicts that modern thin wearing course (TWC) surfaces (Low Noise Surface) would be 2.5 dB quieter (where speeds are >75 km/h) than hot rolled asphalt with a 2mm texture depth, as measured by a sand patch test.
Smart Motorways: opportunity to manage traffic speeds which impacts on noise levels through reduction of traffic speed.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Temporary	Reversible	The NPS supports an extensive programme of Smart Motorways. Smart Motorways can indirectly improve noise levels due to vehicle speed reduction to manage traffic flows. The NPS supports speed management as one of a range of techniques to mitigate air quality increases as a result of new schemes. This policy is likely to indirectly reduce overall noise levels. Evidence: The Birmingham Box Phase 3 Managed Motorways AST stated that some properties in the vicinity of Junctions 5, 6 and 8 were predicted to experience noise reduction benefits in the short term. In addition, the M42 managed motorways pilot in 2010 found that noise levels decreased by 1.8 dB(A), over existing levels (Annex to the DfT Advanced Motorway Signalling and Traffic Management Feasibility Study Report).
Smart Motorways: impact on receptors due to source of noise emissions moving closer to receptors	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. Smart Motorways include the use of hard shoulder running and therefore, traffic moves closer to the receptor i.e. the noise source moves closer to the receptor. This is likely to negatively impact noise levels on receptors close to the SRN, increasing the exposure of people and dwellings to transport noise from national networks. Although as Smart Motorways will move traffic closer to receptors only by a relatively small distance, i.e. the width of an additional lane, this impact will be small. Evidence: Design Manual for Roads and Bridges: Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques Part 5 HD 213/11 Revision 1 Noise and Vibration (2011) states that horizontal alignment of a road impacts sensitive receptors (i.e. moving the route closer to the receptor) will increase noise levels and vice versa. Furthermore it states that “At a distant reception point the noise level is attenuated by a number of additional factors, including the distance from the noise source, the nature of the intervening ground surface and the presence of obstructions.”

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Road infrastructure measures including pinch point investments, trunk road upgrades: impacts due to noise sources moving closer to sensitive receptors (e.g. people and wildlife).	Direct	Neutral (/)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of pinch point investments including junction improvements and new slip roads. It also supports a large programme to upgrade the trunk road network. This may result in vehicles moving closer to receptors and there may be an increase in exposure of people and dwellings to transport noise from national networks due to closer proximity to noise source. On the other hand, there may also be positive impacts as noise sources may move further way, for example in the case of new bypasses. Impacts are likely to be dependent on individual schemes i.e. in some locations, impacts on noise may worsen whereas in other locations, impacts on noise may improve. Furthermore, the NPS commits to providing low noise surfacing and noise barriers where appropriate on new developments. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that for 79 road schemes assessed, 26 had a neutral impact on noise, 40 had a beneficial impact on noise and 13 had an adverse impact. This evidence shows that both positive and negative impacts can occur as a result of road developments. It should be noted that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
New links and bypasses and bypasses: impact on receptors due to increased noise levels from new roads.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Small	Large	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. New road links introduce a new source of noise to a new location and may therefore have substantial impacts on local receptors through the increase in exposure of people and dwellings to transport noise from national networks. However, these impacts need to be considered against reductions in noise levels on existing roads (see next row), and the commitment in the NPS to providing low noise surfacing and noise barriers where appropriate on new road developments. Evidence: Published AST tables for road schemes indicate an increased number of dwellings exposed to noise disturbance e.g. the POPE of Major Schemes Summary Report for the A69 Haydon Bridge Bypass states that the bypass has introduced a new source of noise into the countryside for the few properties nearer to the new route than existing roads. The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.
New links and bypasses and bypasses: impact on receptors due to decreased noise levels on existing roads.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Large	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. New road links and bypasses have the potential to reduce noise at source along existing routes as traffic is redirected on to new roads. This is likely to have a substantial impact on local receptors which are currently impacted by heavily trafficked routes. Furthermore, the NPS commits to providing low noise surfacing and noise barriers where appropriate on new road developments. Evidence: The noise benefits will vary depending on the scheme, for example, the POPE of Major Schemes Summary Report (Five years after study) for the A63 Selby Bypass states that traffic within Selby and on other local roads has reduced since the bypass opened and it is likely that

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										local residents will have benefited from reduced traffic noise. However, the Highways Agency POPE Analysis of the A38 Dobwalls bypass shows that 87% of traffic was re-routed away from the village to use the bypass. This includes a large proportion of HGV traffic. This indicates that whilst traffic is removed from one area, it is increased in another location and may therefore have an impact on other receptors. The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that for 79 road schemes assessed, 26 had a neutral impact on noise, 40 had a beneficial impact on noise and 13 had an adverse impact. This evidence shows that both positive and negative impacts can occur as a result of road developments. It should be noted that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.
Implementation of noise enhancement measures for existing road developments: reduced impacts on sensitive receptors.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	The NPS supports the implementation of measures to address existing noise problems along certain areas of the existing SRN. These would be targeted measures through the Noise Action Planning process to improve areas where noise problems currently exist. Enhancement measures would include the resurfacing of the SRN with low noise surfacing, noise barriers and earthworks. Evidence: Obstructions in the path of a sound cause its diffraction or reflection and this in turn causes a reduction of sound levels at the receptor located behind the obstruction. Obstructions include noise barriers. Sound attenuation is maximum immediately behind the barrier and decreases with the distance behind the object (Sinha, K.C. and Labi, S., 2007. Transportation Decision Making: Principles of Project Evaluation and Programming).
Additional train movements on existing rail network and more carriages on trains: impact on sensitive receptors due to noise from increased rail activity.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. The addition of trains on existing railway lines is likely to increase noise levels, and therefore increase the exposure of people and dwellings to transport noise from national networks due to increased rail activity. Evidence: The Chiltern Railways (Bicester to Oxford Improvements) Order Non-Technical Summary states that although most of the scheme consists of an existing operational railway, the scheme will result in an increase in train movements and speeds along the route resulting in increased noise as trains pass receptors.
New rail links, new chords and track widening: impact on sensitive receptors due to noise from new or increased rail activity.	Direct	Large negative (- -)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. There are a number of noise sources associated with the operational railway, of these, rolling noise is often considered to be the most important. Evidence: The Environmental Statement for the development of a rail link between LUL's Metropolitan line in the west of Watford and Watford Junction main line station predicted an increase in environmental noise for properties closest to the proposed link, particularly along the section between Ascot Road and the existing Over ground line once the proposed

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										scheme is open to use.
Rail electrification: impact on noise levels.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. This will have a large beneficial impact on noise levels across England due to the replacement of diesel engines by electrification. Evidence: The Atkins study for RSSB of 2007 stated the Calculation of Railway Noise (CRN) factors for a Pendolino EMU (a type of electric high-speed train used in the UK) as +10.7dB and the equivalent figure for a Voyager DMU (diesel multiple unit) of +13.8dB.
SRFIs: noise impacts associated with the operation of SRFIs.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative noise impacts through increasing the exposure of people and dwellings to transport noise from national networks. Evidence: Documents in support of planning applications for currently proposed SRFIs predict localised noise impacts. e.g. the St. Albans ES for construction of an SRFI states that road traffic, both within the site and on adjacent road links on the public highway; rail traffic on lines within the site and on the Midland Main Line; and site activity are likely to result in increases in noise. However, with appropriate mitigation in place, overall, the proposed scheme is expected to result in the noise climate remaining in the 'reasonable' category.
Commitment to funding of ULEVs: reduction in noise levels due to transition from petrol and diesel powered vehicles to ULEVs.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	The NPS supports the commitment to funding of ULEVs. Through the Office for Low Emission Vehicles (OLEV) the government are providing funding to advance ULEV technology and encourage people to buy and drive ULEVs. Provision will be focused in the following areas: helping to support the purchase of ULEVS; facilitating the provision of recharging infrastructure; preparing for hydrogen fuel cell electric vehicles in the UK; encouraging and investing in research and development; and lowering emissions from other vehicles. The transition to ULEV technologies is likely to reduce noise levels at source on national networks overall. Evidence: The government's vision for the road network, Action for roads: a network for the 21st century, commits additional capital investment to support industry and consumers in the shift to ULEVs. Driving the Future Today - A strategy for ultra-low emission vehicles in the UK states that ULEVs are extremely quiet compared to conventional vehicles.

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AoS2: To contribute towards improving local air quality

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction of road, rail and SRFI infrastructure: emissions (particularly dust) during construction of infrastructure.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks and the development of SRFIs. Air quality may temporarily decline in the local area to any infrastructure upgrades or construction due to an increase in levels of air pollutant emissions, particularly dust, however, this is only for the short term, and can usually be mitigated. The NPS commits to ensuring that breaches of air quality standards are limited as far as possible, through mitigation measures if a scheme is likely to result in breaches of air quality standards. Therefore, impacts on human health are likely to be limited. Evidence: Air quality assessments within Environmental Statements (e.g. M6 J10a-13, M1 J1-13), for road schemes predict temporary impacts during construction but these are not considered likely to be significant. DIRFT III Environmental Statement, Air Quality Chapter K, states that due to the large scale and long duration of construction activities, the potential significance of construction phase impacts would be slight or moderate adverse without mitigation. However, with mitigation, it is expected that all impacts would be negligible, except at two receptors where it is considered that impacts may be slight adverse based on a worst case scenario.
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and associated emissions to air, and therefore impacts on air quality.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic is likely to impact on levels of air pollutant emissions from national networks, although the extent of the impact on local air quality will depend on the locations of developments. The NPS commits to ensuring that breaches of air quality standards are limited as far as possible, through mitigation measures if a scheme is likely to result in breaches of air quality standards. Therefore, impacts on human health are likely to be limited. Evidence: TASM Modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 with respect to the baseline. At an aggregate level the modelling forecasts NOx and PM10 emissions to increase by 0.76% and 1.10% respectively in the Do NPS scenario with regard to the baseline by 2040.
Smart Motorways: impact on receptors due to source of emissions moving closer to receptors, with an associated increase in pollutant concentrations.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. The Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, HA 207/7 Air Quality indicates that the traffic contribution of pollutants decreases with distance from the road. Hence, moving traffic closer to a fixed receptor (e.g. housing) will result in higher levels of pollutant emissions from national networks at receptors, although as Smart Motorways will move traffic closer to receptors only by a relatively small distance, i.e. the width of an additional lane, the impact on human health will be small. Evidence: Air quality assessments within Environmental Statements (e.g. M6 J10a-13), and Appraisal Summary Tables (e.g. M62 J 25 - 30, M25 J 23-27) for Smart Motorway schemes do not predict overall significant air quality

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										effects, although some small increases in pollutant concentrations on some links are predicted.
Smart Motorways: opportunity to manage traffic speeds along the SRN in order to reduce emissions to air.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. Emissions from road vehicles are significantly influenced by road traffic speeds, with levels of air pollutant emissions lower at speeds that achieve optimal engine combustion efficiency. The relationship between vehicle speed and emissions is commonly understood and is a key factor in modelling emissions from vehicles. Smart Motorways therefore provide the ability to manage the speed of vehicles to manage traffic flows and this also provides an opportunity to manage speeds to reduce emissions to air. This could help to improve air quality in areas which are worse affected by air pollution from the SRN and in turn positively impact human health. Evidence: The European Environment Agency (http://www.eea.europa.eu/themes/transport/speed-limits) states that introducing lower speed limits on motorways is expected to cut both fuel consumption and pollutant emissions. Cutting speed can also significantly reduce emissions of other pollutants, particularly reducing NOx and particulate matter (PM) output from diesel vehicles, Department for Transport (Updated Vehicle Emission Curves for Use in the National Transport Model, AEA, 2009).
New links and bypasses: impact on air quality due to reductions in emissions on existing roads and related to congestion and queuing.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. Air quality in bypassed villages can improve through substantial reductions in traffic volumes. In addition, new link roads are often targeted to reduce congestion, and a more continuous flow of traffic can lead to a reduction in queue lengths which will reduce the size of areas affected by poor air quality. This may have positive impacts on human health. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that 22 out of 32 bypasses assessed had a beneficial impact on air quality. The air quality impacts will vary depending on the schemes, for example, the POPE of Major Schemes Summary Report for the A43 Improvements shows that air quality in the bypassed villages of Syrensham and Silverstone has improved through substantial reductions in traffic volumes.
Road infrastructure measures including pinch point investments and trunk road upgrades: exposure to increased air quality due to source of air emissions moving closer to receptors.	Direct	Neutral (/)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of pinch point investments including junction improvements and new slip roads. This may decrease the distance between the source of emissions and receptors, particularly where roads are in close proximity to residential areas. However, smoother flowing traffic and a reduction in the level of congestion may lead to a reduction in air pollutant emissions. Impacts are likely to be dependent on individual schemes i.e. in some locations, impacts on air quality may worsen whereas in other locations, impacts on noise may improve. Furthermore, the NPS commits to mitigating significant increases in levels of air pollutant emissions as a result of new road developments. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that out of 79 road schemes assessed, 17 had a neutral impact on air quality, 13 had an adverse impact and 49 had a beneficial impact. It should be noted that these figures include all road improvement schemes, including motorway widening. The report

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										does not differentiate between different types of air quality impacts and these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
Implementation of air quality enhancement measures for existing road developments: reduced impacts on sensitive receptors.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the implementation of enhancement measures for existing air quality problems along certain areas of the existing SRN. These would be targeted measures to reduce pollution in areas of poor air quality on the existing SRN. Enhancement measures would include the management of vehicle speed, increasing the distance between live traffic and neighbouring properties, and working with local authorities and other partners to identify measures that provide benefits over a wider area. This would be likely to positively impact human health. Evidence: A study conducted in the Netherlands by Innovatie Programma Luchtkwaliteit (IPL, 2010) Dutch Air Quality Innovation Programme Concluded shows that the installation of a 4m barrier adjacent to a road network reduces concentrations of air pollutants in locations behind the barrier. At 10m behind the barrier, concentrations of NO2, NOx and PM10 are reduced by 14%, 20% and 34% respectively.
Additional train movements on existing rail network and more carriages on trains: impact on air quality as a result of more trains and carriages.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. The addition of any diesel trains on existing railway lines is likely to increase levels of air pollutant emissions as there will be a higher number of trains and therefore rail traffic. The addition of carriages is also likely to increase emissions as trains will burn more fuel per journey. This in turn may impact upon human health. Evidence: The Northern Hub is a programme of targeted upgrades to the railway in the North of England. Trains using the new railway infrastructure on the Ordsall Chord will be electric, which will have minimal local emissions. However, The Northern Hub scheme will allow up to 700 more trains to run each day in the North of England, potentially increasing emissions. The Rail Command Paper (DfT, 2012. Reforming our railways: Putting our customers first) gives details on the use of both electric and diesel trains. Whilst there is a programme of electrification outlined for the future and the benefits of electrification are discussed, including the benefits for air quality, the Command Paper also highlights that “many parts of the rail network will continue to rely on diesel rolling stock for the foreseeable future”.
New rail links, new chords and track widening: impact on air quality as a result of new links, chords and track widening.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. The development of new rail links is likely to introduce new sources of air pollutants to new areas, therefore, there is potential for negative impacts due to this rail activity. The impact will depend on the nature of the trains using the new links i.e. whether they are diesel or electric, as electric trains are zero emissions at the point of use, whereas diesel trains emit pollutants to air. It is understood that a large proportion of the new links proposed will be electrified, however, where this is not the case there will be a small negative impact on emissions of air pollutants, and subsequently, human health. Evidence: The Rail Command Paper (DfT, 2012. Reforming our railways: Putting our customers first) highlights that “many parts of the rail network

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										will continue to rely on diesel rolling stock for the foreseeable future", despite the electrification of some lines. Local Air Quality Management Technical Guidance LAQM.TG(09) (Defra, 2009) shows that diesel trains emit SO_2 and NO_2 and evidence shows that concentrations of these pollutants are elevated along railway lines. These pollutants contribute to a reduction in air quality. Therefore, the continued use of diesel trains is likely to negatively impact on air quality in the vicinity of railway lines.
Rail electrification: impacts on local air quality due to electrification of diesel powered rail lines.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. Electric trains perform better than diesel trains in terms of levels of air pollutant emissions to air. They are zero emissions at the point of use. This helps improve air quality in areas of high pollution such as city centres and main line stations. Evidence: Rail modelling of HLOS electrification predicts that with the electrification proposed in the NPS, NOx emissions would reduce by 29.3% in 2018/19 compared to 2010/11 levels, PM emissions would reduce by 49.0% and SO_2 emissions would fall by 99.2% over the same time period. There would be a slight increase in emissions of NOx, PM and SO_2 as a result of electricity generation by 38.4%, 14.7% and 5.3% respectively over the same time period. This would result in a slight overall increase in NOx emissions, but a substantial reduction in both PM and SO_2 emissions. The Network RUS Electrification (Network Rail, 2009) states that a significant proportion of passengers and the majority of freight is carried by diesel operations which is more costly and produces more emissions than its electric equivalent.
SRFIs: modal shift from road to rail reduces road traffic emissions on the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs can reduce levels of congestion both locally and nationally. For the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Where rail is used instead of road, there is a large reduction in emissions of air pollutants for each tonne transported. Therefore the development of SRFIs should lead to a benefit in air quality terms and in turn, human health due to the reduction in emissions from road traffic. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that rail freight produces fewer harmful gases than road freight in terms of other emissions that impact upon people's health – less than a tenth of the nitrogen oxide and fine particulates of road haulage per tonne carried when compared to road transport.
Commitment to funding of ULEVs: improvements to local air quality due to transition from petrol and diesel powered vehicles to ULEVs.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	The NPS includes measures to support the shift to ULEVs. Through the Office for Low Emission Vehicles (OLEV) the government are providing funding to advance ULEV technology and encourage people to buy and drive ULEVs. Provision will be focused in the following areas: helping to support the purchase of ULEVS; facilitating the provision of recharging infrastructure; preparing for hydrogen fuel cell electric vehicles in the UK; encouraging and investing in research and development; and lowering emissions from other vehicles. The transition to ULEV technologies is likely to improve air quality across the whole network.

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										Evidence: The government's vision for the road network, Action for roads: a network for the 21st century, commits additional capital investment to support industry and consumers in the shift to ULEVs. Driving the Future Today - A strategy for ultra-low emission vehicles in the UK states that ULEVs have an important role to play in reducing the air quality impact of road transport. Vehicles travelling under electric power will emit no tailpipe emissions of NOx and PM10, (although ULEVs powered partly by combustion engines will (e.g. Range-Extended Electric Vehicles)). DfT analysis shows air pollutant emissions declining overall at the roadside, where air quality problems are most significant (although no location-specific modelling has been carried out). The analysis did not cover air pollution from power generated for electric vehicles. It is possible that including power generation could offset this reduction in emissions, although this would depend on various factors, in particular the source of electricity and the types of ULEVs in use.

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AoS3: To contribute towards the reduction of greenhouse gas emissions

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction including embodied carbon (i.e. construction materials) and operational carbon (e.g. energy used).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks and the development of SRFIs. The construction of infrastructure will involve the use of large amounts of material (both raw and recycled). Carbon embodied in materials for construction and maintenance work will vary across interventions, however, it is likely that the materials used will be sourced in accordance with industry standard good practice guidelines to ensure efficient use of materials. The carbon footprint as a result of fitting materials and site energy usage is likely to vary across schemes. Evidence: Huang et al (Measuring the carbon footprint of road construction using CHANGER, 2012) states that several elements and their impacts are found to contribute to the variation in CO_2 per kilometre construction, namely the amount of traffic and increased capacity, current condition (e.g. foundation, pavement), materials used, construction technique, drainage and structures (type, number, etc.). A Carbon Calculation Tool has been developed to enable the Highways Agency to identify the carbon footprint associated with the Highways Agency's activities. The tool provides a means of capturing the volume of carbon produced through construction, maintenance and operational activities undertaken by the Highways Agency itself, and its main contractors. It takes into account energy, materials, transport and waste removal. Network Rail also state in their Sustainable Development Strategy (2013-2024) that they aim to take a whole life approach to resource use in our asset management, so that virgin material requirements and waste production are minimised, and the carbon embedded in new infrastructure is measured and reduced. In addition, they aim to use low carbon energy sources to minimise rail's carbon footprint.
Cumulative impact of NPS interventions on SRN: increased traffic and increased speeds as a result of increased capacity on the SRN	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Irreversible	The NPS supports extensive programmes of pinch point investments and smart motorways, a large programme of trunk road upgrades and limited new link roads and bypasses. This will increase the capacity on the SRN, resulting in a small increase in traffic across the network due to higher demand, but also reduce overall levels of congestion. The reduction in levels of congestion may increase traffic speed, therefore increasing levels of GHG emissions as vehicles emit more emissions at higher speeds. Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. The modelling forecasts CO_2 emissions to increase by 0.43% by 2040 in the Do NPS scenario with regard to the baseline. The annual CO_2 emissions from delivering a programme of investment on the SRN of the scale envisaged in the Do NPS investment

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										scenario amount to below 0.1% of average annual carbon emissions allowed in the fourth carbon budget. The Highways Agency Scheme evaluation table shows that the majority of road schemes resulted in an increase in carbon emissions. However, there were also some cases where carbon emissions were reduced as a result of new road developments. These developments include examples from trunk road upgrades and new links and bypasses.
Smart Motorways: impact on carbon emissions through management of traffic speed.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. Smart motorways can indirectly reduce levels of GHG carbon emissions due to road traffic speed reduction to manage traffic flow The NPS supports speed management as one of a range of techniques to mitigate air quality increases as a result of new schemes. This policy will indirectly reduce overall levels of GHG emissions. Evidence: Data within the Advanced Motorway Signalling and Traffic Management Feasibility Study (DfT, 2008) report shows that for the M42 Smart Motorways pilot scheme emissions of CO_2 from light duty vehicles reduced from 108 g/mile to 87 g/mile when speeds reduced from 70mph to 50mph respectively. In addition, the AST for the M62 Junction 25-30 Managed Motorway Scheme states that the scheme will lead to a reduction in greenhouse gas emissions. Although vehicle km would increase by 2.2million vehicle km over the sixty year appraisal period, the total carbon dioxide emissions with the scheme would be 370,000 tonnes lower.
Rail infrastructure measures: impacts on greenhouse emissions due to new rail links and making use of existing rail infrastructure.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. It also supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. Although there are likely to be increases in embodied carbon due to new infrastructure, the impact of modal shift from road to rail may result in a reasonable reduction in levels of GHG emissions. Evidence: A carbon assessment of the Manchester Hub strategies was carried out as part of the Manchester Hub Rail Study, consistent with WEBTAG appraisal criteria for reduction in road vehicle mileage as a result of modal shift to rail and Defra guidance on the carbon impact of vehicles. The resultant appraisal identified a reduction of 1.98 million tonnes of Carbon over 60 years from implementation of the Manchester Hub based on current traction type and performance. The East-West Rail: The Economic Case for Investment describes how the development supports sustainable growth, reduces Carbon emissions and encourages modal shift from car to train.
Rail electrification: reduction in greenhouse gas emissions due to electrification of diesel powered rail lines.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. Electric trains perform better than diesel trains in terms of emissions to air. They are zero emissions at the point of use. This helps improve air quality and reduce levels of greenhouse gas emissions in areas of high pollution such as city centres and main line stations. Evidence: Rail modelling of HLOS electrification schemes shows that the implementation of these schemes will result in an overall decrease in rail traction CO_2 emissions of 11% by 2018/19 compared to the do-minimum

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										scenario of no line electrification. However, as rail GHG emissions accounts for only 1.8% of all domestic transport GHG emissions (UK transport greenhouse gas emissions, Department for Transport, 2009), this is likely to be of small positive magnitude. The Network RUS Electrification (Network Rail, 2009) states that a significant proportion of passengers and the majority of freight is carried by diesel operations which is more costly and produces more emissions than its electric equivalent. Electrification has a potentially significant role to play in reducing carbon emissions from rail transport as well as improving air quality and reducing noise. Electric trains, on average, emit 20 to 30 per cent less carbon than diesel trains.
SRFIs: modal shift from road to rail reduces road traffic emissions on the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs can reduce congestion both locally and nationally. For the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Where rail is used instead of road, there is a large reduction in levels of CO_2 emissions for each tonne transported. Therefore the development of SRFIs should lead to a benefit in air quality terms due to the reduction in emissions from road traffic. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that there could potentially be a 76% reduction in CO_2 emissions per tonne transported when using rail instead of road. This document also states that the modal shift of road to rail will greatly reduce congestion, where each freight train could take approximately 60 lorry journeys off the road. It is considered that overall the impact of modal shift is likely to result in 20-24 lorries being taken off the road, taking into account transport to and from SRFIs.
Door-to-door Strategy measures and cycling measures: improvements to cycling and walking facilities encourage more people to make journeys using sustainable transport modes.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Irreversible	The NPS supports measures to encourage people to use more sustainable modes of transport. This is likely to reduce levels of GHG emissions from transport if more people cycle or walk, especially for short journeys. Evidence: 21% of CO_2 emissions in the UK are as a result of domestic transport, with passenger cars accounting for over half of these emissions. 10 million tonnes of CO_2e are emitted per annum in the UK by transport for journeys between 2 and 5 miles. 3 in 10 motorists claim that they would reduce their car use and one half of cyclists would increase the amount they cycle if better cycling provisions (such as dedicated cycle paths) were implemented (DfT, 2011. Creating Growth, Cutting Carbon). This would be likely to reduce carbon emissions from transport and have a wider environmental benefit.
Commitment to funding of ULEVs: reduction in carbon emissions due to transition from petrol and diesel powered vehicles to ULEVs.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	The NPS includes measures to support the shift to ULEVs. Through the Office for Low Emission Vehicles (OLEV) the government are providing funding to advance ULEV technology and encourage people to buy and drive ULEVs. Provision will be focused in the following areas: helping to support the purchase of ULEVS; facilitating the provision of recharging infrastructure; preparing for hydrogen fuel cell electric vehicles in the UK; encouraging and investing in research and development; and lowering emissions from other vehicles. The transition to ULEV technologies is likely to reduce levels of GHG emissions across the whole network.

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										Evidence: The government's vision for the road network, Action for roads: a network for the 21st century, commits additional capital investment to support industry and consumers in the shift to ULEVs. Driving the Future Today - A strategy for ultra-low emission vehicles in the UK states that an ULEV emits extremely low levels of carbon dioxide (CO_2) compared to conventional vehicles fuelled by petrol/diesel. Since 2009, the OLEV has considered ULEVs as new cars or vans that emit less than 75 grams of CO_2 from the tailpipe per kilometre driven, based on the current European type approval test.

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AoS4: To protect and enhance landscape quality, townscape quality and to enhance visual amenity

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI infrastructure: impacts on landscape and townscape quality and visual amenity during construction (e.g. noise and light disturbance).	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across England	Temporary	Reversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks and the development of SRFIs which may have construction impacts on landscape, townscape and visual amenity at a national and local level including on nationally and locally designated landscapes. Construction impacts that may affect landscape, townscape, visual amenity or tranquillity are likely to include noise, light pollution, and large construction vehicles. These impacts are likely to be largely mitigated and occur on a short term basis. Evidence: Landscape can be negatively impacted during the life cycle of a project, which includes the construction phase, Guidelines for Landscape and Visual Impact Assessment (Third Edition, Consultation Draft) Landscape Institute (n.d.).
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in levels of road traffic across the network due to higher demand, although the levels of road traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to negative impacts on landscape character, visual amenity and tranquillity on the wider network, although the extent of the impacts will depend on the locations of developments. Evidence: TASM modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 with respect to the baseline. Lancashire County Council (n.d.) A Landscape Strategy for Lancashire states that increases in traffic may threaten visual amenity and landscape character.
Smart Motorways: visual impacts on local landscape and townscape from associated infrastructure (e.g. gantries, lighting).	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of Smart Motorways. The impact of implementing Smart Motorways on an existing network is likely to generate small negative impacts on landscape character, views, townscape, visual amenity and tranquillity. This could vary between schemes due to lighting provision within designated landscape areas. Individual gantries and other new features may also have more locally significant adverse impacts. The impacts will depend on the locations of developments. Evidence: HA publication IAN 161/13 states that with reduced verge width it may not always be possible to mitigate localised impacts by landscape planting as it may not be maintainable. In such instances consideration must be given to others forms of screening. Combining noise barriers with visual barriers, where both are warranted, is one option to achieve efficiencies in the design. The Birmingham Box Phase 3 Managed Motorways AST states that a slightly increased awareness of the motorway corridor as a result of the increased number of gantries and localised vegetation loss at major infrastructure locations would not result in significant adverse effects on the landscape character.
Road infrastructure	Direct	Small	Longer	Medium (50-	Large	Medium	Various	Permanent	Irreversible	The NPS supports an extensive programme of pinch point investments, a

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measures including pinch points, trunk road upgrades, new links and bypasses: visual impacts on local landscape and townscape.		negative (-)	term (20+ years)	75%)			across SRN			large programme of trunk road upgrades and limited new links and bypasses. These are likely to result in small negative impacts on landscape, townscape and tranquillity due to the introduction of new infrastructure into the landscape and associated loss of views. However, the NPS commits to effectively integrating new road developments into the landscape as far as possible. The impacts will also be dependent on the locations of developments. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 79 road schemes assessed, 61 had an adverse impact on the landscape, 15 had a neutral impact and 3 had a beneficial impact. It should be noted that the report did not specify the type of landscape impact and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
Implementation of landscape improvement measures for existing road developments: reduced impacts on landscape quality and visual amenity.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across SRN	Permanent	Irreversible	The NPS supports the implementation of measures to preserve, protect and where possible, improve landscape and townscape impacts where existing roads are causing particular impacts on neighbouring people or sensitive areas. Where this occurs, the NPS supports the implementation of works to, where possible, improve landscape quality, such as planting, screening and earthworks. Evidence: The 6Cs Design Guide (2009) is used by Leicestershire County Council, Leicester City Council, Derby City Council, Derbyshire County Council, Nottingham City Council and Nottinghamshire County Council to provide guidance relating to highways and transportation infrastructure for new developments. The landscape section details that well designed landscaping can have a positive visual influence on the final appearance of a new development and that carefully designed tree planting in particular can provide screening at a number of levels.
New rail links, new chords and track widening: visual impacts on local landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. Major new links are likely to result in large negative impacts on landscape, townscape and tranquillity due to the introduction of new infrastructure into the landscape and associated loss of views. Evidence: Network Rail (Ordsall Chord) Order states that during operation, there will be potential visual effects on receptors from viaduct widening and a new section of railway and associated new bridges (Network Arch and replacement Pedestrian and Cycle Bridge) crossing the River Irwell. The Environmental Statement Non-Technical Summary for the proposed Ipswich Chord states that there would be significant visual effects upon the Railway Cottages and the users of the River Gipping footpath/ cycleway during and immediately after the construction phase. Landscape planting mitigation would be developed, however, permanent adverse effects upon the railway cottages and the River Gipping footpath/ cycle path in the immediate vicinity of the new river bridge would remain and cannot be mitigated for. Moreover, the Environmental Statement Non-Technical Summary for the North Doncaster Chord states that the operational effect on landscape and visual amenity as a result of the scheme will have some significant effects. This is because two significant structures, namely the viaduct and highway bridge, will be constructed in a relatively rural landscape.

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Rail electrification: visual impacts from new rail infrastructure and overhead power lines.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. Overhead Line Electrification System (OLE) and gantries would be prominent in flat rural areas but be an impact of lower magnitude in urban areas. Potential visual receptors are residential areas, road users and users of public right of ways. Evidence: The ES for the Great Western Main Line Electrification Project (April, 2013) identifies the landscape and visual impacts associated with permanent and temporary structures such as feeder stations, switching stations, support structures and bridge works. Significant effects are predicted as likely to occur where OLE bridgeworks affect viaducts as these locations are likely to be more prominent, increasing the magnitude of impacts and potentially affecting sensitive receptors. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that areas such as the Reading Urban Fringe, Thatcham to Theale Corridor and several other locations will experience slight to moderate adverse effects on landscape as a result of the scheme. The scheme broadly maintains the existing landscape character in an area which includes some landscape and heritage designations of local importance.
SRFIs: localised impacts on landscape and townscape	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on landscape, townscape and tranquillity due to the introduction of new infrastructure into the landscape/townscape and associated loss of views. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some large localised landscape and visual impacts e.g. DIRFT III. The appraisal of landscape character effects for this project concludes that the initial development will result in a substantial adverse effect on the immediate landscape at Year 0, and negligible to minor adverse effect on the landscape beyond. By Year 15, this is likely to result in a moderate adverse effect once structural planting has established. Beyond the site, the proposals will have only a negligible or minor adverse effect by year 15.

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AoS5: To protect and conserve heritage assets in a manner appropriate to their significance

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on heritage assets.	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the road network. Increased capacity of the network will result in a small increase in levels of road traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in levels of road traffic may lead to localised negative impacts on setting of cultural heritage, including designated sites, although the extent of impacts will depend on the location of developments. Evidence: TASM modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 with respect to the baseline. Transport and the Historic Environment (English Heritage, 2004) explains that increasing levels of traffic are gradually eroding the quality of the historic environment through traffic blight.
Smart Motorways: impacts on sites, features and areas of historical and cultural value.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of Smart Motorways. For most schemes, scoping exercises are likely to identify that Smart Motorways projects are contained within the 'disturbed' highway boundary, therefore impacts on the buried archaeology resource, including designated sites, are considered to be unlikely although still possible. Evidence: The Birmingham Box Phase 3 Managed Motorways AST states that there would be no impacts on the below ground archaeological resource as all works were within highway boundary. Impacts on the built heritage and historic landscape would be through local visual intrusion on their setting, but are not significant.
Smart Motorways: impacts on setting of sites, features and areas of historical and cultural value due to associated infrastructure (e.g. gantries).	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of Smart Motorways. This is likely to result in the construction of additional infrastructure such as gantries. Impacts are likely to be limited to receptors off site, including sites, features and areas of historical and cultural value and designated sites. . Impacts would be through local visual intrusion on their setting, but are unlikely to be significant, due to the fact that the motorway already exists at that location. Impacts will depend on the location of schemes. Evidence: The Birmingham Box Phase 3 Managed Motorways AST states that the incorporation of gantries on elevated sections of the motorway would give rise to minor impacts as a result of localised changes within the motorway corridor.
Implementation of trunk road upgrades: impact on sites, features and areas of historical and cultural value due to development on previously undeveloped land outside of HA boundary.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	The NPS supports a large programme of trunk road upgrades, potentially including installing dual lanes and grade separation. Where dual lanes and grade separation is undertaken outside of the existing highway boundary, there is the potential to damage previously undiscovered buried archaeological resource. The probability of this is likely to be larger than Smart Motorways due to the acquisition of undeveloped land potentially outside of the HA boundary. Impacts will depend on the location of schemes. Evidence: The A21 Tonbridge to Pembury Dualling AST states that there is likely to be large adverse impacts as the scheme would require demolition of

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										two Grade II listed buildings & four historic buildings.
Implementation of trunk road upgrades: impacts on setting of sites, features and areas of historical and cultural value due to associated infrastructure (e.g. gantries).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	The NPS supports a large programme of trunk road upgrades, potentially including installing dual lanes and grade separation. These will result in potentially negative impacts on the setting of sites, features and areas of historical and cultural value, and designated sites due to visual impact, noise and lighting from new infrastructure. However, the NPS commits to specific works such as screen planting to remove views from strategic roads from heritage sites in the delivery of new schemes when the opportunity arises. Impacts will depend on the location of schemes. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 80 road schemes evaluated, 43 had an adverse impact on heritage assets, 27 had a neutral impact and 10 had a beneficial impact. It should be noted that the report did not specify the type of heritage impacts from different schemes and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways..
Implementation of cultural heritage enhancement measures for existing road developments: reduced impacts on setting of sites, features and areas of historical and cultural value.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	The NPS supports the implementation of enhancement measures for cultural heritage impacts where existing roads are causing particular impacts on sites, features and areas of cultural and heritage value, and designated sites. Where this occurs, the NPS supports the implementation of works to improve setting, such as planting, screening or earthworks. Evidence: DMRB Volume 10, Section 3 Part 2 HA 108/04 Landscape Management Handbook explains that amenity grass areas, heath and moorland, native species hedges and individual trees help to provide setting and landscape character for heritage sites.
Additional train movements on existing rail network and more carriages on trains: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Large	Various across rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. The addition of trains and carriages to existing railway lines is likely to have a small negative impact on sites, features and areas of cultural and heritage value, and designated sites due to the increase in noise, light and visual impact impacting on setting. Evidence: The Initial Environmental Report for Piccadilly Platforms 15 and 16 and Oxford Road Interventions (2012) states that whilst impacts from the development on setting are not likely to be significant, there may still be some indirect impacts on setting as a result of longer and more frequent trains.

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New rail links, new chords and track widening: impacts on sites, features and areas of historical and cultural value.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Medium	Medium	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. Where development is undertaken outside of the existing railway boundary, there is the potential to damage previously undiscovered buried archaeological resource, sites, features and areas of historical and cultural value, and designated sites. Evidence: Network Rail (Ordsall Chord) Order states that the proposed development has the potential to impact directly and physically upon eight historic buildings during the construction phase. This will include the demolition of the Girder Bridge and Prince's Bridge, the removal of part of the Zig Zag viaduct, and the removal of a cast iron span at the Castlefield end of the MSJ&R viaduct. However, it also states that there will be no significant impacts on sub-surface heritage assets of archaeological interest during the operation of the proposed development. The Environmental Statement Non-Technical Summary for the North Doncaster Chord states that there will be significant residual effects on cultural heritage as a result of the loss of sections of historic field boundaries and a parish boundary.
New rail links, new chords and track widening: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Medium	Medium	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. These measures are likely to result in large negative impacts on the setting of sites, features and areas of cultural and heritage value, and designated sites due to visual impact, noise and lighting from new infrastructure. Evidence: Network Rail (Ordsall Chord) Order states that 13 heritage assets, in the form of historic buildings, in the vicinity of the scheme may be impacted upon in terms of visual impacts as a result of changes to their settings. The 13 assets are subject to permanent adverse effects as a result of changes to setting due to the presence of new structures and modifications to existing structures. The Environmental Statement Non-Technical Summary for the North Doncaster Chord states that the visual setting of the former railway cottages at Joan Croft Junction will be affected by the operation of the new viaduct and highway bridge. There will also be a significant adverse effect during operation as a result of the changes to the setting of the unlisted buildings of local historic interest at Joan Croft Junction.
Rail electrification: impact on heritage assets due to overhead power line installation.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. This may require the installation of overhead power lines, therefore, current infrastructure will need to be able to accommodate this change. Direct impacts are likely to sites and features of cultural and heritage value, and designated sites such as bridges that may be demolished or altered to allow sufficient room for the Overhead Line Electrification System (OLE) to pass underneath. Evidence: The Environmental Statement Non-Technical Summary for the Great Western Main Line Electrification Project (April, 2013) states that there may be direct impacts to heritage assets such as bridges to allow sufficient room for the OLE to pass underneath. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that the existing canopies at Pangbourne Station would require cutting back to facilitate the OLE. This would be a minor adverse impact affecting the historic character of the station, resulting in a permanent slight adverse

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										effect. Furthermore, Frouds Lane Overbridge (No. BHL 4551) would be demolished and reconstructed. This would be a permanent major adverse impact, resulting in a large adverse effect.
Rail electrification: impacts on setting of sites, features and areas of historical and cultural value due to over-head power lines.	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network, which will require overhead power lines. This could lead to localised negative impacts on landscape and townscape. This could be significant if located in or close to designated sites such as Areas of Outstanding Natural Beauty, National Parks, etc. Evidence: The Environmental Statement Non-Technical Summary for the Great Western Main Line Electrification Project (April, 2013) states that there will be indirect effects to the setting of heritage assets close to the railway, particularly Gwent Levels which is a Registered Landscape of Outstanding Historic Interest in Wales. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that the addition of Overhead Line Electrification System (OLE) equipment along the Gatehampton Viaduct (No. MLN1 4412) would affect its visual character. The addition of OLE equipment would constitute a permanent minor adverse impact on this high value structure.
SRFIs: impacts due to construction on previously undeveloped land.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on buried archaeological resource. Impacts will be significant if development were to take place on undeveloped land. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some localised impacts on buried archaeology e.g. DIRFT III states that the development of the SRFI site would have a medium adverse direct impact on an earthwork ridge, a ploughed-out ridge and furrows as a result of machine stripping during construction which would remove assets within central and southern parts of the site. Furthermore, there would be a high adverse impact on a number of archaeological assets including ditches, pits, post-holes, barns and several buildings as these would need to be removed or demolished in order for the construction of the SRFI.
SRFIs: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on landscape and townscape. This could be significant if located in or close to designated sites such as Areas of Outstanding Natural Beauty, National Parks, etc. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some localised impacts on cultural heritage e.g. DIRFT III Cultural Heritage and Archaeological Assessment states that there would be a low adverse impact on Motte and Bailey Castle, a Scheduled Ancient Monument due to changes in setting. Furthermore, there would be a number of impacts on undesignated sites due to changes in views as a result of the construction of the SRFI. It was anticipated that here would be a medium adverse impact on the character and setting of the historic landscape during operation of the site.

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AoS6: To preserve, protect and enhance biodiversity

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction (e.g. noise and light disturbance).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks and the development of SRFIs which will have construction impacts on biodiversity, including on internationally, nationally and locally designated sites and areas. Construction impacts are likely to include reduced air quality due to dust generation, habitat loss due to construction compounds and haul roads, light pollution, etc., however, these are likely to be largely mitigated by construction best practice and occur on a short term basis. Evidence: The main impacts arising during the construction phase of the A453 Widening M1 Junction 24 to A52 Nottingham included: direct habitat loss to sites and habitats; direct harm (including mortality) to species; indirect effects on sites through losses of connecting habitats, foraging habitats and ecological networks and corridors; severance and fragmentation effects on other habitats and species; and potential for habitat degradation through pollution during construction, particularly uncontrolled discharges to watercourses.
Cumulative impact of NPS interventions on SRN: increase in road traffic across SRN impacts biodiversity.	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. This is likely to result in indirect impacts on habitat quality due to light and noise pollution as a result of increased road traffic. Evidence: TASM modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. Increased traffic increases the risk of animals being killed by crossing a road which cuts across their traditional territory or foraging routes. For example, some animals will generally continue to travel along established runs, regardless of the presence of a new road, unless prevented from doing so. With regards to flora, air pollutants from road traffic may have effects on local habitats and species, for example certain ferns and lichens are particularly vulnerable to vehicle emissions (Somerset County Council, 2010. Transport Policies Habitats Regulation Assessment).
Smart Motorways: direct impacts on biodiversity (e.g. habitat loss) and indirect impacts on biodiversity (e.g. noise and light disturbance).	Direct/ Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of Smart Motorways. Whilst Smart Motorways are largely located within existing highways boundaries, the additional infrastructure required can lead to some limited loss of habitat as a result of land take and direct disturbance to flora and fauna. They can also move sources of disturbance (i.e. vehicles) closer to ecological receptors. Evidence: The AST for M62 Junction 25-30 Managed Motorway Scheme states that there will be a potential loss of some highway verge of low ecological value. During the construction phase there would be a neutral

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										effect on habitats of lower value within the soft estate and their associated protected species. This was due to the reduction of buffering of adjacent designated sites and loss and severance of habitat within the Highways Agency soft estate. IAN 161/13 states that schemes may result in adverse noise and vibration impacts, as a result of traffic permanently moving closer to receptors.
Road infrastructure measures including pinch point investments, trunk road upgrades and new links and bypasses: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of pinch point investments, a large programme of trunk road upgrades and limited new links and bypasses. These interventions are considered likely to result in large direct impacts on biodiversity, particularly habitat loss due to land take. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact. It should be noted that the nature of these impacts (i.e. direct or indirect) were not identified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways..A1 Elkesley Grade Separated Junction AST states that the scheme resulted in a direct loss of a small extent of habitats that are common to the area and of relatively low value. There is potential to impact on protected reptiles (if present) and ubiquitous nesting birds. The A595 Parton to Lillyhall Improvement ES states that the proposed scheme could have significantly adverse impacts on broadleaved woodland due to the loss of mature, possibly ancient woodland. The loss of terrestrial and pond habitat leading to potential fragmentation of great crested newt populations, could have permanent effects on population viability. Without mitigation, the magnitude of the impacts would be very negative. The A3 Hindhead ES states that over the whole scheme, the negative impacts arise primarily through the loss of habitat in Boundless Copse and Tyndall's Wood, and the subsequent impacts on species of conservation importance, both through direct habitat loss and through disturbance and mortality arising from the operation of the new A3 carriageway.
Road infrastructure measures including pinch point investments, trunk road upgrades and new links and bypasses: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of pinch point investments, a large programme of trunk road upgrades and limited new links and bypasses. These interventions are considered likely to result in indirect impacts on habitat quality due to light and noise generated on national networks as a result of increased proximity of traffic and associated infrastructure to the ecological receptors. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact. It should be noted that the nature of these impacts (i.e. direct or indirect) were not identified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The POPE One Year After evaluation of the A27 Southerham to Beddingham Improvements stated that construction noise, vibration, and general activity would all be likely to have short term impacts on ecology within the area, particularly on ecologically sensitive areas such as the

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										Beddingham Level Grazing Marshes SNCI, and on sensitive bird species such as the Skylark and Yellowhammer. Given the nature conservation value of the ditches in Beddingham Grazing Marsh and Glynde Reach SNCI is high, indirect impacts such as light, noise, water pollution to this site were considered to be slight adverse without mitigation.
Road infrastructure measures including pinch point investments, trunk road upgrades and new links and bypasses: habitat isolation and severance.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of pinch point, a large programme of trunk road upgrades and limited new links and bypasses. These interventions are considered likely to lead to severance and fragmentation effects on habitats and species, due to the introduction of new infrastructure in the form of new roads, junctions and lanes. However, the NPS commits to provide opportunities to preserve, protect and where possible improve biodiversity for example, by providing links across networks to reconnect habitats and ecosystems (through the provision of green bridges for example) in the delivery of new schemes where possible. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact. It should be noted that the nature of these impacts (i.e. direct or indirect) were not identified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The AST for the A453 Widening between the M1 and the A52 states that the habitat loss and severance caused by widening of the road during the construction phase would not increase during the operational phase, however the impact of the severance in the water vole ditches between Thrumpton and Barton-in Fabis would be on-going. This was deemed to be a permanent adverse effect, significant at the local level. Highways Agency: A Review of Bat Mitigation in Relation to Highway Severance describes how roads can have several adverse effects on bat populations including: direct loss of foraging habitat and/or decline in quality (e.g. through change in land use or pollution) affecting insect abundance, direct loss of roosts, severance of flight commuting routes for foraging and dispersal, and bat/vehicle collision mortalities.
Road infrastructure measures including pinch point investments, trunk road upgrades and new links and bypasses: potential reduction in air quality	Indirect	Small negative(-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of pinch point, a large programme of trunk road upgrades and limited new links and bypasses. These interventions are considered likely to increase capacity on the SRN. This, in turn is likely to result in an increase in emissions of air pollutants. Some ecological designations are sensitive to changes in air quality, and as a result, there may be some small negative impacts on sensitive ecological areas as a result in the increase in traffic, where these areas are close to the SRN. Evidence: DMRB HA 207/07 Air Quality (2007) states that some air pollutants will also have an impact on vegetation which can damage vegetation or affect plant health and productivity, with the pollutant of greatest concern being NOx. Furthermore, Natural England's Microeconomic Evidence for the Benefits of Investment in the Environment 2 (MEBIE2) (NERR057) (2014) highlights that air pollution can impact on plant health and agricultural productivity.

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Implementation of biodiversity enhancement measures for existing road developments: reduced impacts on severance of habitats.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	The NPS supports the implementation of measures to address existing habitat severance along certain areas of the existing SRN. These would be targeted works to reconnect habitats and ecosystems wherever possible. Enhancement measures would include the construction of green bridges and the extension of habitats along the length of the network in order to positively impact biodiversity and to reduce the severance associated with road infrastructure. Evidence: In terms of Green Bridges, a report by the European Commission (2008) LIFE Building Up Europe's Green Infrastructure shows that green bridges constructed for large mammals in various locations in Europe have helped to restore crucial habitat and food sources and increased genetic flow between fragmented populations. Furthermore, evaluation of evidence by DfT and East Sussex for the Bexhill to Hastings Link Road (2012) shows that a green bridge is likely to be included within the scheme. It is thought that the bridge will particularly benefit dormouse and bats as it will provide a link between habitats. Furthermore, biodiversity is likely to be improved as the bridge will be planted with indigenous shrubs. Whilst the bridge would reduce severance for a number of species, it would not reduce severance for waterborne species.
Additional train movements on existing rail network and more carriages on trains: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. The addition of trains and carriages to existing railway lines is likely to have a small negative impact on biodiversity due to an increase in noise and lighting pollution generated on national networks. Evidence: English Nature (Rail construction and operational effects on biodiversity and geological interests, 2002) highlights that secondary impacts of linear projects such as railways include noise, artificial lighting and wildlife casualties. Railways provide corridors for a wide range of flora and fauna and enhance connectivity between sites. It is thought that this is because of the relative lack of human disturbance. However, the attraction of animals to railway corridors is also likely to lead to an increase in mortality due to rail movements. In turn, this indicates that an increase in train movements and disturbance is likely to lead to a negative impact on biodiversity. Furthermore, the Bat Conservation Trust (Bats and lighting in the UK, 2008) notes that artificial lighting can delay bats from emerging from their roosts and shortens the amount of time spent foraging and can impact the feeding behaviour of bats. They also note that bright light may reduce social flight activity.
New rail links, new chords and track widening: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. These interventions are considered likely to result in large direct impacts on biodiversity, particularly habitat loss due to land take. Evidence: The Ecological Impact Assessment for the new Croxley rail link demonstrated that the proposed development would not have a significant effect on habitats of greater than local importance. However, in terms of species, it was predicted that the loss of existing planting would fragment existing commuting routes for bats and reduce foraging habitat and there could be disturbance of a badgers. This includes the disturbance of a sett located 30m away from the proposed link and the risk that badgers could be

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										killed or harmed as a result of collisions and that some badgers may be deterred from using established commuting routes where this would require them to cross a newly active railway corridor (Mouchel, 2011. Croxley Rail Link Environmental Statement).
New rail links, new chords and track widening: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. These interventions are considered likely to result in indirect impacts on habitat quality due to light and noise pollution generated on national networks as a result of new rail activity and increased proximity to ecological receptors. Evidence: English Nature (Rail construction and operational effects on biodiversity and geological interests, 2002) highlights that secondary impacts of linear projects such as railways include noise, artificial lighting and wildlife casualties. Railways provide corridors for a wide range of flora and fauna and enhance connectivity between sites. It is thought that this is because of the relative lack of human disturbance. However, the attraction of animals to railway corridors is also likely to lead to an increase in mortality due to rail movements. In turn, this indicates that an increase in train movements and disturbance is likely to lead to a negative impact on biodiversity. Furthermore, the Bat Conservation Trust (Bats and lighting in the UK, 2008) notes that artificial lighting can delay bats from emerging from their roosts and shortens the amount of time spent foraging and can impact the feeding behaviour of bats. They also note that bright light may reduce social flight activity.
New rail links, new chords and track widening: habitat isolation and severance.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. These interventions are considered likely to lead to severance and fragmentation effects on habitats and species, due to the introduction of new infrastructures such as tracks and platforms. Evidence: The Ecological Impact Assessment for the new Croxley rail link demonstrated that the proposed development would not have a significant effect on habitats of greater than local importance. However, in terms of species, it was predicted that: the loss of existing planting would fragment existing commuting routes for bats and reduce foraging habitat and there could be disturbance of a badgers. This includes the disturbance of a sett located 30m away from the proposed link and the risk that badgers could be killed or harmed as a result of collisions and that some badgers may be deterred from using established commuting routes where this would require them to cross a newly active railway corridor (Mouchel, 2011. Croxley Rail Link Environmental Statement).

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Rail electrification: Severance flight paths and direct mortality of birds and bats due to overhead cabling.	Direct	Small negative (-)	Longer term (20+ years)	Low (20-40%)	Medium	Small	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of railways which will require the installation of new infrastructure. Schemes may cause localised disruption to bat commuting routes where line side vegetation is cleared, and there may be a potential risk of collision with overhead lines or supports by bats or birds. Evidence: Great Western Main Line Electrification Project (April, 2013) states that the works may cause noise or visual disturbance of notable animals using habitats on or adjacent to line, including the presence of construction staff, machinery, and lighting. This disturbance may potentially affect habitat such as flight paths for birds and bats. The Scheme may also cause localised disruption to bat commuting routes where line side vegetation is cleared, introducing potential risk of collision with overhead lines or supports by bats or birds.
SRFIs: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to some direct habitat loss during their construction. However, it is considered unlikely that this will be high value habitat should the development occur on previously developed land. Evidence: Environmental Statement for SRFIs e.g. DIRFT III states that the majority of habitats south of the Clifton Brook Tributary are to be lost to facilitate the proposed development. The nature and scale of the proposed development are such that this level of habitat loss is necessary in order to provide sufficient area for the development footprint. Construction of the proposed development will result in the direct loss (on a phased basis) of all semi-improved grassland, hedgerows and ponds south of Lilbourne Meadows, as well as extensive areas of improved pasture.
SRFIs: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and will operate 24 hours a day. They will include use of artificial lighting and will generate noise, however these would be designed to industry standards to minimise impacts. Evidence: Environmental Statement for SRFIs e.g. DIRFT III states that operational impacts on bats could arise through the inappropriate positioning of lighting (Myotis sp. and Brown Long-eared bats being particularly susceptible to lighting), which could impact on bat foraging areas and commuting corridors, an impact considered to be of minor adverse significance at the international level. Best practice measures for the lighting industry will be followed, with reference to guidelines produced by the Institution of Lighting Professionals. Careful design of the lighting scheme will ensure that potential impacts on important bat foraging areas and commuting corridors are avoided.
SRFIs: habitat isolation and severance.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are substantial developments and may lead to some habitat severance and/or isolation. Evidence: Environmental Statements have identified potential for habitat fragmentation due to the development of SRFIs. DIRFT III, for example, states that there will be loss and severance of the hedgerows as part of the construction of the proposed development which may inhibit foraging and

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										commuting opportunities for bats, however, this has been classed as minor significance due to the low level of activity at the proposed site.

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AoS7: To ensure the protection of water resources (quantity)

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI developments: impacts on water use.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks and the development of SRFIs. Construction works use water and therefore small magnitude, localised adverse impacts on both surface and groundwater resources (quantity) are expected for the infrastructure measures proposed. These are likely to be site specific and will be largely mitigated through standard procedures incorporated into the design. Evidence: Water use in the Highways Agency supply chain includes water embodied within materials and products associated with their services and that used during construction. Using the Highways Agency Water Footprint for 2009/10, Managing Agent Contractor (MAC) and Design, Build, Finance and Operate (DBFO) schemes used in the region of 400,000-530,000m³ of water per annum. During the construction process, the primary uses of water were for dust suppression and wheel washing. Research undertaken by the Strategic Forum for Construction estimates that the construction industry uses approximately 14 million m³ of water per year in England and Wales which accounts for approximately 0.12% of total water use.

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AoS8: To encourage the protection of water quality

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of NPS interventions on SRN: increase in road traffic across SRN increases risk of impact on water quality.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to an increased risk of localised negative impacts on water quality (in terms of both its chemical and ecological content), although the extent of impacts will depend on the locations of developments. These impacts are likely to be influenced by factors such as proximity of national networks to watercourses, and levels of traffic flow. Evidence: TASM Modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. DMRB, Volume 11, Section 3, Part 10 HD 45/09. Road Drainage and the Water Environment states that where traffic levels are high the level of contamination increases and therefore, the potential for unacceptable harm being caused to the receiving water also increases.
New road and rail developments: introduction of new potential sources of pollution increases risk of impact on water quality.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across England	Permanent	Irreversible	The NPS supports an extensive programme of road and rail investments. There are potential risks to water resources (both surface and groundwater) associated with highways and rail activity, including the increase in impermeable surfaces which increase runoff (and sediments/contaminants) to watercourses. In some instances, the inclusion of catch pits, balancing ponds and interceptors, would result in a slight benefit to water quality and conveyance of flow, however, this benefit over baseline conditions would only occur when existing schemes are being upgraded rather than for new infrastructure. However, the NPS commits to mitigating the impacts of new schemes where there may be an impact on water quality. Therefore, negative impacts would be minimised wherever possible. Evidence: The Highways Agency DMRB Volume 11 HD45/09 states that pollution from road drainage can arise from a variety of sources including general vehicle and road degradation, incomplete fuel combustion, leaks of oil, fuel or other pollutants, fires and atmospheric deposition. Road runoff may also contain runoff from adjacent properties or agricultural land. CIRIA C643 (The potential for Water Pollution from Railways) states that the operation of a railway, both historic and current, has the potential to give rise to pollution as water drains from the railway into watercourses. The A1 Elkesley Grade Separated Junction AST states that the scheme could potentially lead to negative impacts on the water quality within the River Poulter and local groundwater through contaminated runoff. Attenuation has been suggested to alleviate these negative impacts. The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that for 79 road schemes assessed, 36 had a neutral impact on water quality, 27 had an adverse impact and 16 had a beneficial impact. Therefore, there are often both adverse and beneficial impacts on water quality. It should be noted that these figures include assessments of the following road schemes: bypasses, road widening,

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										junction improvements and A-road upgrades to motorways.
Implementation of water quality enhancement measures for existing road developments: reduced impacts on water quality.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	The NPS supports the implementation of enhancement measures for water quality impacts (in terms of both chemical and ecological content) where existing roads are causing particular impacts on water quality (both surface and groundwater). Where this occurs, the NPS supports the implementation of works to enhance water quality, such as upgrades of interceptors or balancing ponds. Evidence: The Highways Agency DMRB Volume 11 HD45/09 states that pollution from road drainage can arise from a variety of sources including general vehicle and road degradation, incomplete fuel combustion, leaks of oil, fuel or other pollutants, fires and atmospheric deposition. Road runoff may also contain runoff from adjacent properties or agricultural land. Where assessments show that the risks of pollution from road runoff require mitigation, there are a number of options available to reduce the risk of pollution incidents including swales and balancing ponds. The Highways Agency acknowledges that existing roads may cause issues and note that advice "may be applied to existing roads".
New road, rail and SRFI developments: physical impact on hydrology and hydrogeology.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across England	Permanent	Irreversible	The NPS supports the development of road, rail and SRFI infrastructure across England. This new infrastructure has the potential to impact upon hydrology and hydrogeology due to infrastructure such as culverts being constructed in order to allow the construction of roads, railways and SRFIs. However, there is also the opportunity to upgrade existing sub-standard infrastructure and therefore this may have a beneficial impact on hydrology and hydrogeology. Evidence: DMRB Volume 11 HD45/09 outlines potential impacts arising from road infrastructure on floodplains and water courses. The construction of a new road forms a barrier that may cross existing drainage routes. Existing land drainage should be kept separate from the road drainage where possible, using culverts and ditches beneath the road. Flood defences and other structures such as weirs should be considered when infrastructure is being designed.
SRFIs: introduction of new potential sources of pollution impacts water quality.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SFRIs across England. SRFIs and new rail alignments are considered likely to have a small adverse impact on water quality (both surface and groundwater) over a small spatial extent. However, the NPS encourages the protection of water quality through the requirement for mitigation measures, for example, for SRFIs, areas for storage and unloading with appropriate drainage facilities should be clearly marked. Therefore, negative impacts would be minimised wherever possible. Evidence: St. Albans SRFI Environmental Statement states that the quality of water discharging from paved areas into sewers and watercourses could be adversely affected by the presence of pollutants and sediment, affecting the River Ver. An increase in the quantity of suspended solids such as silt and particles of rubber could be expected in the sewers and watercourses, caused by discharges from roads and paved areas. Dissolved material such as hydrocarbons can be expected from oil on carriageways. Spillages may also have the potential to cause damage to controlled waters.

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AoS9: To contribute towards increase resilience on national networks

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI infrastructure measures: impact on the climate change resilience of the SRN and the rail network through introduction of upgraded adaptation measures within new infrastructure.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports a significant programme of improvements and enhancements to the road and rail networks. The NPS requires consideration of potential impacts of climate change (such as heavy rainfall events causing landslips) in all new infrastructure proposals, which will improve resilience of both new and existing routes. Due to recent events, it could be considered that rail is at greater risk from climate change impacts compared to roads. Evidence: Highways Agency Climate Change Adaptation Framework (2009) states that options assessments will be undertaken for the road network and these options include future-proof designs whereby a precautionary approach will be adopted so that the asset/activity will perform satisfactorily throughout its life in the event of climatic changes towards extreme predictions. Network Rail recognise that a change in climate will have an impact on their assets and activities and in order to address this, they will consider design and build options to ensure long term resilience of railway infrastructure. Further research from the RSSB recommends designing and building for long term resilience (National Rail Climate Change Adaptation Report (2011) and Rail Safety and Standards Board (RSSB) Adapting to Extreme Climate Change Tomorrow's Railway and Climate Change Adaptation (2011)). SRFIs incorporate both rail and road infrastructure and therefore resilience measures will be similar to those above. Network Rail (2014) details that in February 2014, the Great West Mainline at Dawlish was severely impacted by an extreme weather event, with part of the railway collapsing into the sea. Between February and April, the Great West Mainline was closed at Dawlish, disrupting journeys for passengers travelling to Newton Abbot, Plymouth and stations in Cornwall.
Road infrastructure including Smart Motorways, pinch point investments, trunk road upgrades and new links and bypasses: impact on resilience to accidents and incidents of the SRN.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of Smart Motorways and pinch point investments, a large programme of trunk road upgrades and limited new links and bypasses. Accidents and incidents on the road network are significantly influenced by speed, with lower speeds usually leading to a reduction in the severity of accidents that may occur. Smart Motorways allow speeds to be controlled, and therefore lowered, as well as drivers informed of incidents up ahead. Where Smart Motorways have been implemented in the UK, the positive impact on accidents and incidents has been shown. In addition, the programme of trunk road upgrades, new roads and pinch point investments mean that when an incident does occur, the speed with which national networks are re-opened after security and other incidents on them is greater, and national networks are likely to return to normal traffic flow more quickly than would be the case without the upgrades. Evidence: The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), a total number of 138 accidents have been prevented in the opening year which equates to a

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										saving of an average of 3.1 per scheme. The M42 MM Monitoring and Evaluation Three Year Safety Review on the M42 Managed Motorway scheme shows that personal injury accidents (PIA) have reduced by 50% since opening. Furthermore on the Smart Motorway scheme along the M40 between junctions 16 and 3A of the M42, the number and severity of accidents decreased (Highways Agency, 2011). Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes including trunk road upgrades and new links and bypasses.

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AoS10: To minimise the impact on soil and land resources including contamination and loss

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI developments: localised impacts on soil and land resources arising from limited new road and rail alignments and SRFIs: loss (if greenfield sites).	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports an extensive programme of road and rail developments, and supports the development of SRFIs. New infrastructure that is proposed on greenfield sites may result in localised adverse impacts, and possibly the loss of soil and land resources. The probability of infrastructure being built on greenfield sites is limited as most work will be carried out within or near to the existing highway or railway boundary. It should be noted that impacts are likely to be dependent on the location of developments. Evidence: Industry Profile – Railway Land (Department of Environment, 1995) identifies contamination risks associated with railways. The on-line dualling of the A21 between Tonbridge and Pembury impacts on ancient woodland, other nature conservation sites, a Scheduled Ancient Monument, Listed Buildings and an Area of Outstanding Natural Beauty. In addition, the A11 Fiveways to Thetford Improvement AST states that there would be slight adverse impacts through the loss of woodland and farmland.
New road, rail and SRFI infrastructure: impacts from ground contamination (e.g. mobilisation of contaminants, brownfield sites).	Direct	Small negative (-)	Longer term (20+ years)	Negligible (<25%)	Small	Large	Various across England	Permanent	Irreversible	The NPS supports an extensive programme of road and rail developments, and supports the development of SRFIs. This includes new infrastructure that could be developed on greenfield or brownfield sites. Such development inherently results in risks relating to ground contamination. However, the development of brownfield sites operates within strict controls and impacts are likely to be mitigated to an acceptable level for all developments. However, an inherent risk of contamination still remains. It should be noted that impacts are likely to be dependent on the location of developments. Evidence: Design Manual for Roads and Bridges Volume 4: Geotechnics and Drainage. (HD 22/08) states that a discussion of potential contamination and proposed remediation requirements (if required) shall be included in the Geotechnical Design Report. This includes a summary of the findings and conclusions of the risk assessments including the site remediation requirements that have been agreed with regulatory authorities.

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AoS11: To minimise the use of previously undeveloped land

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: Road and rail alignments along with SRFIs may be built on previously undeveloped land.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports an extensive programme of road and rail developments and supports the development of SRFIs. Road and rail alignments and widening schemes and SRFIs may involve the use of previously undeveloped land. Evidence: The report, 'Keeping Britain Moving', produced by McKinsey & Company (2011) states that around 75% of all UK transport projects are built on brownfield land, compared with about 55% in continental Europe or the United States.

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AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure including road resurfacing: use of materials in the construction phase impacts on the waste infrastructure.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	The NPS supports an extensive programme of road and rail developments, including road resurfacing and supports the development of SRFIs. The construction of infrastructure will involve the use of large amounts of material (both raw and recycled). The material used will be sourced in accordance with industry standard good practice guidelines to encourage the use of recovered materials. Evidence: Non-statutory guidance for Site Waste Management Plans (Defra) aims to improve materials resource efficiency, by promoting the economic use of construction materials and methods so that waste is minimised and any waste that is produced can be re-used, recycled or recovered in other ways before disposal options are explored. The Highways Agency A421 Improvement used 450,000 tonnes of recycled aggregates in the build, including the asphalt surface, avoiding the need for traditional quarried materials (The Green Construction Board, 2013).

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AoS13: To contribute towards reducing the risk of flooding in the hinterland

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: disturbance to local flood regime and drainage hydrology due to building of new infrastructure (or introduction of additional impermeable surfaces) impacts on the risk of flooding.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across England	Permanent	Irreversible	The NPS supports an extensive programme of road and rail investments and supports the development of SRFIs. The NPS states that there is a requirement for a Flood Risk Assessment to be undertaken at each development site, which includes taking into account climate change impacts. Furthermore, the NPS commits to mitigating flood risk impacts in the hinterland of new schemes. This will be influenced by factors such as areas of hard standing, design standards for drainage systems, interactions of national networks with flood plains and watercourses and maintenance standards. The design of all new infrastructure will incorporate mitigation measures relating to any adverse impacts on local hydrology. This is likely to impact upon people, property and ecosystems. It should be noted that impacts are likely to be dependent on the location of developments. Evidence: The AST for the A6 Clapham Bypass scheme states that even with mitigation, there may still be an impact on flood risk as the scheme is within a floodplain and also bridges a river. A moderate adverse impact was predicted overall.
Implementation of flooding mitigation measures for existing road developments: reduced impacts on existing drainage infrastructure and flooding.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports the implementation of mitigation for existing flooding problems at locations along the existing SRN where inadequate drainage is in place or where existing sections of the network are vulnerable to flooding (either now or in the future as a result of climate change) and/or those sections contribute to flooding of people or land adjacent to the network. At these locations, improvements will be sought (either through specific schemes or where the opportunity arises on other schemes) through techniques such as the implementation of Sustainable Drainage Systems, improved maintenance practices, contingency planning measures or collaborative schemes with flood risk authorities. This will impact upon people, property and ecosystems. Evidence: The Environment Agency 2009 (Flooding in England: A national assessment of flood risk) shows that 10% of major roads and 20% of railways are at risk of flooding. The road and rail network have both experienced the impact of serious flood events, for example in 2007, there were 10,000 motorists trapped on the M5 motorway due to a flood event. This demonstrates that there are parts of the network where flood risk is an issue. The Highways Agency website states that the A36 Steeple Langford improvements are driven by several incidents of carriageway flooding that have been observed in recent years. The scheme will help to reduce incidences of flooding on this section of the A36.

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AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction of new road, rail and SRFI infrastructure: disruption during the construction period likely to cause congestion which may lead to additional accidents and incidents.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	The NPS supports an extensive programme of road developments, including resurfacing and the development of SRFIs. The construction phases of these works are likely to lead to localised disruption and congestion on the road network, which can in turn lead to an increase in accidents and incident risk. Evidence: Institute for Road Safety Research (SWOV), 2010. Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity decreases, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease.
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN leads to increased traffic resulting in an increase in accidents and incidents.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the road network. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. These increased traffic levels are likely to have a cumulative impact on the number of accidents and incident risk across the wider network. However, the NPS interventions commit to improving the perception of road safety for Non-Motorised Users (NMUs), which in turn, may reduce the number of incidents in terms of NMUs Evidence: TASM Modelling of an NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in 2040 in 2040 in the Do NPS with respect to the baseline. However, even with an increase in traffic, the central scenario forecasts that congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity decreases, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease. The Institute for Road Safety Research (SWOV), 2010.
Programme of maintenance on the SRN, including resurfacing: reduce likelihood of accidents and incidents due to optimum road surfacing from a safety perspective.	Direct	Small positive (+)	Long term (10-20 years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of road resurfacing on the SRN. This is likely to reduce the number of accidents on the SRN as a result of an improved road surface. Evidence: The RAC Foundation The Economics of Road Maintenance (2013) suggests that poor road maintenance can lead to an increase in accidents on the road network. The Design Manual for Roads and Bridges (DMRB) Volume 7 HD37/06 details the standards with which new road surfacing must comply in terms of skid resistance. Therefore, new road surfaces will comply with the latest standards and are likely to be an improvement over existing surfacing, thereby reducing the risk of accidents and incidents on the SRN.
Smart Motorways: reduce the number and severity of accidents and incidents on	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. Accidents and incidents on the road network are significantly influenced by speed, with lower speeds usually leading to a reduction in accident risk and the

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the SRN.										severity of those accidents which occur. Smart Motorways allow speeds to be controlled, and therefore lowered, as well as drivers informed of incidents up ahead. Smart Motorways are most often utilised during peak traffic flows. Where Smart Motorways have been implemented in the UK, a positive impact on accidents and incidents has been shown. Evidence: Highways Agency, 2011. M42 MM Monitoring and Evaluation Three Year Safety Review shows that on the M42 Managed Motorway scheme, personal injury accidents (PIA) have reduced by at least 50% since opening in 2006.
Road infrastructure including pinch point investments and trunk road upgrades: reduce the number and severity of accidents and incidents on the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	The NPS supports an extensive programme of pinch points and a large programme of trunk road upgrades. New highways developments provide an opportunity to make significant safety improvements. Some developments have safety as a key objective, but even where safety is not the main driver of a development, there will be the opportunity to introduce the most modern and effective safety measures. Therefore, this is likely to reduce accident and incident risk on the SRN. Evidence: The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), a total number of 138 accidents have been prevented in the opening year which equates to a saving of an average of 3.1 per scheme. HA Post Opening Project Evaluations (POPEs) show safety benefits of various infrastructure upgrades, e.g. M62 Junction 6 upgrade led to 5.6 less accidents per year, and dualling of the A30 Bodmin to Indian Queens led to annual saving of 84 Personal Injury Accidents compared to 5 years before opening. Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes and is not limited to trunk road upgrades.
New links and bypasses: reduction in flows on alternative links where new link is introduced thereby reducing the probability of incidents and accidents.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. Where these new roads take traffic off alternative routes (i.e. bypasses), especially where the traffic is reduced in town and village centre, there is likely to be a reduction of accidents and incidents on the roads where traffic has been reduced. In addition, new highways developments provide an opportunity to make significant safety improvements. Some developments have safety as a key objective, but even where safety is not the main driver of a development, there will be the opportunity to introduce the most modern and effective safety measures. Therefore, overall, new road links are likely to reduce the accident and incident risk on the SRN. Evidence: HA Post Opening Project Evaluations (POPEs) show safety benefits of various infrastructure upgrades, e.g. A21 Lamberhurst Bypass new dual carriageway led to halving of accident rate along former route and the A500 Basford, Hough and Shavington Bypass new dual carriageway led to a 50% reduction in PIAs and casualties on the old A500. Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road

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										schemes and is not limited to new links and bypasses.
SRFIs: modal shift from road to rail reduces accidents and incidents on the wider road network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are expected to result in a modal shift from road to rail and the resulting reduction of large freight vehicles on the road is likely to reduce the number of accidents and incidents on the SRN. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that each freight train could take approximately 60 lorry journeys off the road. However, for the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. It has been estimated that the use of rail for freight movements reduces road casualties by 500 per year (Network Rail, Value and Importance of Freight, 2010). This is also noted in the Daventry International Rail Freight Terminal Needs Case.

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AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
All NPS interventions: it is considered unlikely that there will be any impacts on crime or fear of crime as a result of the interventions contained within the NPS.	N/A									

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AoS16: To contribute towards the maximisation of user benefits on the National Networks

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction: road resurfacing and the construction of infrastructure measures causing disruption during the construction period and this is likely to cause congestion and therefore increased journey times which reduces user benefits.	Direct	Small negative (-)	Short term (0-5 years)	High (>75%)	Large	Medium	Various across SRN	Temporary	Reversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks, including resurfacing and the development of SRFIs. The disruption caused by this resurfacing programme is likely to impact on user benefits due to increased journey times. Evidence: Press releases from the Highways Agency show that the majority of resurfacing takes place overnight which is likely to reduce the impacts on congestion on the SRN. However, during these overnight periods, the roads are often closed and traffic is diverted to alternative routes which would also have an impact on congestion on local roads. This change in congestion is likely to have a subsequent impact on journey times and therefore user benefits.
Cumulative impact of NPS interventions on SRN: reduction in congestion across the SRN reduces journey times and increases journey time reliability and in turn improves user benefits.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the road network. Increased capacity is likely to reduce congestion due to smoother flow of traffic and reduced journey times leading to user benefits across the wider network. For example, road infrastructure measures including trunk road upgrades, pinch point investments ,new links and bypasses and Smart Motorways are likely to increase capacity which reduces congestion and journey times, resulting in user benefits and imprived levels of service on the SRN. Impacts will vary depending on the location of the developments. Evidence: TASM modelling of a do NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS scenario with respect to the baseline. However, even with an increase in traffic, the central scenario forecasts that congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. This reduction in congestion is likely to improve journey times across the road network and in turn create user benefits. The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), the total journey time savings amounts to 1.89 million vehicle hours or 42,000 hours per scheme on average.

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Additional train movements on existing rail network and more carriages on trains: an increase in rail movements will reduce journey times and overcrowding on the rail network and therefore improve user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. This will be focused on routes in and out of, and between, major cities. An increase in the number of trains is likely improve the level of service and in turn, reduce journey times for some users and therefore positively impact on user benefits. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 75 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 75 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: new links and an increase in capacity of existing lines will reduce journey times and overcrowding on the rail network and therefore improve user benefits.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. This is likely to increase capacity of the rail network and therefore result in journey time savings, which will positively impact on user benefits. Evidence: The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds (Network Rail, 2013, Northern Hub Factsheet). The Nuneaton North Chord has recently opened and therefore actual impacts of the development have not been assessed. However, the Needs Case for the project anticipated that the provision of a new section of track to allow increased freight trains to use the line and increase the reliability of passenger trains. This would allow 24 freight trains per day to travel between Felixstowe and Nuneaton (compared to up to 10 trains per day previously). Furthermore, the freeing up of the line for passenger trains would benefit users of the line by £482 million and non-users by £135 million through reduced congestion on the roads (Network Rail, 2010. Nuneaton North Chord Order Statement of Case of the Applicant).
Rail electrification: reduction of journey times which improves user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. Electrification has been shown to improve acceleration and deceleration times and have greater reliability due to lower failure rates compared to diesel trains. This therefore results in an improved level of service, and in turn, user benefits due to the reduced journey times on electrified lines. Evidence: The Network RUS Electrification report (Network Rail, 2009) states that electric trains have a lower failure rate compared to diesel trains and

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										overall electrification improves system reliability. In addition electric trains accelerate and decelerate quicker than diesel trains, which over long journeys, improve journey times.
SRFIs: modal shift from road to rail reduces congestion on the SRN which in turn reduces journey times and improves user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. They are likely to result in a modal shift of freight from road to rail thereby reducing the number of lorries on the SRN which reduces congestion and results in user benefits of reduced journey times. Evidence: Each freight train takes approximately 60 lorries of the road (Network Rail, Value and Importance of Freight, 2010). However, for the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Furthermore, the Environmental Statement for Daventry International Rail Freight Terminal highlights that the modal shift of freight from road to rail reduces congestion and this therefore benefits users of the SRN as journey times are reduced.

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AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction: road resurfacing and infrastructure measures lead to disruption during construction period and this is likely to cause congestion and therefore increased journey times.	Direct	Small negative (-)	Short term (0-5 years)	High (>75%)	Large	Large	Various across SRN	Temporary	Reversible	The NPS supports a significant package of improvements and enhancements across the road and rail networks, including resurfacing and the development of SRFIs. The disruption (including congestion and delays on the national networks) caused by this resurfacing and infrastructure programme is likely to negatively impact on congestion during construction periods and therefore journey times and reliability. Evidence: Press releases from the Highways Agency show that the majority of resurfacing takes place overnight which is likely to reduce the impacts on congestion on the SRN. However, during these overnight periods, the roads are closed and traffic is diverted on to alternative routes. This is likely to have an impact on congestion and therefore journey time reliability on local roads. The construction of Smart Motorways, for example, usually involves hard shoulder closures, narrower lanes and safety barriers in place, as a 50mph speed restriction is implemented for the safety of drivers and road workers. This can lead to increased congestion and slow moving traffic. The AST for the M25 Junction 5-7 Managed Motorway – All Lane Running states that there will be delays to all users during the construction and future maintenance of the scheme.
Cumulative impact of NPS interventions on SRN: increase in capacity of the SRN reduces congestion.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. This increased capacity is likely to reduce congestion and increase journey time reliability due to smoother flow of traffic and reduced journey times across the wider network. Evidence: TASM modelling forecasts that in the central scenario, traffic on the SRN will increase by 1.03% by 2040 with the implementation of the NPS. However, even with an increase in traffic, TASM shows that congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. This is likely to improve journey time reliability across the SRN. The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), the total journey time savings amounts to 1.89 million vehicle hours or 42,000 hours per scheme on average.
Smart Motorways: increase capacity and reliability and reduce congestion on the SRN.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. Smart Motorways offer the ability to manage speeds to manage congestion. Reduced congestion leads to increased speeds, meaning journey time savings and increased journey time reliability on national networks. Evidence: Highways Agency, 2011 Birmingham Box Managed Motorway Phases 1&2 Year 3 Summary Report shows that the scheme has had an impact on variations in average traffic speeds which make journeys smoother. Users have also reported a significant reduction in stop/start conditions on parts of the scheme. Furthermore, the Environmental Assessment Report for the M6 Junction 10a to 13 Smart Motorway scheme states that this improvement would relieve congestion and smooth the flow of the traffic by increasing route capacity and regulating speed during busy

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										times. This will also improve safety and journey time reliability.
Additional train movements on existing rail network and more carriages on trains: an increase in capacity will reduce congestion and overcrowding on the rail network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. This will be focused on routes in and out of, and between, major cities. An increase in the number of trains and carriages will increase capacity across the rail network and in turn reduce congestion and overcrowding. Evidence: Modelling of HLOS 2 schemes shows that all schemes combined will have a benefit cost ratio of 4.1. These benefits include time savings, crowding relief and decreasing congestion for road users. Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 75 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 75 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: new links and an increase in the capacity of existing lines will reduce congestion and overcrowding.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. This will increase capacity across the rail network and in turn reduce congestion, delays and overcrowding. A reduction in congestion and an increase in capacity is likely to result in increased journey time reliability. Evidence: Modelling of HLOS 2 schemes shows that all schemes combined will have a benefit cost ratio of 4.1. These benefits include time savings, crowding relieve and decreasing congestion for road users. The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds. It is also expected that an additional 700 trains will be able to run each day by 2019, allowing additional capacity for 44 million passengers per year. It will also potentially create between 20,000 and 30,000 jobs (Network Rail, 2013, Northern Hub Factsheet). The North Doncaster Chord (part of the East Coast Mainline between Yorkshire and London) will divert slow-moving freight trains from a key pinch point, thus allowing additional passenger trains to use the line. This increase in the frequency of passenger trains will improve long distance journeys and in turn will improve access to employment centres (Mott MacDonald and Network Rail, 2011. North Doncaster Chord Environmental Statement Non-Technical Summary).
Rail electrification: increase capacity and reliability and therefore reduce journey	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	The NPS supports an extensive programme of electrification of the rail network. Electrification has been shown to improve acceleration and deceleration times and have greater reliability due to lower failure rates

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times.										compared to diesel trains. In addition, electric trains have increased capacity due to the lack of requirement for power cars that diesel trains need. This therefore results in reduced journey times and congestion, and increased reliability on electrified lines. Evidence: Network RUS Electrification, Network Rail, 2009. Electric trains have a lower failure rate compared to diesel trains and overall electrification improves system reliability. However, failures of overhead equipment can cause delays on electrified routes. Furthermore, electric trains do not require a separate power car, which in turn increases the capacity of the train. Electric trains accelerate and decelerate quicker than diesel trains, which over long journeys, improve journey times.
SRFIs: modal shift from road to rail reduces congestion on the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. They are likely to result in a modal shift of freight from road to rail thereby reducing the number of lorries on the SRN, which in turn reduces levels of congestion, delays and increases journey time reliability. Evidence: The Environmental Statement for Daventry International Rail Freight Terminal highlights that the modal shift of freight from road to rail reduces congestion and increases journey time reliability.

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AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of NPS interventions on SRN: increase in road capacity across SRN results in improved access.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall, the NPS interventions aim to increase capacity on the SRN. It is likely that this will result in improved access to employment centre and regeneration areas, although this will depend on the location of developments. Road infrastructure measures including Smart Motorways, trunk road upgrades and pinch point investments are considered likely to result in reductions in congestion, in turn leading to increased access to regeneration areas, employment centres, deprived areas and areas of high unemployment. Evidence: TASM Modelling of an NPS investment scenario forecasts that in the central scenario the implementation of the NPS could reduce congestion on the SRN by 39.8% compared to 2040 baseline levels. This reduction in congestion is likely to increase the capacity of the road network and therefore improve access. The nature of impacts will depend on the locations of developments. The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that anecdotal evidence suggests that a number of major schemes have helped to facilitate local and regional economic development by reducing congestion and improving journey time reliability. It should be noted that POPE Meta-Analysis includes assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The M25 J30/A13 Corridor Stage 1 Environmental Impact Report (EIR) (for grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has the potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 75-160 due to lessening of transport constraints. In addition, the Birmingham Box Managed Motorway Scheme EIR predicted that the scheme would have a positive impact on regeneration areas in the West Midlands as it would make it easier for people to access employment opportunities.
Additional train movements on existing rail network and more carriages on trains: improvements to the railway network increases access to regeneration areas, employment centres and areas of high unemployment.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across the rail network	Permanent	Irreversible	The NPS supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. This will be focused on routes in and out of, and between major cities. The improvement of existing lines in terms of capacity and reliability are likely to result in improved access to regeneration areas, deprived areas and areas of high unemployment through improved journey times. Impacts will be dependent on the location of developments. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 75 additional carriages will be provided on trains running on the TransPennine express route from Glasgow

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										to London and on the London Midlands route will receive up to 75 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: improvements to the railway network increases access to regeneration areas, employment centres and areas of high unemployment.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Various across the rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening. These new rail links are likely to increase the accessibility to and from employment and regeneration areas due to the facilitation of new rail services, and increase in capacity on existing lines, and, in limited cases, a greater proximity to the rail network. Impacts will be dependent on the location of developments. Evidence: The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds. It is also expected that an additional 700 trains will be able to run each day by 2019, allowing additional capacity for 44 million passengers per year. It will also potentially create between 20,000 and 30,000 jobs (Network Rail, 2013, Northern Hub Factsheet). The North Doncaster Chord (part of the East Coast Mainline between Yorkshire and London) will divert slow-moving freight trains from a key pinch point, thus allowing additional passenger trains to use the line. This increase in the frequency of passenger trains will improve long distance journeys and in turn will improve access to employment centres (Mott MacDonald and Network Rail, 2011. North Doncaster Chord Environmental Statement Non-Technical Summary).
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to facilitate the use of the national networks for non-car users, which can help with access to regeneration areas, and employment centres. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income and that poor transport impacts social exclusion and deprivation. By improving accessibility to national networks through the use of non-car modes, accessibility to the jobs, services and social networks are likely to be improved.

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AoS19: To contribute towards the improvement of accessibility to rural areas

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of NPS interventions on SRN: increase in road capacity across SRN results in improved access.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall, the NPS interventions aim to increase capacity on the SRN. It is likely that this will result in improved access to rural areas and green spaces from regionally/nationally strategic locations, although this will depend on the location of developments. For example, Smart Motorways, trunk road upgrades, and pinch point investments are considered likely to reduce congestion and journey times and therefore improve accessibility to rural communities. Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario implementation of the NPS will reduce congestion on the SRN by 39.8% compared to 2040 baseline levels. This reduction in congestion is likely to increase the capacity of the road network and therefore improve access to rural areas, although the impacts will depend on the location of developments. HA Post Opening Project Evaluations (POPEs) show that trunk road upgrades along the A30 from Bodmin to Indian Queens has resulted in a 19% increase in traffic using the route and more reliable journey times compared to the previous route.
New links and bypasses: additional routes increases access to and from rural areas.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Medium	Medium	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. Where these new links and bypasses are located close to or within rural communities, access to the SRN for those living in, or wishing to visit rural communities is improved. Impacts will be dependent on the location of developments. Evidence: There are examples of schemes that have improved access to rural areas. The A249 Iwade to Queenborough Improvement involved improved access between north Kent and the Isle of Sheppey via a new bridge. The scheme has been crucial for promoting economic growth in these areas (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013). The HA Post Opening Project Evaluations (POPEs) for the A38 Dobwalls bypass in Cornwall shows that this scheme is attributed to a 4.4% rise in traffic using the A38 corridor. The A5 Nesscliffe bypass in Shropshire has increased levels of vehicles using the road by 5% between the first year and fifth year since opening.

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New rail links, new chords and track widening, and additional train movements on existing rail network and more carriages on trains, and rail electrification: improvements to the railway network increases accessibility.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across the rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening, as well as a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. It also supports an extensive programme of electrification. The improvement of existing lines in terms of capacity and reliability, and the new rail links are likely to result in improved access to rural areas and green spaces from regionally/nationally strategic locations. Impacts will be dependent on the location of developments. Evidence: A report commissioned by The Scottish Government (Review of Economic Assessment in Rural Transport Appraisal, 2009) identifies that improvements in frequency of rural rail, ferry and bus services have been seen to increase usage by up to 42%. The Control Period 4 (CP4) Delivery Plan 2009 (Network Rail, 2009) states that investment in the railway network will result in a bigger railway network and enhancements to the network to increase capacity and capability. Network improvements will be carried out in rural areas. For example in the rural North West, there is an increased demand on the route for freight but the route is primarily used for commuters from rural areas to Carlisle. Improvements will be made to the network to enable more frequent trains to run during peak times and to increase speeds. This will improve access to rural areas.
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access to rural areas.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to facilitate the use of the national networks for non-car users, which can help with access to rural areas and green spaces from regionally/nationally strategic locations. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) explains that people in rural areas in Scotland have a greater reliance on cars and are more likely to drive every day and drive to work. Improvements to the facilities for non-car users to access national networks would improve accessibility in rural areas.

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AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on severance across the wider network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Whole SRN	Permanent	Irreversible	Overall the NPS interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic level is across the wider network, with potentially greater impacts on severance at locations where individual interventions increase traffic. Evidence: Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. Guidelines from the Institute of Environmental Assessment for assessing Road Traffic (1993) suggest that an increase in traffic flows along road networks increases severance as there is increased difficulty with crossing a heavily trafficked road. For individual interventions the traffic impact could be significant, for example, the dualling of the A43 increased traffic flows by 60% between 2004 and 2009.
New links and bypasses: additional routes impact severance within communities by introducing a physical barrier.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. These new roads can result in severance where they are located within communities due to the physical barrier created by the road which can impact on non-motorised user movements. However, the NPS commits to mitigating the impacts of severance of new schemes where appropriate. Impacts will be dependent on the location of developments. Evidence: There are some examples of new roads increasing severance. E.g. HA Post Opening Project Evaluations (POPEs) show that severance has been increased in some locations e.g. upgrades of the A1(M) Wetherby to Walshford which included 3.3 miles of new dual three-lane carriageways, showed that severance was increased as the scheme severed two public rights of way, although it should be noted that short diversions were implemented.
New links and bypasses: additional routes impact severance within communities by reducing traffic on existing roads.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. This is likely to reduce severance within towns and villages where bypasses take traffic away from urban areas such as town or village centres. Impacts will be dependent on the location of developments. Evidence: A breakdown of the Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013 shows that 23 out of 25 bypass schemes had a positive impact on severance in local communities. Some scheme specific examples include: HA Post Opening Project Evaluations (POPEs) show that severance has been reduced e.g. the A38 Dobwalls bypass POPE shows that 75% of residents living in Dobwalls feel that conditions for cyclists and pedestrians are better within the village and the A60 Haydon Bridge bypass has reduced severance in the village of Haydon and increased the journey ambience of pedestrians and cyclists within the village.

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Implementation of mitigation measures for existing road developments: reduced impact on severance within communities.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	The NPS supports the enhancement of existing schemes in order to mitigate existing severance issues. This includes measures to cycle-proof the SRN. This is likely to positively impact on communities where severance is problematic. Evidence: The A19 Black Swan Bridge provides a grade separated crossing of an existing junction which restricted turning movements and had a high rate of accidents. The previous scheme was not suitable for safe pedestrian crossings. The POPE for the scheme shows that it has had a beneficial impact on severance. Prior to the scheme, there were no facilities for pedestrians, equestrians or cyclists to cross the A19 at this location, with the nearest crossing being 2.2 miles to the north. The scheme provided a crossing for non-motorised users, however North Yorkshire County Council have observed that the crossing has a low level of use, although there has been an increase is usage of the local lanes by cyclists and horse riders (Post Project Evaluation Report (POPE) for A19 Black Swan Bridge). Other HA Post Opening Project Evaluations (POPEs) show that severance has been reduced with junction upgrades e.g. the A1 Peterborough to Blyth grade separated junctions have had a slight beneficial impact on severance as at all junctions, as there have been improved and safer crossing provisions for pedestrians and cyclists. A number of schemes identified by the Heart of the South West Local Transport Board (2013) including improvements to Cattledown roundabout, Plymouth and Yeovil Western Corridor to provide improved facilities for cyclists and pedestrians will reduce severance.
New rail links: additional lines impact severance within communities.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Large	Various across rail network	Permanent	Irreversible	The NPS supports a small number of major new links. This is likely to increase severance within communities and therefore have a negative impact in areas where improvements are proposed. Evidence: A report commissioned by DfT (Understanding Community Severance, 2005) highlights that new transport schemes such as railways can have detrimental social impact on communities due to the creation of a real or perceived barrier which people may have to cross in order to reach services and facilities. However, it does note that the magnitude of severance is likely to depend on the nature and location of the crossings provided.
SRFIs: severance due to additional road and rail links to the site	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	The NPS supports the development of SRFIs across England. SRFIs are likely to require new road and rail links to the site which may impact on severance due to increasing traffic and creating a physical barrier between communities. Evidence: The Environmental Statement for an SRFI in St Albans indicates that upgrades to the existing road network and new roads will be required in order to facilitate the SRFI. The transport assessment included within the ES shows that there is either a neutral or slight adverse impact on severance as a result of the SRFI.

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AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of NPS interventions on SRN: increase in capacity across the whole SRN results in improved access	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall, the NPS interventions aim to increase capacity on the SRN. It is likely that this increased capacity will result in improved access to the SRN and the jobs, services and social networks it provides. For example, Smart Motorways, trunk road upgrades, and pinch point investments are considered likely to result in reductions in congestion, in turn leading to increased access to the SRN for all (including disadvantaged sections of the community). Evidence: TASM modelling of a NPS investment scenario forecasts that in the central scenario, there will be 1.03% traffic on the SRN in 2040 in the Do NPS with respect to the baseline. However, even with an increase in traffic, the TASM modelling shows that in the central scenario congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. This reduction in congestion and increase in capacity is likely to result in better access to the SRN. There are examples of schemes that have improved access to the SRN and therefore jobs, services and social networks. For example, the A5 Weeford to Fazeley Improvement has brought about improved journey times and journey time reliability and the scheme has facilitated access to employment and services as a result of this (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013). The M25 J30/A13 Corridor Stage 1 EIR (grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 75-160 due to lessening of transport constraints. The Birmingham Box Managed Motorway Scheme along the M6 J5-8 EIR predicts that the scheme would have a positive impact on regeneration areas in the West Midlands as it would make it easier for people to access employment opportunities.
New links and bypasses: additional routes increase access to SRNs.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Medium	Whole SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. These new links and bypasses will increase access to the SRN for all, including disadvantaged sections of the community. The benefits will depend on the location of developments. Evidence: The A249 Iwade to Queenborough Improvement involved improved access between north Kent and the Isle of Sheppey via a new bridge. The scheme has been crucial for promoting economic growth in these areas (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013).

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Tolling on limited number of new links and bypasses: impact on costs to road users.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Very limited locations across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses. These new links and bypasses will increase access to the SRN for all, including disadvantaged sections of the community. However, the Government will consider tolling as an option for funding new road capacity in very limited circumstances which may have a negative impact on the most disadvantaged sections of the community. Evidence: The proposed A14 toll as outlined in the Cambridge to Huntingdon Improvement A14 (Highways Agency, 2013) would be operational between the Ellington and Swavesey junctions but not the A14 to the east of Swavesey or any part of the A1. Tariffs have not yet been agreed, but it is proposed that between £1.00 and £1.50 would be charged for cars and other light vehicles and between £2.00 and £3.00 for HGVs/ The charge would apply between 6am and 10pm.
Additional train movements on existing rail network and more carriages on trains: improvements to the railway network impacts on access to jobs, services and social networks.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across the rail network	Permanent	Reversible	The NPS supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. This will be focused on routes in and out of, and between major cities. An increase in the capacity of existing trains and lines is likely to result in an increase in access to jobs, services and social networks. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 75 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 75 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: improvements to the railway network impacts on access to jobs, services and social networks.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across the rail network	Permanent	Irreversible	The NPS supports a small number of major new links, chords and track widening and an extensive programme of electrification. The improvement of existing lines in terms of capacity and reliability, and the new rail links are likely to result in an increased access to the rail network and the jobs, services and social networks it creates. Evidence: The Control Period 4 (CP4) Delivery Plan 2009 (Network Rail, 2009) states that investment in the railway network will result in a bigger railway network and enhancements to the network to increase capacity and capability. CP4 includes an Access for All programme whereby accessibility will be improved in around 100 stations across England, Wales and Scotland.

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Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access to national networks, even for the most disadvantaged.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to improve the quality of public transport, such as user information, ease of access, standards of comfort. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income. In Scotland, 37% of households with an annual net income of less than £10,000 own a car, compared to 98% of households with an annual net household income of over £40,000. Poor transport impacts social exclusion and deprivation. By improving accessibility to national networks through the use of non-car modes, accessibility to the jobs, services and social networks are likely to be improved for the most disadvantaged. Furthermore, the Door-to-Door Strategy (DfT, 2013) highlights the point that the cost of travel is important for users of national networks and that by integrating the door-to-door strategy as a whole, journeys for non-car users will be more affordable.

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AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Smart Motorways: increasing capacity on the road may impact disadvantaged groups who lack confidence using the road network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Reversible	The NPS supports an extensive programme of Smart Motorways. This is likely to increase capacity and therefore the number of vehicle movements on the SRN. This may impact upon vulnerable social groups who lack confidence in using busy roads. However it is acknowledged that the reduction in congestion as a result of the implementation of Smart Motorways may also impact positively on vulnerable users. Furthermore, the Government is committed to creating more accessible and inclusive transport that works for everyone. Evidence: A study published by the Highways Agency (Future Managed Motorways Concept: Equality Impact Assessment 2012) to assess the impacts of future Smart Motorway schemes on vulnerable groups identifies that older people, younger people (i.e. novice drivers), disabled people and pregnant women are likely to be at the greatest disadvantage as a result of a Smart Motorways programme. Evidence collected shows that older people with physical and sensory impairments lack confidence when driving and this in turn means they take shorter journeys (50% of drivers aged 75 or over say they are more cautious when using heavily trafficked roads), younger people tend to avoid busy motorways because they feel they lack the necessary skills and 40% of women surveyed say that they avoided motorway driving in the first year after passing their driving tests. Furthermore, the use of hard should running may impact vulnerable groups, for example some women, older people and younger people have serious concerns over breaking down on the motorway.
Road and rail developments including trunk road upgrades, new links and bypasses, new rail links: Compulsory Purchase Orders (CPOs) may be required for these measures which would impact on the owners of properties adjacent to the road and rail networks where a CPO is enforced.	Direct	Large negative (- -)	Longer term (20+ years)	Medium (50-75%)	Medium	Small	Various across England	Permanent	Irreversible	The NPS support a large programme of trunk road upgrades and limited new rail and road links. These measures are likely to require land take and there is the possibility that CPOs may be used to acquire land where improvements are to be carried out outside of existing highway and rail boundaries. This will have a disproportionate impact on residents whose properties are bought, although they will receive financial compensation. Evidence: Compulsory Purchase Orders may be enforced if a proposed road scheme is considered to be in the public interest. For example, the A21 Tonbridge to Pembury Dualling Scheme requires the demolition of private properties where appropriate compensation will be provided through the CPO process. In addition, the construction of the A375 Kingskerswell Bypass requires the demolition of eleven properties. Nine of the properties are owned by Devon County Council, however, the owners of the two properties not owned by the authority would be compensated in the land purchase procedures.
Tolling on limited number of new links and bypasses: impact on costs to road users.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Very limited locations across SRN	Permanent	Irreversible	The NPS supports limited new links and bypasses which are likely to improve access to network for all social groups. However, the Government will consider tolling as an option for funding new road capacity in very limited circumstances, which may have a disproportionate impact on the most financially disadvantaged groups. However, the Government is committed to creating more accessible and inclusive transport that works for everyone, creating benefits for equality target groups.

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										Evidence: The proposed A14 toll as outlined in the Cambridge to Huntingdon Improvement A14 (Highways Agency, 2013) would be operational between the Ellington and Swavesey junctions but not the A14 to the east of Swavesey or any part of the A1. Tariffs have not yet been agreed, but it is proposed that between £1.00 and £1.50 would be charged for cars and other light vehicles and between £2.00 and £3.00 for HGVs/ The charge would apply between 6am and 10pm.
New rail links, new chords and track widening, and additional train movements on existing rail network and more carriages on trains: improvements to the railway network impacts on disabled groups.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across rail network	Permanent	Irreversible	The NPS supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. It also supports a small number of major new links, chords and track widening. This includes some additional trains serving new and existing routes and some station improvements. These upgrades will need to consider inclusive design and will need to comply with the Rail Vehicle Accessibility (Interoperable Rail System) Regulations (RVAR) 2008, Rail Vehicle Accessibility (Non Interoperable Rail System) Regulations (RVAR) 2010 and The Equality Act 2010 whereby station operators must take reasonable steps to ensure that they do not discriminate against disabled people. These upgrades are likely to positively impact disabled people who may have previously found it difficult to access trains and stations. The Government is committed to ensuring that all rail fleets Evidence: As part of the Railways for All Strategy 2006, Access for All funding is being used to provide an accessible route at more than 150 of the busiest inaccessible stations by 2015. Furthermore, as part EU guidelines and under the RVAR 2008 and RVAR 2010 Regulations, all rail vehicles must be accessible by no later than January 1st 2020.
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved travel alternatives provision for non-car users.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport. This is likely to facilitate the use of the national network for non-car users. Furthermore, the Government is committed to ensuring that all bus fleets comply with modern access standards by 2020, resulting in benefits for equality target groups. Evidence: The Door-to Door Strategy (DfT, 2013) shows that improvements at every stage of the journey will improve access to national networks, primarily rail services, by improving the integration between cycling and rail, for example.

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AoS23: To contribute towards improving health and public health

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Door-to-door Strategy measures and cycling measures: improvements to health due to facilitation of cycling and walking.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	The NPS supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport. This is likely to facilitate the use of the national networks for all, and the encouragement of walking and cycling is likely to have a beneficial impact on health. Evidence: The link between physical activity and health is described in Health Impact Assessment of Transport Initiatives, A Guide, Transport Scotland, 2007.

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Alternative 1 Detailed Impact Assessment Tables

AoS1: To contribute towards the reduction of noise levels from road and rail national networks

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction (i.e. noise disturbance).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. Construction impacts due to noise will affect local receptors including people and dwellings and wildlife; however these are likely to be largely mitigated by standard best practice construction and will be temporary impacts. Evidence: ESs for SRFIs, e.g. the St. Albans ES for the construction of an SRFI stated that recommended limits could be exceeded in respect of some properties for short periods of time during construction of the earth mounds, the new relief road/Radlett Road roundabout, and the rail links to the MMR. ESs for road widening schemes e.g. the ES for the A453 Widening M1 Junction 24 to A52 Nottingham stated the HA would follow a Construction Environmental Management Plan which outlined the methodology for minimising environmental impacts during works. However, the ES stated there would inevitably be localised increases in noise and dust during site clearance works, earthworks, bridge construction and the construction of the carriageway; and due to the daily movement of construction traffic around the site.
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts from noise on sensitive receptors.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand although the traffic increase is unlikely to be evenly distributed. The increase in traffic is likely to impact on noise levels, although the impact on noise receptors will depend on the locations of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that in the central scenario, there will be 0.33% more traffic on the SRN in 2040 for Alternative 1 with respect to the baseline. The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts on noise levels.	Indirect	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn reduce traffic and congestion. This reduction in traffic is likely to impact on noise levels across the SRN by facilitating the reduction in levels of noise at source. Evidence: Modelling from DfT shows that with an increase in the cost of motoring (equivalent to the cost of motoring remaining the same in real values) of between 25 and 28% by 2025, traffic levels on the SRN are

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										forecast to be 9.1% less than the baseline scenario by 2025 (central forecasts) [21]. The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.
Programme of maintenance on the SRN, including resurfacing: impact on noise levels.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	Alternative 1 supports an extensive programme of road resurfacing on the SRN. The introduction of low noise road surfacing is likely to have a substantial benefit with regards to noise on local receptors, through reducing noise levels at source, where it is replacing existing concrete roads or previously unmodified surfaces. Evidence: Department for Transport: Guidance on Noise Nuisance from Trunk Roads and Motorways (Chapter 6: Making Life Better for Communities) states that the noise arising from the newest quieter surfaces, compared to the more traditional ones, is about the same as if the amount of traffic had been halved. The ES for the A1 Bramham to Wetherby Upgrading Scheme predicts that modern thin wearing course (TWC) surfaces (Low Noise Surface) would be 2.5 dB quieter (where speeds are >75 km/h) than hot rolled asphalt with a 2mm texture depth, as measured by a sand patch test.
Smart Motorways: opportunity to manage traffic speeds which impacts on noise levels through reduction of traffic speed	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. Smart Motorways can indirectly improve noise levels at local receptors due to vehicle speed reduction for air quality purposes. This will also impact on congestion. Evidence: The Birmingham Box Phase 3 Managed Motorways AST stated that some properties in the vicinity of Junctions 5, 6 and 8 were predicted to experience noise reduction benefits in the short term. In addition, the M42 managed motorways pilot in 2010 found that noise levels decreased by 1.8 dB(A), over existing levels (Annex to the DfT Advanced Motorway Signalling and Traffic Management Feasibility Study Report).
Smart Motorways: impact on receptors due to source of noise emissions moving closer to receptors.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. Smart Motorways include the use of hard shoulder running and therefore, traffic moves closer to the receptor i.e. the noise source moves closer to the receptor. This is likely to negatively impact on the exposure of people and dwellings to transport noise on those receptors close to the SRN, although as Smart Motorways will move traffic closer to receptors only by a relatively small distance, i.e. the width of an additional lane, this impact will be small. Evidence: Design Manual for Roads and Bridges: Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques Part 5 HD 213/11 Revision 1 Noise and Vibration (2011) states that horizontal alignment of a road impacts sensitive receptors i.e. moving the route closer to the receptor will increase noise levels and vice versa. Furthermore it states that “At a distant reception point the noise level is attenuated by a number of additional factors, including the distance from the noise source, the nature of the intervening ground

[21] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline so results should be quantitatively similar.

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										surface and the presence of obstructions."
Road infrastructure measures including pinch point investments, trunk road improvements: impacts due to noise sources moving closer to sensitive receptors (e.g. people and wildlife).	Direct	Neutral (/)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a limited programme of pinch point investments and very limited trunk road upgrades. This may result in vehicles moving closer to receptors. There may be an impact on sensitive receptors due to closer proximity to noise source. Impacts are likely to be dependent on individual schemes i.e. in some locations, exposure to noise levels may worsen whereas in other locations, exposure to noise levels may mprove. Furthermore, Alternative 1 commits to providing low noise surfacing and noise barriers where appropriate on new developments. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that out of that for 79 road schemes assessed, 26 had a neutral impact on noise, 40 had a beneficial impact on noise and 13 had an adverse impact. This evidence shows that both positive and negative impacts can occur as a result of road developments. It should be noted that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
New links and bypasses: impact on receptors due to increased noise levels on new roads.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. New road links introduce a new source of noise to a new location and may therefore have substantial impacts on local receptors (including people, dwellings and wildlife). However, Alternative 1 commits to providing low noise surfacing and noise barriers where appropriate on new road developments. Evidence: Published AST tables for road schemes indicate an increased number of dwellings exposed to noise disturbance e.g. the POPE of Major Schemes Summary Report for the A69 Haydon Bridge Bypass states that the bypass has introduced a new source of noise into the countryside for the few properties nearer to the new route than existing roads. The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.
Road infrastructure measures including new links and bypasses and dualling: impact on receptors due to decreased noise levels on existing roads.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. New road links and bypasses have the potential to reduce noise along existing routes as traffic is redirected on to new roads. This is likely to have a substantial impact on local receptors which are currently impacted by heavily trafficked routes. Furthermore, Alternative 1 commits to providing low noise surfacing and noise barriers where appropriate on new road developments, therefore reducing noise levels at source. Evidence: The POPE of Major Schemes Summary Report (Five years after study) for the A63 Selby Bypass states that traffic within Selby and on other local roads has reduced since the bypass opened and it is likely that local residents will have benefited from reduced traffic noise.
Implementation of noise enhancement measures for existing road developments: reduced impacts on sensitive receptors.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports the targeted use of noise barriers along existing sections of the SRN where noise pollution has proved to be problematic. This will reduce the noise levels at receptors closest to the SRN (including people and dwellings) where noise nuisance has been identified. Evidence: Obstructions in the path of a sound cause its diffraction or

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										reflection and this in turn causes a reduction of sound levels at the receptor located behind the obstruction. Obstructions include noise barriers. Sound attenuation is greatest immediately behind the barrier and decreases with the distance behind the object (Sinha, K.C. and Labi, S., 2007. Transportation Decision Making: Principles of Project Evaluation and Programming).
New rail links, new chords and track widening: impact on sensitive receptors due to noise from new or increased rail activity.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. There are a number of noise sources associated with the operational railway, of these, rolling noise is often considered to be the most important. Evidence: The Environmental Statement for the development of a rail link between LUL's Metropolitan line in the west of Watford and Watford Junction main line station predicted an increase in environmental noise for properties closest to the proposed link, particularly along the section between Ascot Road and the existing Over ground line once the proposed scheme is open to use.
Additional train movements on existing rail network and more carriages on trains: impact on sensitive receptors due to noise from increased rail activity.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. The addition of trains on existing railway lines is likely to increase noise levels due to increased rail activity. Evidence: The Chiltern Railways (Bicester to Oxford Improvements) Order Non-Technical Summary states that although most of the scheme consists of an existing operational railway, the scheme will result in an increase in train movements and speeds along the route resulting in increased noise as trains pass receptors."
Rail electrification: impact on noise levels.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. This will have a large beneficial impact on noise levels across England due to the replacement of diesel engines by electrification, reducing noise levels at source. Evidence: The Atkins study for RSSB of 2007 stated the Calculation of Railway Noise (CRN) factors for a Pendolino EMU (a type of electric high-speed train used in the UK) as +10.7dB and the equivalent figure for a Voyager Diesel Multiple Unit of +13.8dB.
SRFIs: noise impacts associated with the operation of SRFIs.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative noise impacts. SRFIs may increase the exposure of people, dwellings and wildlife to transport noise. Evidence: Documents in support of planning applications for currently proposed SRFIs predict localised noise impacts e.g. the St. Albans ES for construction of an SRFI states that road traffic, both within the site and on adjacent road links on the public highway; rail traffic on lines within the site and on the Midland Main Line; and site activity are likely to result in increases in noise. However, with appropriate mitigation in place, overall, the proposed scheme is expected to result in the noise climate remaining in the 'reasonable' category.
Commitment to funding of	Direct	Small	Longer	High (>75%)	Large	Large	Various	Permanent	Irreversible	Alternative 1 supports the commitment to funding of ULEVs. Through the

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ULEVs: reduction in noise levels due to transition from petrol and diesel powered vehicles to ULEVs.		positive (+)	term (20+ years)				across England			Office for Low Emission Vehicles (OLEV) the government are providing funding to advance ULEV technology and encourage people to buy and drive ULEVs. Provision will be focused in the following areas: helping to support the purchase of ULEVS; facilitating the provision of recharging infrastructure; preparing for hydrogen fuel cell electric vehicles in the UK; encouraging and investing in research and development; and lowering emissions from other vehicles. The transition to ULEV technologies is likely to reduce noise levels across the SRN. Evidence: The government's vision for the road network, Action for roads: a network for the 21st century, commits additional capital investment to support industry and consumers in the shift to ULEVs. Driving the Future Today - A strategy for ultra-low emission vehicles in the UK states that ULEVs are extremely quiet compared to conventional vehicles.

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AoS2: To contribute towards improving local air quality

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction of road, rail and SRFI infrastructure: emissions (particularly dust) during construction of infrastructure.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. Air quality may temporarily decline in the local area to any infrastructure upgrades or construction due to an increase in levels of air pollutant emissions, particularly dust emissions .This may negatively impact upon human health, however, this is only for the short term, and can usually be mitigated. Evidence: Air quality assessments within Environmental Statements (e.g. M6 J10a-13, M1 J1-13), for road schemes predict temporary impacts during construction but these are not considered likely to be significant. DIRFT III Environmental Statement, Air Quality Chapter K, states that due to the large scale and long duration of construction activities the potential dust emission classification for construction activities is large. Predicted impacts within a worst-case sensitivity analysis suggested that impacts after construction are likely to be at worst slight adverse at two receptors.
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and associated emissions to air, and therefore impacts on air quality.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Whole SRN	Permanent	Irreversible	An increase capacity on the SRN will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic is likely to impact on air pollutant emissions, although the extent of the impact on local air quality and subsequently human health will depend on the locations of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that in the central scenario, there will be 0.33% more traffic on the SRN in 2040 for Alternative 1 with respect to the baseline. The modelling forecasts NOx emissions to be 0.47% higher in the Alternative 1 scenario with regard to the baseline by 2040. In addition, PM10 is expected to be 0.51% higher in the Alternative 1 scenario with regard to the baseline by 2040.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts on air quality.	Indirect	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn, reduce levels of traffic and congestion. This reduction in traffic is likely to reduce air pollutant emissions from road traffic across the SRN. This is likely to impact upon human health. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025 (central scenario)[Error! Bookmark not defined.]. The modelling also forecasts that with an increase in the cost of motoring, emissions of NOx and PM10 will reduce by 6.83% and 8.41% respectively compared to the baseline.

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Smart Motorways: impact on receptors due to source of emissions moving closer to receptors, with an associated increase in pollutant concentrations.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. The Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, HA 207/7 Air Quality indicates that the traffic contribution of pollutants decreases with distance from the road. Hence, moving traffic closer to a fixed receptor (e.g. housing) will result in higher pollutant concentrations at receptors, although as Smart Motorways will move traffic closer to receptors only by a relatively small distance, i.e. the width of an additional lane, this impact will be small. This is likely to impact upon human health. Evidence: Air quality assessments within Environmental Statements (e.g. M6 J10a-13), and Appraisal Summary Tables (e.g. M62 J 25 - 30, M25 J 23-27) for Smart Motorway schemes do not predict overall significant air quality effects, although some small increases in pollutant concentrations on some links are predicted.
Smart Motorways: opportunity to manage traffic speeds along the SRN in order to reduce emissions to air.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. Speeds on the areas of the SRN where Smart Motorways are implemented will be managed when hard shoulder running is in operation in order to reduce emissions to air from road vehicles. Emissions from road vehicles are significantly influenced by speed, with emissions lower at speeds that achieve optimal engine combustion efficiency. The relationship between vehicle speed and emissions is commonly understood and is a key factor in modelling emissions from vehicles. Smart Motorways therefore provide the ability to manage the speed of vehicles, and this also provides an opportunity to manage speeds to reduce air pollutant emissions. This may have a positive impact on human health. Evidence: Data within the Advanced Motorway Signalling and Traffic Management Feasibility Study (DfT, 2008) report shows that for the M42 Smart Motorways pilot scheme emissions of CO_2 from light duty vehicles reduced from 108 g/mile to 87 g/mile when speeds reduced from 70mph to 50mph respectively, emissions of NOx from light duty vehicles reduced from 0.31 g/mile to 0.16 g/mile when speeds reduced from 70mph to 50mph respectively and emissions of PM from light duty vehicles reduced from 0.019 g/mile to 0.010 g/mile when speeds reduced from 70mph to 50mph respectively. In terms of emissions from the pilot Smart Motorways scheme compared to the pre-pilot running of the M42, emissions at 50mph from light duty vehicles reduced as follows: CO2 from 89 g/mile to 87 g/mile; NOx from 0.18 g/mile to 0.16 g/mile; and PM from 0.012 g/mile to 0.010 g/mile.

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New links and bypasses: impact on air quality due to reductions in emissions on existing roads related to congestion and queuing.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. Air quality in bypassed villages can improve through substantial reductions in traffic volumes. In addition, new link roads are often targeted to reduce congestion, and a more continuous flow of traffic can lead to a reduction in queue lengths which will reduce the size of areas affected by poor air quality, and in turn, positively impact on human health. Evidence: The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) identifies that 22 out 32 bypasses assessed had a beneficial impact on air quality. It should be noted that the report did not specify the exact nature of the air quality impacts. The POPE of Major Schemes Summary Report for the A43 Improvements shows that air quality in the bypassed villages of Syrensham and Silverstone has improved through substantial reductions in traffic volumes.
Road infrastructure measures including pinch point investments, new link roads and trunk road upgrades: exposure to reduced air quality due to source of air emissions moving closer to receptors.	Direct	Neutral (/)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a limited programme of pinch point investments including junction improvements and new slip roads. This may decrease the distance between the source of emissions and receptors, particularly where roads are in close proximity to residential areas. However, smoother flowing traffic and a reduction in congestion may lead to a reduction in air pollutant emissions. Impacts are likely to be dependent on individual schemes i.e. in some locations, impacts on air quality may worsen whereas in other locations, impacts on air quality may improve. Furthermore, Alternative 1 commits to mitigating significant increases in air pollution as a result of new road developments. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that out of 79 road schemes assessed, 17 had a neutral impact on air quality, 13 had an adverse impact and 49 had a beneficial impact. It should be noted that these figures include all road improvement schemes, including motorway widening. It should also be noted that the report did not differentiate between different types of air quality impacts and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
Implementation of air quality enhancement measures for existing road developments: reduced impacts on sensitive receptors.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports the implementation of enhancement measures for existing air quality problems along certain areas of the existing SRN. These would be targeted measures to reduce pollution in areas of poor air quality on the existing SRN. Enhancement measures would include the management of vehicle speed, increasing the distance between live traffic and neighbouring properties, and working with local authorities and other partners to identify measures that provide benefits over a wider area. This is likely to have a positive impact on human health. Evidence: A study conducted in the Netherlands by Innovatie Programma Luchtkwaliteit (IPL, 2010) Dutch Air Quality Innovation Programme Concluded shows that the installation of a 4m barrier adjacent to a road network reduces concentrations of air pollutants in locations behind the barrier. At 10m behind the barrier, concentrations of NO2, NOx and PM10 are reduced by 14%, 20% and 34% respectively.

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Additional train movements on existing rail network and more carriages on trains: impact on air quality as a result of more trains and carriages.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. The addition of any diesel trains on existing railway lines is likely to increase air pollutant emissions as there will be a higher number of trains and therefore rail traffic. The addition of carriages is also likely to increase air pollutant emissions as trains will burn more fuel per journey. Evidence: The Rail Command Paper (DfT, 2012. Reforming our railways: Putting our customers first) gives details on the use of both electric and diesel trains. Whilst there is a programme of electrification outlined for the future and the benefits of electrification are discussed, including the benefits for air quality, the Command Paper also highlights that "many parts of the rail network will continue to rely on diesel rolling stock for the foreseeable future".
New rail links, new chords and track widening: impact on air quality as a result of new links, chords and track widening.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new rail links, new chords and track widening. The development of new rail links is likely to introduce new sources of air pollutants to new areas, therefore, there is the potential for negative impacts on air quality. The impact will depend on the nature of the trains using the new links i.e. whether they are diesel or electric, as electric trains are zero emissions at the point of use, whereas diesel trains emit pollutants to air. It is understood that a large proportion of the new links proposed will be electrified, however, where this is not the case there will be a small negative impact on air quality and subsequently human health. Evidence: The Rail Command Paper (DfT, 2012. Reforming our railways: Putting our customers first) highlights that "many parts of the rail network will continue to rely on diesel rolling stock for the foreseeable future", despite the electrification of some lines. Local Air Quality Management Technical Guidance LAQM.TG(09) (Defra, 2009) shows that diesel trains emit SO_2 and NO_2 and evidence shows that concentrations of these pollutants are elevated along railway lines. These pollutants contribute to a reduction in air quality. Therefore, the continued use of diesel trains is likely to negatively impact on air quality in the vicinity of railway lines.
Rail electrification: impacts on local air quality due to electrification of diesel powered rail lines.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. Electric trains perform better than diesel trains in terms of emissions to air. They are zero emissions at the point of use. This helps improve air quality in areas of high pollution such as city centres and main line stations. Evidence: Rail modelling of HLOS electrification predicts that with the electrification proposed in the NPS, NOx emissions would reduce by 29.3% in 2018/19 compared to 2010/11 levels, PM emissions would reduce by 49.0% and SO_2 emissions would fall by 99.2% over the same time period. There would be a slight increase in emissions of NOx, PM and SO_2 as a result of electricity generation by 38.4%, 14.7% and 5.3% respectively over the same time period. This would result in a slight increase in NOx emissions, but a substantial reduction in both PM and SO_2 emissions. Alternative 1 supports a larger programme of electrification than the NPS, however this modelling gives a

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										representation of the changes in emissions that could be expected under Alternative 1 i.e. possibly slightly larger net NOx emissions but further decreases in PM and SO_2 emissions. The Network RUS Electrification (Network Rail, 2009) states that a significant proportion of passengers and the majority of freight is carried by diesel operations which is more costly and produces more emissions than its electric equivalent.
SRFIs: modal shift from road to rail reduces road traffic emissions on the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs can reduce congestion both locally and nationally. For the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Where rail is used instead of road, there is a large reduction in emissions to air for each tonne transported. Therefore the development of SRFIs should lead to an improvement in air quality terms due to the reduction in emissions from road traffic. This may have a positive impact upon human health. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that rail freight produces fewer harmful gases than road freight in terms of other emissions that impact upon people's health – less than a tenth of the nitrogen oxide and fine particulates of road haulage per tonne carried when compared to road transport. This document also states that the modal shift of road to rail will greatly reduce congestion.
Commitment to funding of ULEVs: improvements to local air quality due to transition from petrol and diesel powered vehicles to ULEVs.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 1 includes measures to support the shift to ULEVs. Through the Office for Low Emission Vehicles (OLEV) the government are providing funding to advance ULEV technology and encourage people to buy and drive ULEVs. Provision will be focused in the following areas: helping to support the purchase of ULEVS; facilitating the provision of recharging infrastructure; preparing for hydrogen fuel cell electric vehicles in the UK; encouraging and investing in research and development; and lowering air pollutant emissions from other vehicles. The transition to ULEV technologies is likely to improve air quality across the whole network and in turn, positively impact on human health. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that NOx and PM10 emissions are likely to reach 67,000 tonnes and 1,200 tonnes respectively by 2030. With the implementation of ULEV policy, emissions in 2030 are predicted to be lower with NOx emissions reaching 66,103 tonnes and PM10 emissions reaching 1,217 tonnes. The government's vision for the road network, Action for roads: a network for the 21st century, commits additional capital investment to support industry and consumers in the shift to ULEVs. Driving the Future Today - A strategy for ultra-low emission vehicles in the UK states that ULEVs have an important role to play in reducing the air quality impact of road transport. DfT analysis shows air pollutant emissions declining overall at the roadside, where air quality problems are most significant (although no location-specific modelling has been carried out). The analysis did not cover air pollution from power generated for electric vehicles. It is possible that including power generation could offset this reduction in emissions, although this would depend on various factors, in particular

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										the source of electricity and the types of ULEVs in use.

AoS3: To contribute towards the reduction of greenhouse gas emissions

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction including embodied carbon (i.e. construction materials) and operational carbon (e.g. energy used).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. The construction of infrastructure will involve the use of large amounts of material (both raw and recycled). Carbon embodied in materials for construction and maintenance work will vary across interventions, however, it is likely that the materials used will be sourced in accordance with industry standard good practice guidelines to ensure efficient use of materials. The carbon footprint as a result of fitting materials and site energy usage is likely to vary across schemes. Evidence: Huang et al (Measuring the carbon footprint of road construction using CHANGER, 2012) states that several elements and their impacts are found to contribute to the variation in CO_2 per kilometre construction, namely the amount of traffic and increased capacity, current condition (e.g. foundation, pavement), materials used, construction technique, drainage and structures (type, number, etc.). Moreover, a Carbon Calculation Tool has been developed to enable the Highways Agency to identify the carbon footprint associated with the Highways Agency's activities. The tool provides a means of capturing the volume of carbon produced through construction, maintenance and operational activities undertaken by the Highways Agency itself, and its main contractors. It takes into account energy, materials, transport and waste removal. Network Rail also state in their Sustainable Development Strategy (2013-2024) that they aim to take a whole life approach to resource use in our asset management, so that virgin material requirements and waste production are minimised, and the carbon embedded in new infrastructure is measured and reduced. In addition, they aim to use low carbon energy sources to minimise rail's carbon footprint.
Road infrastructure measures including pinch point investments, smart motorways, trunk road improvements and new links and bypasses: increased speeds due to reduction in congestion as a result of increased capacity on the wider network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across England	Permanent	Irreversible	Alternative 1 supports a limited programme of pinch point investments, a large programme of smart motorways, very limited trunk road upgrades and very limited new links and bypasses. This will increase the capacity of the whole network, increasing traffic and the number of vehicles on the network, but also reducing overall congestion. This may increase traffic speed, therefore increasing carbon emissions as vehicles emit more GHG emissions at higher speeds. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that in the central scenario, there will be 0.33% more traffic on the SRN in 2040 for Alternative 1 with respect to the baseline. The modelling forecasts CO_2 emissions to be 0.24% higher in Alternative 1 with regard to the baseline by 2040. This may lead to a relatively small increase in emissions across the whole network. In 2009, total GHG emissions from transport (including international transport) were 165.8

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										MtCO2e, accounting for 27% of total UK GHG emissions (607.2 $MtCO_2e$). Domestic transport accounted for 20% of total UK GHG emissions. Road transport accounted for 93% of all domestic transport GHG emissions, with 58% for car & taxis, 17% for heavy goods vehicles, 12% for light vans and 4% for buses & coaches (UK transport greenhouse gas emissions, Department for Transport). The POPE (five years after study) Report for the A11 Roudham Heath to Attleborough Improvements states that there has been a net increase of 9,175 tonnes of carbon in the first five years after opening, as a result of building the scheme. This is, however, to be expected on a scheme of this type, where average speeds have increased from around 40mph to around 70mph. The Highways Agency Scheme evaluation table shows that the majority of road schemes, resulted in an increase in carbon emissions. However, there were also some cases where carbon emissions were reduced as a result of new road developments. These developments include examples from trunk road upgrades and new links and bypasses.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts on greenhouse gas emissions.	Indirect	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Irreversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn, reduce traffic and congestion. This reduction in traffic is likely to reduce emissions of GHGs across the SRN. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025.The modelling also forecasts that with an increase in the cost of motoring, emissions of CO_2 will reduce by 5.82% to the baseline.[22]
Smart Motorways: impact on carbon emissions through management of traffic speed.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across England	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. Speeds on the areas of the SRN where Smart Motorways are implemented will be managed when hard shoulder running is in operation in order to reduce emissions to air from road vehicles. Evidence: Data within the Advanced Motorway Signalling and Traffic Management Feasibility Study (DfT, 2008) report shows that for the M42 Smart Motorways pilot scheme emissions of CO_2 from light duty vehicles reduced from 108 g/mile to 87 g/mile when speeds reduced from 70mph to 50mph respectively. In addition, the AST for the M62 Junction 25-30 Managed Motorway Scheme states that the scheme will lead to a reduction in greenhouse gas emissions. Although vehicle km would increase by 2.2million vehicle km over the sixty year appraisal period, the total carbon dioxide emissions with the scheme would be 370,000 tonnes lower.

[22] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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Rail infrastructure measures: impacts on greenhouse emissions due to new rail links and making use of existing rail infrastructure.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. It also supports an extensive programme to make better use of existing railway lines, including through the provision of more trains and longer trains. Although there are likely to be increases in embodied carbon due to new infrastructure, the impact of modal shift from road to rail may result in a significant reduction in GHG emissions. Evidence: The Thames Valley Berkshire Local Enterprise Partnership Ltd website states that there will be reduced CO_2 emissions (5,100 tonnes per year) due to vehicle journeys as a result of the Western Rail Access to Heathrow development. Furthermore, The East-West Rail: The Economic Case for Investment describes how the development supports sustainable growth, reduces carbon emissions and encourages modal shift from car to train.
Rail electrification: reduction in greenhouse gas emissions due to electrification of diesel powered rail lines.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. Electric trains perform better than diesel trains in terms of emissions to air. They are zero emissions at the point of use. This helps improve air quality and reduce greenhouse gas emissions in areas of high pollution such as city centres and main line stations. Evidence: The Network RUS Electrification (Network Rail, 2009) states that a significant proportion of passengers and the majority of freight is carried by diesel operations which is more costly and produces more emissions than its electric equivalent. Electrification has a potentially significant role to play in reducing carbon emissions from rail transport as well as improving air quality and reducing noise. Electric trains, on average, emit 20 to 30 per cent less carbon than diesel trains. Rail modelling of HLOS electrification schemes shows that the implementation of these schemes compared to the 'do minimum scenario' would result in an overall decrease in CO_2 emissions of 11% by 2018/19. This decrease is likely to be higher as Alternative 1 supports a more extensive electrification programme than that of the NPS. As rail GHG emissions accounts for only 1.8% of all domestic transport GHG emissions (UK transport greenhouse gas emissions, Department for Transport, 2009), this is likely to be of small positive magnitude.
SRFIs: modal shift from road to rail reduces road traffic emissions on the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs can reduce congestion both locally and nationally. For the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Where rail is used instead of road, there is a large reduction in CO_2 emissions for each tonne transported. Therefore the development of SRFIs should lead to a benefit in air quality terms due to the reduction in emissions from road traffic. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that there could potentially be a 76% reduction in CO_2 emissions per tonne transported when using rail instead of road. This document also states that the modal shift of road to rail will greatly reduce congestion, where each freight train could take approximately 60 lorry

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										journeys off the road. It is considered that overall the impact of modal shift is likely to result in 20-24 lorries being taken off the road, taking into account transport to and from SRFIs.
Door-to-door Strategy measures and cycling measures: improvements to cycling and walking facilities encourage more people to make journeys using sustainable transport modes.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Irreversible	Alternative 1 supports expanded measures relative to the NPS to encourage people to use more sustainable modes of transport. This is likely to reduce GHG emissions from transport if more people cycle or walk, especially for short journeys. Evidence: 21% of CO_2 emissions in the UK are as a result of domestic transport, with passenger cars accounting for over half of these emissions. 10 million tonnes of CO_2e are emitted per annum in the UK by transport for journeys between 2 and 5 miles. 3 in 10 motorists claim that they would reduce their car use and one half of cyclists would increase the amount they cycle if better cycling provisions (such as dedicated cycle paths) were implemented (DfT, 2011. Creating Growth, Cutting Carbon). This would be likely to reduce carbon emissions from transport and have a wider environmental benefit.
Commitment to funding of ULEVs: reduction in carbon emissions due to transition from petrol and diesel powered vehicles to ULEVs.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 1 includes measures to support the shift to ULEVs. Through the Office for Low Emission Vehicles (OLEV) the government are providing funding to advance ULEV technology and encourage people to buy and drive ULEVs. Provision will be focused in the following areas: helping to support the purchase of ULEVS; facilitating the provision of recharging infrastructure; preparing for hydrogen fuel cell electric vehicles in the UK; encouraging and investing in research and development; and lowering emissions from other vehicles. The transition to ULEV technologies is likely to reduce GHG emissions across the whole network. Evidence: The government's vision for the road network, Action for roads: a network for the 21st century, commits additional capital investment to support industry and consumers in the shift to ULEVs. Driving the Future Today - A strategy for ultra-low emission vehicles in the UK states that an ULEV emits extremely low levels of CO_2 compared to conventional vehicles fuelled by petrol/diesel. Also, they typically have much lower or virtually nil emissions of air pollutants and lower noise levels. Since 2009, the OLEV has considered ULEVs as new cars or vans that emit less than 75 grams of CO_2 from the tailpipe per kilometre driven, based on the current European type approval test. TASM Modelling of an Alternative 1 investment scenario forecasts that the 0.24% increase in GHG emissions due to other Alternative 1 interventions will be more than offset by increased ULEV uptake, with Alternative 1 plus ULEVS resulting in a 2.65% reduction in Carbon emissions compared to the 2030 baseline.

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AoS4: To protect and enhance landscape quality, townscape quality and to enhance visual amenity

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI infrastructure: impacts on landscape and townscape quality and visual amenity during construction (e.g. noise and light disturbance).	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across England	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs, all of which may have construction impacts on landscape, townscape and visual amenity. Construction impacts that may affect landscape, townscape, visual amenity or tranquillity are likely to include noise, light pollution, and large construction vehicles. These impacts are likely to be largely mitigated and occur on a short term basis. Evidence: Landscape can be negatively impacted during the life cycle of a project, which includes the construction phase, Guidelines for Landscape and Visual Impact Assessment (Third Edition, Consultation Draft) Landscape Institute (n.d.).
Cumulative impact of Alternative 1infrastructure interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to negative impacts on landscape quality, visual amenity and tranquillity on the wider network, although the extent of the impacts will depend on the location of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts in the central scenario 0.33% more traffic on the SRN is forecast by 2040 with respect to the baseline. Lancashire County Council (n.d.) A Landscape Strategy for Lancashire states that increases in traffic, litter, signage and built development may threaten visual amenity and landscape character.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts landscape and townscape.	Indirect	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn reduce traffic and congestion. This reduction in traffic is likely to positively impact on landscape, townscape, visual amenity and tranquillity on the wider network. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025[23]. Lancashire County Council (n.d.) A Landscape Strategy for Lancashire states that increases in traffic, litter, signage and built development may threaten visual amenity and landscape character. This insinuates that a decrease in traffic would have a positive impact on visual amenity and landscape character.

[23] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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Smart Motorways: visual impacts on local landscape and townscape from associated infrastructure (e.g. gantries, lighting).	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a large programme of Smart Motorways. The impact of implementing Smart Motorways on an existing network is likely to generate small negative impacts on landscape, visual amenity and tranquillity. This could vary between schemes due to lighting provision within designated landscape areas. Individual gantries and other new features may also have more locally significant adverse impacts. Evidence: HA publication IAN 161/13 states that with reduced verge width it may not always be possible to mitigate localised impacts by landscape planting as it may not be maintainable. In such instances consideration must be given to others forms of screening. Combining noise barriers with visual barriers, where both are warranted, is one option to achieve efficiencies in the design. The Birmingham Box Phase 3 Managed Motorways AST states that a slightly increased awareness of the motorway corridor as a result of the increased number of gantries and localised vegetation loss at major infrastructure locations would not result in significant adverse effects on the landscape character.
Road infrastructure measures including pinch points, trunk road upgrades and new links and bypasses: visual impacts on local landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports a very limited programme of trunk road upgrades and new links and bypasses and a limited programme of pinch point investments. These will result in small negative impacts on landscape, townscape and tranquillity due to the introduction of new infrastructure into the landscape and associated loss of views. However, Alternative 1 commits to effectively integrating new road developments into the landscape as far as possible. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 79 road schemes assessed, 61 had an adverse impact on the landscape, 15 had a neutral impact and 3 had a beneficial impact. It should be noted that the report did not specify the type of landscape impact and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
Implementation of landscape enhancement measures for existing road developments: reduced impacts on landscape quality and visual amenity.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports the implementation of enhancement measures for landscape and visual impacts where existing roads are causing particular impacts on neighbouring people or sensitive areas. Where this occurs, Alternative 1 supports opportunities to preserve, protect and where possible improve landscapes and townscapes, such as planting, screening and earthworks. Evidence: The 6Cs Design Guide (2009) is used by Leicestershire County Council, Leicester City Council, Derby City Council, Derbyshire County Council, Nottingham City Council and Nottinghamshire County Council to provide guidance relating to highways and transportation infrastructure for new developments. The landscape section details that well-designed landscaping can have a positive visual influence on the final appearance of a new development and that carefully designed tree planting in particular can provide screening at a number of levels.

*It should be noted that the evidence cited is for illustrative purposes only and, whilst it may not be representative of all schemes nor all potential impacts arising from these schemes, from professional judgement and experience is considered to support the general assessment of impacts made in this assessment table.

New rail links, new chords and track widening: visual impacts on local landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. Major new links are likely to result in large negative impacts on landscape, townscape and tranquillity due to the introduction of new infrastructure into the landscape and associated loss of views. Evidence: Network Rail (Ordsall Chord) Order states that during operation, there will be potential visual effects on receptors from viaduct widening and a new section of railway and associated new bridges (Network Arch and replacement Pedestrian and Cycle Bridge) crossing the River Irwell. The Environmental Statement Non-Technical Summary for the proposed Ipswich Chord states that there would be significant visual effects upon the Railway Cottages and the users of the River Gipping footpath/ cycleway during and immediately after the construction phase. Landscape planting mitigation would be developed, however, permanent adverse effects upon the railway cottages and the River Gipping footpath/ cycle path in the immediate vicinity of the new river bridge would remain and cannot be mitigated for. Moreover, the Environmental Statement Non-Technical Summary for the North Doncaster Chord states that the operational effect on landscape and visual amenity as a result of the North Doncaster Chord scheme will have some significant effects on landscape character. This is because two significant structures, namely the viaduct and highway bridge, will be constructed in a relatively rural landscape.
Rail electrification: visual impacts from new rail infrastructure and overhead power lines.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. Overhead Line Electrification System (OLE) and gantries would be prominent in flat rural areas but be an impact of lower magnitude in urban areas. Potential visual receptors are residential areas, road users and users of public right of ways. Evidence: The ES for the Great Western Main Line Electrification Project (April, 2013) identifies the landscape and visual impacts associated with permanent and temporary structures such as feeder stations, switching stations, support structures and bridge works. Significant effects are predicted as likely to occur where OLE bridgeworks affect viaducts as these locations are likely to be more prominent, increasing the magnitude of impacts and potentially affecting sensitive receptors. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that areas such as the Reading Urban Fringe, Thatcham to Theale Corridor and several other locations will experience slight to moderate adverse effects on landscape as a result of the scheme.
SRFIs: localised impacts on landscape and townscape	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on landscape, townscape and tranquillity due to the introduction of new infrastructure into the landscape, townscape and associated loss of views. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some large localised landscape and visual impacts e.g. DIRFT III. The appraisal of landscape character effects for this project

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										concludes that the initial development will result in a substantial adverse effect on the immediate landscape at Year 0, and negligible to minor adverse effect on the landscape beyond. By Year 15, this is likely to result in a moderate adverse effect once structural planting has established. Beyond the site, the proposals will have only a negligible or minor adverse effect by year 15.

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AoS5: To protect and conserve heritage assets in a manner appropriate to their significance

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on heritage assets.	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the road network. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to localised negative impacts on setting of sites, features and areas cultural and heritage value, and designated sites, although the extent of impacts will depend on the location of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that in the central scenario, there will be 0.33% more traffic on the SRN in 2040 with respect to the baseline. Transport and the Historic Environment (English Heritage, 2004) explains that increasing levels of traffic are gradually eroding the quality of the historic environment through both road building and traffic blight.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts heritage assets.	Indirect	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn, reduce traffic and congestion. This reduction in traffic is likely to positively impact on the setting of sites, features and areas cultural and heritage value, and designated sites relative to the baseline predictions. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025 (central scenario)[24]. Transport and the Historic Environment (English Heritage, 2004) explains that increasing levels of traffic are gradually eroding the quality of the historic environment through both road building and traffic blight. This insinuates that a decrease in traffic would have a positive impact on the setting and therefore the quality of the historic environment.
Smart Motorways: impacts on sites, features and areas of historical and cultural value.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Medium	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a large programme of Smart Motorways. For most schemes, scoping exercises are likely to identify that Smart Motorways projects are contained within the 'disturbed' highway boundary, therefore impacts on the buried archaeology resource are considered to be unlikely although still possible. The extent of impacts will depend on the location of developments. Evidence: The Birmingham Box Phase 3 Managed Motorways AST states that there would be no impacts on the below ground archaeological resource as all works were within highway boundary. Impacts on the built heritage and historic landscape would be through local visual intrusion on their setting, but are not significant.

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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Smart Motorways: impacts on setting of sites, features and areas of historical and cultural value due to associated infrastructure (e.g. gantries).	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Medium	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a large programme of Smart Motorways. This is likely to result in the construction of additional infrastructure such as gantries. Impacts are likely to be limited to receptors off site, such as the effects on the setting of any adjacent listed building, designated sites such as Scheduled Monuments, conservation areas, or historic landscapes. Impacts would be through local visual intrusion on their setting, but are unlikely to be significant, due to the fact that the motorway already exists at that location. The extent of impacts will depend on the location of developments. Evidence: The Birmingham Box Phase 3 Managed Motorways AST states that the incorporation of gantries on elevated sections of the motorway would give rise to minor impacts as a result of localised changes within the motorway corridor.
Implementation of trunk road upgrades including installing dual lanes and grade separation: impact on sites, features and areas of historical and cultural value due to development on previously undeveloped land outside of HA boundary.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports a very limited programme of trunk road upgrades including installing dual lanes and grade separation. Where dual lanes and grade separation is undertaken outside of the existing highway boundary, there is the potential to damage previously undiscovered buried archaeological resource. The probability of this is likely to be larger than Smart Motorways due to the acquisition of undeveloped land potentially outside of the HA boundary. The extent of impacts will depend on the location of developments. Evidence: A21 Tonbridge to Pembury Dualling AST states that there is likely to be large adverse impacts as the scheme would require demolition of two Grade II listed buildings and four historic buildings.
Implementation of trunk road upgrades including installing dual lanes and grade separation: impacts on setting of sites, features and areas of historical and cultural value due to associated infrastructure (e.g. gantries).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports a very limited programme of trunk road upgrades including installing dual lanes and grade separation. These will result in potentially negative impacts on the setting of sites, features and areas cultural and heritage value, and designated sites due to visual impact, noise and lighting from new infrastructure. However, Alternative 1 commits to specific works such as screen planting to remove views from strategic roads from heritage sites in the delivery of new schemes when the opportunity arises. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 80 road schemes evaluated, 43 had an adverse impact on heritage, 27 had a neutral impact and 10 had a beneficial impact. It should be noted that the report did not specify the type of heritage impacts from different schemes and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
Implementation of cultural heritage enhancement measures for existing road developments: reduced impacts on setting of sites, features and areas of historical and cultural	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports the implementation of enhancement measures for cultural heritage impacts where existing roads are causing particular impacts on sites, features and areas cultural and heritage value, and designated sites. Where this occurs, Alternative 1 supports the implementation of works to improve setting, such as planting, screening and earthworks.

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value.										Evidence: DMRB Volume 10, Section 3 Part 2 HA 108/04 Landscape Management Handbook explains that amenity grass areas, heath and moorland, native species hedges and individual trees help to provide setting and landscape character for heritage sites.
Additional train movements on existing rail network and more carriages on trains: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. The addition of trains and carriages to existing railway lines is likely to have a small negative impact on sites, features and areas cultural and heritage value, and designated sites due to the increase in noise, light and visual impact impacting on setting. Evidence: The Initial Environmental Report for Piccadilly Platforms 15 and 16 and Oxford Road Interventions (2012) states that whilst impacts from the development on setting are not likely to be significant, there may still be some indirect impacts on setting as a result of longer and more frequent trains.
New rail links, new chords and track widening: impacts on sites, features and areas of historical and cultural value.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. Where development is undertaken outside of the existing railway boundary, there is the potential to damage previously undiscovered buried archaeological resource, sites, features and areas of historical and cultural value and designated sites. Evidence: Network Rail (Ordsall Chord) Order states that the proposed development has the potential to impact directly and physically upon eight historic buildings during the construction phase. This will include the demolition of the Girder Bridge and Prince's Bridge, the removal of part of the Zig Zag viaduct, and the removal of a cast iron span at the Castlefield end of the MSJ&R viaduct. However, it also states that there will be no significant impacts on sub-surface heritage assets of archaeological interest during the operation of the proposed development. The Environmental Statement Non-Technical Summary for the North Doncaster Chord states that there will be significant residual effects on cultural heritage as a result of the loss of sections of historic field boundaries and a parish boundary.
New rail links, new chords and track widening: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. These measures are likely to result in large negative impacts on the setting of sites, features and areas cultural and heritage value, and designated sites due to visual impact, noise and lighting from new infrastructure. Evidence: Network Rail (Ordsall Chord) Order states that 13 heritage assets, in the form of historic buildings, in the vicinity of the scheme may be impacted upon in terms of visual impacts as a result of changes to their settings. The 13 assets are subject to permanent adverse effects as a result of changes to setting due to the presence of new structures and modifications to existing structures. The Environmental Statement Non-Technical Summary for the North Doncaster Chord states that the visual setting of the former railway cottages at Joan Croft Junction will be affected by the operation of the new viaduct and highway bridge. There will also be a significant adverse

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										effect during operation as a result of the changes to the setting of the unlisted buildings of local historic interest at Joan Croft Junction.
Rail electrification: impact on heritage assets due to overhead power line installation.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. This may require the installation of overhead power lines, therefore, current infrastructure will need to be able to accommodate this change. Direct impacts are likely to heritage assets and designated sites such as bridges that may be demolished or altered to allow sufficient room for the Overhead Line Electrification System to pass underneath. Evidence: The Environmental Statement Non-Technical Summary for the Great Western Main Line Electrification Project (April, 2013) states that there may be direct impacts to heritage assets such as bridges to allow sufficient room for the Overhead Line Electrification System to pass underneath. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that the existing canopies at Pangbourne Station would require cutting back to facilitate the Overhead Line Electrification System. This would be a minor adverse impact affecting the historic character of the station, resulting in a permanent slight adverse effect. Furthermore, Frouds Lane Overbridge (No. BHL 4551) would be demolished and reconstructed. This would be a permanent major adverse impact.
Rail electrification: impacts on setting of sites, features and areas of historical and cultural value due to overhead power lines.	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network, which will require overhead power lines. This could lead to localised negative impacts on setting of sites, features and areas of historical and cultural value and designated sites. This could be significant if located in or close to designated areas. Evidence: The Environmental Statement Non-Technical Summary for the Great Western Main Line Electrification Project (April, 2013) states that there will be indirect effects to the setting of heritage assets close to the railway, particularly Gwent Levels which is a Registered Landscape of Outstanding Historic Interest in Wales. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that the addition of Overhead Line Electrification System equipment along the Gatehampton Viaduct (No. MLN1 4412) would affect its visual character. The addition of OLE equipment would constitute a permanent minor adverse impact on this high value structure, resulting in a slight adverse effect.
SRFIs: impacts due to construction on previously undeveloped land.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on buried archaeological resource. Impacts will be significant if development were to take place on undeveloped land. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some localised impacts on cultural heritage e.g. DIRFT III states that the development of the SRFI site would have a medium adverse direct impact on an earthwork ridge, a ploughed-out ridge and furrows as a result of machine stripping during construction which would remove assets within central and southern parts of the site.

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										Furthermore, there would be a high adverse impact on a number of archaeological assets including ditches, pits, post-holes, barns and several buildings as these would need to be removed or demolished in order for the construction of the SRFI.
SRFIs: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on landscape and townscape. This could be significant if located in or close to designated sites such as Areas of Outstanding Natural Beauty, National Parks, etc. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some localised setting impacts on cultural heritage e.g. DIRFT III Cultural Heritage and Archaeological Assessment states that there would be a low adverse impact on Motte and Bailey Castle, a Scheduled Ancient Monument due to changes in setting. Furthermore, there would be a number of impacts on undesignated sites due to changes in views as a result of the construction of the SRFI. It was anticipated that there would be a medium adverse impact on the character and setting of the historic landscape during operation of the site.

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AoS6: To preserve, protect and enhance biodiversity

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction (e.g. noise and light disturbance).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs, all of which will have construction impacts on biodiversity, potentially including internationally, nationally and local designated sites and areas. Construction impacts are likely to include reduced air quality due to dust generation, habitat loss due to construction compounds and haul roads, light pollution, etc., however, these are likely to be largely mitigated by construction best practice and occur on a short term basis. Evidence: The main impacts arising during the construction phase of the A453 Widening M1 Junction 24 to A52 Nottingham included: direct habitat loss to sites and habitats; direct harm (including mortality) to species; indirect effects on sites through losses of connecting habitats, foraging habitats and ecological networks and corridors; severance and fragmentation effects on other habitats and species; and potential for habitat degradation through pollution during construction, particularly uncontrolled discharges to watercourses.
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in road traffic across SRN impacts biodiversity.	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the road network. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to indirect impacts on habitat quality due to light and noise pollution, although the extent of impacts will largely depend on the location of developments[25]. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts an increase in traffic i.e. in the Alternative 1 central scenario, 0.33% more traffic on the SRN is forecast by 2040 with respect to the baseline. Increased traffic increases the risk of animals being killed by crossing a road which cuts across their traditional territory or foraging routes. For example, animals will generally continue to travel along established runs, regardless of the presence of a new road, unless prevented from doing so. With regards to flora, air pollutants from road traffic may have effects on local habitats and species, for example certain ferns and lichens are particularly vulnerable to elements of

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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										vehicle emissions.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts biodiversity (e.g. noise and light disturbance).	Indirect	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn, reduce traffic and congestion. This reduction in traffic is likely to positively impact on biodiversity relative to the baseline predictions. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025[1]. Increased traffic increases the risk of animals being killed by crossing a road which cuts across their traditional territory or foraging routes. A decrease in traffic would therefore have a positive impact on biodiversity.
Smart Motorways: direct impacts on biodiversity (e.g. habitat loss) and indirect impacts on biodiversity (e.g. noise and light disturbance).	Direct/ Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a large programme of Smart Motorways. Whilst Smart Motorways are largely located within existing highways boundaries, the additional infrastructure required can lead to some limited loss of habitat due to land take and direct disturbance to flora and fauna. They can also move sources of disturbance (i.e. vehicles) closer to ecological receptors. Evidence: The AST for M62 Junction 25-30 Managed Motorway Scheme states that there will be a potential loss of some highway verge of low ecological value. During the construction phase there would be a neutral effect on habitats of lower value within the soft estate and their associated protected species. This was due to the reduction of buffering of adjacent designated sites and loss and severance of habitat within the Highways Agency soft estate. IAN 161/13 states that schemes may result in adverse noise and vibration impacts, as a result of traffic permanently moving closer to receptors.
Road infrastructure measures including pinch point investments and trunk road upgrades: impacts on biodiversity (e.g. habitat loss).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports a very limited programme of trunk road upgrades, very limited new links and bypasses and a limited programme of pinch point investments. These interventions are considered likely to result in large direct impacts on biodiversity, particularly habitat loss due to land take. However, whilst road infrastructure will have an impact on habitat loss adjacent to the SRN, mitigation will be put in

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										place to try to reduce net habitat loss as much as possible, for example, green bridges and biodiversity offsetting. Biodiversity offsetting habitat loss in one place can be compensated for by providing biodiversity benefits in another place. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact.. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. A1 Elkesley Grade Separated Junction AST states that the scheme resulted in a direct loss of a small extent of habitats that are common to the area and of relatively low value. There is potential to impact on protected reptiles (if present) and ubiquitous nesting birds. Biodiversity offsetting is currently being piloted in 6 counties in the UK and these counties are due to report on the results of these pilots in April 2014. There are very limited examples of biodiversity offsetting, however Defra consulted widely in order to prepare a number of principles for offsetting and confirmed that offsetting must deliver real benefits by: expanding and restoring habitats (not just protecting them); enhancing England's ecological network; providing additionality to existing conservation actions; creating habitat in perpetuity; and following the mitigation hierarchy. The Business and Biodiversity Offset Programme have set out 10 international guiding principles for offsetting and if these are rigorously followed, then biodiversity gain is assured (The Environment Bank Ltd, n.d. Biodiversity Offsetting: A general guide).
Road infrastructure measures including pinch point investments and trunk road upgrades: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Large negative (--)	Longer term (20+ years)	High (>75%)	Medium	Medium	Various across SRN	Permanent	Reversible	Alternative 1 supports a very limited programme of trunk road upgrades, very limited new links and bypasses and a limited programme of pinch point investments. These interventions are considered likely to result in indirect impacts on habitat quality due to light and noise pollution generated on national networks as a result of increased proximity to the ecological receptors. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact.. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The POPE One Year After evaluation of the A27 Southerham to Beddingham Improvements stated that construction noise, vibration, and general activity would all be likely to have short term impacts on ecology within the area, particularly on ecologically sensitive areas such as the Beddingham Level Grazing Marshes SNCI, and on sensitive bird species such as the Skylark and Yellowhammer. Given the nature

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										conservation value of the ditches in Beddingham Grazing Marsh and Glynde Reach SNCI is high, indirect impacts such as light, noise, water pollution to this site were considered to be slight adverse without mitigation.
Road infrastructure measures including pinch point investments and trunk road upgrades: habitat isolation and severance.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Medium	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports a very limited programme of trunk road upgrades, very limited new links and bypasses and a limited programme of pinch point investments. These interventions are considered likely to lead to severance and the fragmentation effects on habitats and species, due to the introduction of new infrastructure in the form of new roads, junctions and lanes. However, whilst road infrastructure will have an impact on severance and fragmentation of habitats and species, mitigation will be put in place to try to reduce severance and fragmentation as much as possible, for example, through the installation of green bridges. Biodiversity offsetting will also be used as a mitigation measure whereby actions are designed to compensate for habitat loss in one place by creating biodiversity benefits in another place. Evidence: 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact.. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The AST for the A453 Widening between the M1 and the A52 states that the habitat loss and severance caused by widening of the road during the construction phase would not increase during the operational phase, however the impact of the severance in the water vole ditches between Thrumpton and Barton-in Fabis would be on-going. This was deemed to be a permanent adverse effect, significant at the local level. In terms of Green Bridges, a report by the European Commission (2008) LIFE building up Europe's Green Infrastructure shows that green bridges constructed for large mammals in various locations in Europe have helped to restore crucial habitat and food sources and increased genetic flow between fragmented populations. Biodiversity offsetting must deliver real benefits by: expanding and restoring habitats; enhancing England’s ecological network; providing additionality to existing conservation actions; creating habitat in perpetuity; and following the mitigation hierarchy. BBOP have set out 10 international guiding principles for offsetting and if these are rigorously followed, then biodiversity gain is assured (The Environment Bank Ltd, n.d. Biodiversity Offsetting: A general guide).
Road infrastructure measures including pinch point investments, trunk road upgrades and new links and bypasses: potential reduction in air quality	Indirect	Small negative(-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Reversible	Alternative 1 supports a very limited programme of trunk road upgrades, very limited new links and bypasses and a limited programme of pinch point investments. These interventions are considered likely to increase capacity on the SRN. This, in turn is likely to result in an increase in emissions of air pollutants. Some ecological designations are sensitive to changes in air quality, and as a result, there may be some small negative impacts on sensitive ecological areas as a result in the increase in traffic, where these areas are close to the SRN.

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										Evidence: DMRB HA 207/07 Air Quality (2007) states that some air pollutants will also have an impact on vegetation which can damage vegetation or affect plant health and productivity, with the pollutant of greatest concern being NOx. Furthermore, Natural England's Microeconomic Evidence for the Benefits of Investment in the Environment 2 (MEBIE2) (NERR057) (2014) highlights that air pollution can impact on plant health and agricultural productivity.
Implementation of biodiversity mitigation for existing road developments: reduced impacts on severance of habitats.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports the implementation of mitigation of habitat severance along certain areas of the SRN. These mitigation measures include the construction of green bridges and the extension of habitats along the length of the network in order to positively impact biodiversity and to reduce the severance associated with existing road infrastructure. Evidence: In terms of Green Bridges, a report by the European Commission (2008) LIFE Building Up Europe's Green Infrastructure shows that green bridges constructed for large mammals in various locations in Europe have helped to restore crucial habitat and food sources and increased genetic flow between fragmented populations. Furthermore, evaluation of evidence by DfT and East Sussex for the Bexhill to Hastings Link Road (2012) shows that a green bridge is likely to be included within the scheme. It is thought that the bridge will particularly benefit dormouse and bats as it will provide a link between habitats. Furthermore, biodiversity is likely to be improved as the bridge will be planted with indigenous shrubs. Whilst the bridge would reduce severance for a number of species, it would not reduce severance for waterborne species.
Additional train movements on existing rail network and more carriages on trains: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. The addition of trains and carriages to existing railway lines is likely to have a small negative impact on biodiversity due to an increase in noise and lighting pollution generated from national networks. Evidence: English Nature (Rail construction and operational effects on biodiversity and geological interests, 2002) highlights that secondary impacts of linear projects such as railways include noise, artificial lighting and wildlife casualties. Railways provide corridors for a wide range of flora and fauna and enhance connectivity between sites. It is thought that this is because of the relative lack of human disturbance. However, the attraction of animals to railway corridors is also likely to lead to an increase in mortality due to rail movements. In turn, this indicates that an increase in train movements and disturbance is likely to lead to a negative impact on biodiversity. Furthermore, the Bat Conservation Trust (Bats and lighting in the UK, 2008) notes that artificial lighting can delay bats from emerging from their roosts and shortens the amount of time spent foraging and can impact the feeding behaviour of bats. They also note that bright light may reduce social flight activity.

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New rail links, new chords and track widening: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links new chords and track widening. These interventions are considered likely to result in large direct impacts on biodiversity, particularly habitat loss due to land take. Evidence: The Ecological Impact Assessment for the new Croxley rail link demonstrated that the proposed development would not have a significant effect on habitats of greater than local importance. However, in terms of species, it was predicted that: the loss of existing planting would fragment existing commuting routes for bats and reduce foraging habitat and there could be disturbance of a badgers. This includes the disturbance of a sett located 30m away from the proposed link and the risk that badgers could be killed or harmed as a result of collisions and that some badgers may be deterred from using established commuting routes where this would require them to cross a newly active railway corridor (Mouchel, 2011. Croxley Rail Link Environmental Statement).
New rail links, new chords and track widening: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links new chords and track widening. These interventions are considered likely to result in indirect impacts on habitat quality due to light and noise pollution generated on national networks as a result of new rail activity and increased proximity to ecological receptors. Evidence: English Nature (Rail construction and operational effects on biodiversity and geological interests, 2002) highlights that secondary impacts of linear projects such as railways include noise, artificial lighting and wildlife casualties. Railways provide corridors for a wide range of flora and fauna and enhance connectivity between sites. It is thought that this is because of the relative lack of human disturbance. However, the attraction of animals to railway corridors is also likely to lead to an increase in mortality due to rail movements. In turn, this indicates that an increase in train movements and disturbance is likely to lead to a negative impact on biodiversity. Furthermore, the Bat Conservation Trust (Bats and lighting in the UK, 2008) notes that artificial lighting can delay bats from emerging from their roosts and shortens the amount of time spent foraging and can impact the feeding behaviour of bats. They also note that bright light may reduce social flight activity.

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New rail links, new chords and track widening: habitat isolation and severance.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links new chords and track widening. These interventions are considered likely to lead to severance and fragmentation effects on habitats and species, due to the introduction of new infrastructures such as tracks and platforms. Evidence: The Ecological Impact Assessment for the new Croxley rail link demonstrated that the proposed development would not have a significant effect on habitats of greater than local importance. However, in terms of species, it was predicted that: the loss of existing planting would fragment existing commuting routes for bats and reduce foraging habitat and there could be disturbance of a badgers. This includes the disturbance of a sett located 30m away from the proposed link and the risk that badgers could be killed or harmed as a result of collisions and that some badgers may be deterred from using established commuting routes where this would require them to cross a newly active railway corridor (Mouchel, 2011. Croxley Rail Link Environmental Statement).
Rail electrification: severance flight paths and direct mortality of birds and bats due to overhead cabling.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Large	Small	Various across rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of railways which will require the installation of new infrastructure. Schemes may cause localised disruption to bat commuting routes where line side vegetation is cleared, and there may be a potential risk of collision with overhead lines or supports by bats or birds. Evidence: English Nature (Rail construction and operational effects on biodiversity and geological interests, 2002) details that one of the key impacts of rail projects is bird collision due to overhead electrical lines. It also highlights two Environmental Statements for the Updating of the Old Dalby Test Track and Crossrail where the overhead cables were identified as an issue in terms of the vegetation situated close to the cables and for birds flight paths. The vegetation was retained where possible in close proximity to the cables in order to try to prevent birds from collisions with cables.
SRFIs: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Short term (0-5 years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to some direct habitat loss during their construction. However, it is considered unlikely that this will be high value habitat should the development occur on previously developed land. Evidence: Environmental Statements for SRFIs e.g. DIRFT III states that the majority of habitats south of the Clifton Brook Tributary are to be lost to facilitate the proposed development. The nature and scale of the proposed development are such that this level of habitat loss is necessary in order to provide sufficient area for the development footprint. Construction of the proposed development will result in the direct loss (on a phased basis) of all semi-improved grassland, hedgerows and ponds south of Lilbourne Meadows, as well as extensive areas of improved pasture.

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SRFIs: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and will operate 24 hours a day. They will include use of artificial lighting and will generate noise pollution, however these would be designed to industry standards to minimise impacts. Evidence: Environmental Statement for SRFIs e.g. DIRFT III states that operational impacts on bats could arise through the inappropriate positioning of lighting (Myotis sp. and Brown Long-eared bats being particularly susceptible to lighting), which could impact on bat foraging areas and commuting corridors, an impact considered to be of minor adverse significance at the international level. Best practice measures for the lighting industry will be followed, with reference to guidelines produced by the Institution of Lighting Professionals. Careful design of the lighting scheme will ensure that potential impacts on important bat foraging areas and commuting corridors are avoided.
SRFIs: habitat isolation and severance.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are substantial developments and may lead to some habitat severance and/or isolation. Evidence: Environmental Statements have identified potential for habitat fragmentation due to the development of SRFIs. DIRFT III, for example, states that there will be loss and severance of the hedgerows as part of the construction of the proposed development which may inhibit foraging and commuting opportunities for bats, however, this has been classed as minor significance due to the low level of activity at the proposed site.

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AoS7: To ensure the protection of water resources (quantity)

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI new infrastructure: impacts on water use.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs, all of which will have construction impacts. Construction works use water and therefore small magnitude, localised adverse impacts on water resources, including both surface and groundwater (quantity) are expected for the infrastructure measures proposed. These are likely to be site specific and will be largely mitigated through standard procedures incorporated into the design. Evidence: Water use in the Highways Agency supply chain includes water embodied within materials and products associated with their services and that used during construction. Using the Highways Agency Water Footprint for 2009/10, Managing Agent Contractor (MAC) and Design, Build, Finance and Operate (DBFO) schemes used in the region of 400,000-530,000m³ of water per annum. During the construction process, the primary uses of water were for dust suppression and wheel washing. Research undertaken by the Strategic Forum for Construction estimates that the construction industry uses approximately 14 million m³ of water per year in England and Wales which accounts for approximately 0.12% of total water use.

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AoS8: To encourage the protection of water quality

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in road traffic across SRN increases risk of impacts to water quality.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Reversible	Overall Alternative 1 interventions aim to increase capacity on the road network. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, therefore, more vehicles will be using the SRN. This increased traffic may lead to an increased risk of localised negative impacts on both surface and groundwater quality (chemical and ecological quality) across the wider network. The extent of impacts will largely depend on the location of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that in the central scenario, there will be 0.33% more traffic on the SRN in 2040 for Alternative 1 with respect to the baseline. DMRB, Volume 11, Section 3, Part 10 HD 45/09. Road Drainage and the Water Environment states that where traffic levels are high the level of contamination increases and therefore, the potential for unacceptable harm being caused to the receiving water also increases.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic on the SRN and in turn impacts on water quality.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn, reduce traffic and congestion. This reduction in traffic is likely to positively impact on surface and groundwater quality across the wider network through the reduction of waste products draining to water and soil resources. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025[26]. DMRB, Volume 11, Section 3, Part 10 HD 45/09. Road Drainage and the Water Environment states that where traffic levels are high the level of contamination increases and therefore, the potential for unacceptable harm being caused to the receiving water also increases.
Implementation of water quality enhancement measures for existing road developments: reduced impacts on water quality.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports the implementation of enhancement measures for surface and groundwater quality impacts where existing roads are causing particular impacts on water quality. Where this occurs, Alternative 1 supports the implementation of works to enhance water quality, such as upgrades of interceptors or balancing ponds. Evidence: The Highways Agency DMRB Volume 11 HD45/09 states that pollution from road drainage can arise from a variety of sources including general vehicle and road degradation, incomplete fuel combustion, leaks of oil, fuel or other pollutants, fires and atmospheric deposition. Road runoff may also contain runoff from adjacent properties or agricultural land. Where assessments show that the risks of pollution from road runoff require mitigation, there are a number of options available to

[26] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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										reduce the risk of pollution incidents.
New road and rail infrastructure: introduction of new potential sources of pollution increases risk of impact on water quality.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. There are potential risks to surface and groundwater resources associated with highways and rail activity, including the increase in impermeable surfaces which increase runoff (and sediments/contaminants) to watercourses. In some instances, the inclusion of catch pits, balancing ponds and interceptors, would result in a slight benefit to surface and groundwater quality and conveyance of flow, however, this benefit over baseline conditions would only occur when existing schemes are being upgraded rather than for new infrastructure. However, Alternative 1 commits to mitigating the impacts of new schemes where there may be an impact on surface and groundwater quality. Therefore, negative impacts would be minimised wherever possible. Evidence: The Highways Agency DMRB Volume 11 HD45/09 states that pollution from road drainage can arise from a variety of sources including general vehicle and road degradation, incomplete fuel combustion, leaks of oil, fuel or other pollutants, fires and atmospheric deposition. Road runoff may also contain runoff from adjacent properties or agricultural land. CIRIA C643 (The potential for Water Pollution from Railways) states that the operation of a railway, both historic and current, has the potential to give rise to pollution as water drains from the railway into watercourses. The A1 Elkesley Grade Separated Junction AST states that the scheme could potentially lead to negative impacts on the water quality within the River Poulter and local groundwater through contaminated runoff. Attenuation has been suggested to alleviate these negative impacts.
New road, rail and SRFI infrastructure: physical impact on hydrology and hydrogeology	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Small	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. This new infrastructure has the potential to impact upon hydrology and hydrogeology due to infrastructure such as culverts being constructed in order to allow the construction of roads, railways and SRFIs. Evidence: DMRB Volume 11 HD45/09 outlines potential impacts arising from road infrastructure on floodplains and water courses. The construction of a new road forms a barrier that may cross existing drainage routes. Existing land drainage should be kept separate from the road drainage where possible, using culverts and ditches beneath the road. Flood defences and other structures such as weirs should be considered when infrastructure is being designed.
SRFIs: Introduction of new potential sources of pollution impacts water quality.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Reversible	Alternative 1 supports the development of SRFIs across England. SRFIs and new rail alignments are considered likely to have a small adverse impact on water quality over a small spatial extent. However, Alternative 1 encourages the protection of water quality through the requirement for mitigation measures, for example, for SRFIs, areas for storage and unloading with appropriate drainage facilities should be clearly marked. Therefore, negative impacts would be minimised wherever possible. Evidence: St. Albans SRFI Environmental Statement states that the quality

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										of water discharging from paved areas into sewers and watercourses could be adversely affected by the presence of pollutants and sediment, affecting the River Ver. An increase in the quantity of suspended solids such as silt and particles of rubber could be expected in the sewers and watercourses, caused by discharges from roads and paved areas. Dissolved material such as hydrocarbons can be expected from oil on carriageways. Spillages may also have the potential to cause damage to controlled waters.

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AoS9: To contribute towards increased resilience on national networks

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI infrastructure measures: impact on the climate change resilience of the SRN and the rail network through introduction of upgraded adaptation measures within new infrastructure.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. Alternative 1 requires consideration of potential impacts of climate change (such as heavy rainfall events causing landslips) in all new infrastructure proposals, which will improve resilience of both new and existing routes. Due to recent events, it could be considered that rail is at greater risk from climate change impacts compared to roads. Evidence: Highways Agency Climate Change Adaptation Framework (2009) states that options assessments will be undertaken for the road network and these options include future-proof designs whereby a precautionary approach will be adopted so that the asset/activity will perform satisfactorily throughout its life in the event of climatic changes towards extreme predictions. Network Rail recognise that a change in climate will have an impact on their assets and activities and in order to address this, they will consider design and build options to ensure long term resilience of railway infrastructure. Further research from the RSSB recommends designing and building for long term resilience (National Rail Climate Change Adaptation Report (2011) and Rail Safety and Standards Board (RSSB) Adapting to Extreme Climate Change Tomorrow's Railway and Climate Change Adaptation (2011)). SRFIs incorporate both rail and road infrastructure and therefore resilience measures will be similar to those above. Network Rail (2014) details that in February 2014, the Great West Mainline at Dawlish was severely impacted by an extreme weather event, with part of the railway collapsing into the sea. Between February and April, the Great West Mainline was closed at Dawlish, disrupting journeys for passengers travelling to Newton Abbot, Plymouth and stations in Cornwall.
Trunk road upgrades, new roads, pinch point investments and Smart Motorways: impact on resilience to accidents and incidents of the SRN.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a large programme of Smart Motorways, very limited trunk road upgrades, limited pinch point investments and very limited new links and bypasses. Accidents and incidents on the road network are significantly influenced by speed, with lower speeds usually leading to a reduction in the severity of accidents which may occur. Smart Motorways allow speeds to be controlled, and therefore lowered, as well as drivers informed of incidents up ahead. Where Smart Motorways have been implemented in the UK, the positive impact on accidents and incidents has been shown. In addition, the programme of trunk road upgrades, new roads and pinch point investments mean that when an incident does occur, the speed with which national networks are re-opened after security and other incidents on them is faster, and is likely to return to normal traffic flow more quickly than would be the case without the upgrades. Evidence: The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report

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										(2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), a total number of 138 accidents have been prevented in the opening year which equates to a saving of an average of 3.1 per scheme. The M42 MM Monitoring and Evaluation Three Year Safety Review on the M42 Managed Motorway scheme shows that personal injury accidents (PIA) have reduced by 50% since opening. Furthermore on the Smart Motorway scheme along the M40 between junctions 16 and 3A of the M42, the number and severity of accidents decreased (Highways Agency, 2011) . The Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This evaluation included a variety of road schemes including pinch point investments, trunk road upgrades and new links and bypasses.

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AoS10: To minimise the impact on soil and land resources including contamination and loss

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: localised impacts on soil and land resources, arising from limited road and rail alignments and SRFIs: loss (if greenfield sites).	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. New infrastructure that is proposed on greenfield sites may result in localised adverse impacts, and possibly the loss of soil and land resources. The probability of infrastructure being built on greenfield sites is limited as most work will be carried out within or near to the existing highway or railway boundary. It should be noted that impacts are likely to be largely dependent on the location of developments. Evidence: Industry Profile – Railway Land (Department of Environment, 1995) identifies contamination risks associated with railways. The on-line dualling of the A21 between Tonbridge and Pembury impacts on ancient woodland, other nature conservation sites, a Scheduled Ancient Monument, Listed Buildings and an Area of Outstanding Natural Beauty. In addition, the A11 Fiveways to Thetford Improvement AST states that there would be slight adverse impacts through the loss of woodland and farmland.
New road, rail and SRFI infrastructure: impacts from ground contamination (e.g. mobilisation of contaminants, brownfield sites).	Direct	Small negative (-)	Longer term (20+ years)	Negligible (<25%)	Small	Large	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. This includes new infrastructure that could be developed on greenfield or brownfield sites. Such development inherently results in risks relating to ground contamination. However, the development of brownfield sites operates within strict controls and impacts are likely to be mitigated to an acceptable level for all developments. However, an inherent risk of contamination still remains. It should be noted that impacts are likely to be largely dependent on the location of developments. Evidence: Design Manual for Roads and Bridges Volume 4: Geotechnics and Drainage. (HD 22/08) states that a discussion of potential contamination and proposed remediation requirements (if required) shall be included in the Geotechnical Design Report. This includes a summary of the findings and conclusions of the risk assessments including the site remediation requirements that have been agreed with regulatory authorities.

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AoS11: To minimise the use of previously undeveloped land

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: road and rail alignments along with SRFIs may be built on previously undeveloped land.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. Road and rail alignments and widening schemes and SRFIs may involve the use of previously undeveloped land for national networks. Evidence: The report, 'Keeping Britain Moving', produced by McKinsey & Company (2011) states that around 75% of all UK transport projects are built on brownfield land, compared with about 55% in continental Europe or the United States.

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AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure including road resurfacing: use of materials in the construction phase impacts on the waste infrastructure.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. The construction of infrastructure will involve the use of large amounts of material (both raw and recycled). The material used will be sourced in accordance with industry standard good practice guidelines to encourage the use of recovered materials. Evidence: Non-statutory guidance for Site Waste Management Plans (Defra) aims to improve materials resource efficiency, by promoting the economic use of construction materials and methods so that waste is minimised and any waste that is produced can be re-used, recycled or recovered in other ways before disposal options are explored. The Highways Agency A421 Improvement used 450,000 tonnes of recycled aggregates in the build, including the asphalt surface, avoiding the need for traditional quarried materials (The Green Construction Board, 2013).

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AoS13: To contribute towards reducing the risk of flooding in the hinterland

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: disturbance to local flood regime and drainage hydrology due to building of new infrastructure (or introduction of additional impermeable surfaces) impacts on the risk of flooding.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. Alternative 1 will ensure that there is a requirement for a Flood Risk Assessment to be undertaken at each development site, which includes taking into account climate change impacts. Furthermore, Alternative 1 commits to mitigating flood risk impacts of new schemes. This will impact upon people, property and ecosystems. The design of all new infrastructure will incorporate mitigation measures relating to any adverse impacts on local hydrology. Evidence: The AST for the A6 Clapham Bypass scheme states that even with mitigation, there may still be an impact on flood risk as the scheme is within a floodplain and also bridges a river. A moderate adverse impact was predicted overall.
Implementation of flooding mitigation measures for existing road developments: reduced impacts on existing drainage infrastructure and flooding.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports the implementation of mitigation for existing flooding problems at locations along the existing SRN where inadequate drainage is in place or where existing sections of the network are vulnerable to flooding (either now or in the future as a result of climate change) and/or those sections contribute to flooding of people or land adjacent to the network. At these locations, improvements will be sought (either through specific schemes or where the opportunity arises on other schemes) through techniques such as the implementation of Sustainable Drainage Systems, improved maintenance practices, contingency planning measures or collaborative schemes with flood risk authorities. This will impact upon people, property and ecosystems. Evidence: The Environment Agency 2009 (Flooding in England: A national assessment of flood risk) shows that 10% of major roads and 20% of railways are at risk of flooding. The road and rail network have both experienced the impact of serious flood events, for example in 2007, there were 10,000 motorists trapped on the M5 motorway due to a flood event. This demonstrates that there are parts of the network where flood risk is an issue. The Highways Agency website states that the A36 Steeple Langford improvements are driven by several incidents of carriageway flooding that have been observed in recent years. The scheme will help to reduce incidences of flooding on this section of the A36.

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AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction of new road, rail and SRFI infrastructure: disruption during the construction period likely to cause congestion which may lead to additional accidents and incidents.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. The construction phases of these works are likely to lead to localised disruption and congestion on the road network, which can in turn lead to an increase level of accidents and incidents. Evidence: Institute for Road Safety Research (SWOV), 2010. Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity decreases with increasing congestion levels, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease.
Cumulative impact of Alternative 1infrastructure interventions on SRN: increase in capacity across the whole SRN leads to increased traffic resulting in an increase in accidents and incidents	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Medium	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the road network. Increased capacity of the network will result in a small increase in traffic due to higher demand, therefore, more vehicles will be using the SRN. These increased traffic levels are likely to have a cumulative impact on the level of accidents and incidents across the wider network. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that traffic on the SRN will increase by 0.33% by 2040 with the implementation of Alternative 1. However, even with an increase in traffic, TASM shows that congestion will reduce by 11.4% on the SRN by 2040 compared to 2040 baseline levels. Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity decreases with increasing congestion levels, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease. The Institute for Road Safety Research (SWOV), 2010.
Cost of motoring: increase in the cost of motoring reduces the amount of traffic and congestion on the SRN and in turn impacts on accidents and incidents across the network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. This increase in the cost of motoring would be likely to discourage people from using the SRN and in turn, reduce traffic and congestion. This reduction in traffic is likely to positively impact on the level of accidents on the SRN. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic and congestion on the SRN will be 9.1%and 15.8% less than the baseline scenario by 2025 respectively[27]. Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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										decreases with increasing congestion levels, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease. The Institute for Road Safety Research (SWOV), 2010).
Programme of maintenance on the SRN, including resurfacing: reduce likelihood of accidents and incidents due to optimum road surfacing from a safety perspective.	Direct	Small positive (+)	Long term (10-20 years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	Alternative 1 supports an extensive programme of road resurfacing on the SRN. This is likely to reduce the level of accidents on the SRN as a result of an improved road surface. Evidence: The RAC Foundation The Economics of Road Maintenance (2013) suggests that poor road maintenance can lead to an increase in accidents on the road network. The Design Manual for Roads and Bridges (DMRB) Volume 7 HD37/06 details the standards with which new road surfacing must comply in terms of skid resistance. Therefore, new road surfaces will comply with the latest standards and are likely to be an improvement over existing surfacing, thereby reducing the risk of accidents and incidents on the SRN.
Smart Motorways: reduce the number and severity of accidents and incidents on the SRN.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across SRN	Permanent	Irreversible	Alternative 1 supports a large programme of Smart Motorways. Accidents and incidents on the road network are significantly influenced by speed, with lower speeds usually leading to a reduction in accidents and the severity of those accidents. Smart Motorways allow speeds to be controlled, and therefore lowered, as well as drivers informed of incidents up ahead. Smart Motorways are most often utilised during peak traffic flows. Where Smart Motorways have been implemented in the UK, a positive impact on accidents and incidents has been shown. Evidence: Highways Agency, 2011. M42 MM Monitoring and Evaluation Three Year Safety Review shows that on the M42 Managed Motorway scheme, personal injury accidents (PIA) have reduced by at least 50% since opening in 2006.
Road infrastructure including pinch point investments and trunk road upgrades: reduce the number and severity of accidents and incidents on the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports a limited programme of pinch point investments and a very limited programme of trunk road upgrades. New highways developments provide an opportunity to make significant safety improvements. Some developments have safety as a key objective, but even where safety is not the main driver of a development, there will be the opportunity to introduce the most modern and effective safety measures. Therefore, this is likely to reduce the levels of accident and incident risk on the SRN. Evidence: Post opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), a total number of 138 accidents have been prevented in the opening year which equates to a saving of an average of 3.1 per scheme. HA Post Opening Project Evaluations (POPEs) show safety benefits of various infrastructure upgrades, e.g. M62 Junction 6 upgrade led to 5.6 less accidents per year, and dualling of the A30 Bodmin to Indian Queens led to annual saving of 84 Personal Injury Accidents compared to 5 years before opening. Furthermore, the Highways Agency Scheme Evaluation shows that the

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										majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes and is not limited to trunk road upgrades and pinch point investments.
New links and bypasses: reduction in flows on alternative links where new link is introduced thereby reducing the probability of incidents and accidents.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. Where these new roads take traffic off alternative routes (i.e. bypasses), especially where the traffic is reduced in town and village centre, there is likely to be a reduction of accidents and incidents on the roads where traffic has been reduced. In addition, new highways developments provide an opportunity to make significant safety improvements. Some developments have safety as a key objective, but even where safety is not the main driver of a development, there will be the opportunity to introduce the most modern and effective safety measures. Therefore, overall, new road links are likely to reduce the levels of accident and incident risk on the SRN. Evidence: HA Post Opening Project Evaluations (POPEs) show safety benefits of various infrastructure upgrades, e.g. A21 Lamberhurst Bypass new dual carriageway led to halving of accident rate along former route and the A500 Basford, Hough and Shavington Bypass new dual carriageway led to a 50% reduction in Personal Injury Accidents and casualties on the old A500. Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes and is not limited to new links and bypasses.
SRFIs: modal shift from road to rail reduces accidents and incidents on the wider road network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are expected to result in a modal shift from road to rail and the resulting reduction of large freight vehicles on the road is likely to reduce the level of accidents and incidents on the SRN. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that each freight train could take approximately 60 lorry journeys off the road. However, for the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. It has been estimated that the use of rail for freight movements reduces road casualties by 500 per year (Network Rail, Value and Importance of Freight, 2010). This is also noted in the Daventry International Rail Freight Terminal Needs Case.

AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types

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Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
All Alternative 1 interventions: it is considered unlikely that there will be any impacts on crime or fear of crime as a result of the interventions contained within Alternative 1.	N/A									

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AoS16: To contribute towards the maximisation of user benefits on the National Networks

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction: road resurfacing and the construction of infrastructure measures causing disruption during the construction period and this is likely to cause congestion and therefore increased journey times which reduces user benefits.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. This includes a large programme of resurfacing. The disruption caused by this resurfacing programme is likely to impact on user benefits due to increased journey times. Evidence: Press releases from the Highways Agency show that the majority of resurfacing takes place overnight which is likely to reduce the impacts on congestion on the SRN. However, during these overnight periods, the roads are often closed and traffic is diverted to alternative routes which would also have an impact on congestion on local roads.
Cumulative impact of Alternative 1 infrastructure interventions on SRN: reduction in congestion across the SRN reduces journey times which improve user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Large	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the road network. Increased capacity is likely to reduce congestion and delays due to smoother flow of traffic and reduced journey times leading to user benefits across the wider network. For example, road infrastructure measures including trunk road upgrades, pinch point investments and new links and bypasses and Smart Motorways are likely to increase capacity which reduces congestion, delays and journey times, resulting in user benefits. Impacts will vary depending on the location of the developments. Evidence: TASM modelling of an Alternative 1 Investment scenario forecasts that in the central scenario, there will be 0.33% more traffic on the SRN in 2040 in Alternative 1 with respect to the baseline. However, even with an increase in traffic, the central scenario forecasts that congestion will reduce by 11.4% on the SRN by 2040 compared to 2040 baseline levels. This reduction in congestion is likely to improve journey times across the road network and in turn create benefits for users. The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), the total journey time savings amounts to 1.89 million vehicle hours or 42,000 hours per scheme on average. The A55/A483 segregated left turn from the A483 from Chester to the A55 east was completed due to the build-up of substantial queues and the resultant delays in evening peak traffic leaving Chester. Journey time delays reduced from 53.9 minutes pre-opening to 29.5 minutes post-opening during the AM peak (Post Project Evaluation Report (POPE) for A55/A483 improvement). The M40/A404 Handy Cross new junction led to journey time savings of 6 minutes and, the dualling of three sections of the A43 led to journey time savings of 6-9 minutes.
Cost of motoring: increase in the cost of motoring reduces the amount of congestion on the SRN and in turn	Indirect	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. The increase in the cost of motoring would be likely to discourage people from using vehicles on the SRN and encourage a shift to other modes of transport, thereby reducing

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reduces journey times.										congestion on the road network. This reduction in congestion would be likely to result in improved journey times and therefore improve user benefits. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic levels on the SRN will be 9.1% less than the baseline scenario by 2025, which will in turn lead to a reduction in congestion on the SRN of 15.8% (central scenario)[1].
Cost of motoring: impact on user benefits through increased cost.	Direct	Large negative (- -)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. The increase in the cost of motoring would be likely to impact on user benefits for road users. Evidence: An increase in the cost of motoring of between 25 and 28% (as used to exemplify the impact of this intervention) would result in a sizable increase in the costs to road users. A survey conducted as part of the RAC Cost of Motoring report (2010) shows that motorists consider the cost of motoring to be of most concern when considering driving.
Additional train movements on existing rail network and more carriages on trains: an increase in rail movements will reduce journey times and overcrowding on the rail network and therefore improve user benefits.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. This will be focused on routes in and out of, and between, major cities. An increase in the number of trains is likely to reduce journey times and improve the level of service for some users and therefore positively impact on user benefits. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: new links and an increase in capacity of existing lines will reduce journey times and overcrowding on the rail network and therefore improve user benefits.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. This is likely to increase capacity of the rail network and therefore result in journey time savings and an improved level of service, which will positively impact on user benefits. Evidence: The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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										England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds (Network Rail, 2013, Northern Hub Factsheet). The Nuneaton North Chord has recently opened and therefore actual impacts of the development have not been assessed. However, the Needs Case for the project anticipated that the provision of a new section of track to allow increased freight trains to use the line and increase the reliability of passenger trains. This would allow 24 freight trains per day to travel between Felixstowe and Nuneaton (compared to up to 10 trains per day previously). Furthermore, the freeing up of the line for passenger trains would benefit users of the line by £482 million and non-users by £135 million through reduced congestion on the roads (Network Rail, 2010. Nuneaton North Chord Order Statement of Case of the Applicant).
Rail electrification: reduction of journey times which improves user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. Electrification has been shown to improve acceleration and deceleration times and have greater reliability due to lower failure rates compared to diesel trains. In addition, electric trains have increased capacity due to the lack of requirement for power cars that diesel trains need. This therefore results in user benefits due to the reduced journey times on electrified lines. Evidence: The Network RUS Electrification report (Network Rail, 2009) states that electric trains have a lower failure rate compared to diesel trains and overall electrification improves system reliability. In addition electric trains accelerate and decelerate quicker than diesel trains, which over long journeys, improve journey times.
SRFIs: modal shift from road to rail reduces congestion on the SRN which reduces journey times and in turn impacts on user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. They are likely to result in a modal shift of freight from road to rail thereby reducing the number of lorries on the SRN which reduces congestion and results in user benefits of reduced journey times. Evidence: Each freight train takes approximately 60 lorries of the road (Network Rail, Value and Importance of Freight, 2010). However, for the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Furthermore, the Environmental Statement for Daventry International Rail Freight Terminal highlights that the modal shift of freight from road to rail reduces congestion and this therefore benefits users of the SRN as journey times are reduced.

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AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction: road resurfacing and infrastructure measures lead to disruption during construction period and this is likely to cause congestion and therefore increased journey times.	Direct	Small negative (-)	Short term (0-5 years)	High (>75%)	Large	Small	Various across SRN	Temporary	Reversible	Alternative 1 supports a smaller roads programme and an expanded rail programme relative to the NPS and supports the development of SRFIs. This includes a large programme of resurfacing. The disruption caused by these programmes is likely to negatively impact on congestion and delays during construction periods and therefore journey times and reliability. Evidence: Press releases from the Highways Agency show that the majority of resurfacing takes place overnight which is likely to reduce the impacts on congestion on the SRN. However, during these overnight periods, the roads are closed and traffic is diverted on to alternative routes. This therefore could have an impact on congestion and therefore journey time reliability on local roads. In terms of Smart Motorway construction there are usually certain procedures in place: hard shoulder closures, narrower lanes and safety barriers are in place as a 50mph speed restriction is implemented for the safety of drivers and road workers. This can lead to increased congestion and slow moving traffic, for example, the AST for the M25 Junction 5-7 Managed Motorway – All Lane Running states that there will be delays to all business users during construction and future maintenance of the scheme.
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in capacity of the SRN reduces congestion and therefore improves levels of congestion and the reliability of the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Large	Whole SRN	Permanent	Irreversible	Alternative 1 interventions aim to increase capacity on the road network. Increased capacity is likely to reduce congestion and increase reliability due to smoother flow of traffic and reduced journey times across the wider network. For example, limited trunk road upgrades, pinch point investments and very limited new links and bypasses are considered likely to result in large direct impacts on congestion, due to increased speeds and therefore journey time savings and increased journey time reliability. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that traffic on the SRN will increase by 0.33% by 2040 with the implementation of Alternative 1 (central scenario). However, even with an increase in traffic, TASM modelling shows that congestion will reduce by 11.4% on the SRN by 2040 compared to 2040 baseline levels (central scenario). This is likely to improve journey times across the wider network and in turn increase reliability on the SRN. Post opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), the total journey time savings amounts to 1.89 million vehicle hours or 42,000 hours per scheme. A55/A483 segregated left turn from the A483 from Chester to the A55 east was completed due to the build-up of substantial queues and the resultant delays in evening peak traffic leaving Chester. Journey time delays reduced from 53.9 minutes pre-opening to 29.5 minutes post-opening during the AM peak (Post Project Evaluation Report (POPE) for A55/A483 improvement). HA Post Opening Project Evaluations (POPEs) show journey time reliability and congestion benefits for various infrastructure projects e.g. A500 Basford,

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										Hough and Shavington Bypass new dual carriageway led to a reduction in journey times of 4-4.5 minutes compared to the previous road despite levels of traffic having increased by 10% in the vicinity of the scheme. Along the A47 Thorney Bypass new dual carriageway journey times have improved by 1.5-2 minutes for users of the A47 and traffic within the village of Thorney has reduced by between 86% and 95%.
Increasing the cost of motoring: discourage people from using the road network and therefore reduce congestion.	Indirect	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 1 supports a moderate increase in the cost of motoring to help control the use of to reduce demand on the SRN. The increase in the cost of motoring would be likely to discourage people from using vehicles on the SRN and encourage a shift to other modes of transport, thereby reducing congestion and delays on the road network. This reduction in congestion and delays would be likely to result in improved journey time reliability. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic and congestion levels on the SRN will be 9.1% and 15.8% less than the baseline scenario by 2025 respectively (central scenario)[1]. The RAC Cost of Motoring Index 2010 gives details of a survey conducted as part of the report shows that motorists consider the cost of motoring to be of most concern when considering driving.
Smart Motorways: increase capacity and reliability and reduce congestion on the SRN.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Large	Various across SRN	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. Smart Motorways offer the ability to manage speeds to manage congestion. Reduced congestion leads to increased speeds meaning journey time savings and increased journey time reliability. Evidence: Highways Agency, 2011 Birmingham Box Managed Motorway Phases 1&2 Year 3 Summary Report shows that the scheme has had an impact on variations in average traffic speeds which make journeys smoother. Users have also reported a significant reduction in stop/start conditions on parts of the scheme. Furthermore, the Environmental Assessment Report for the M6 Junction 10a to 13 Smart Motorway scheme states that this improvement would relieve congestion and smooth the flow of the traffic by increasing route capacity and regulating speed during busy times. This will also improve safety and journey times.
Additional train movements on existing rail network and more carriages on trains: an increase in capacity will reduce congestion and overcrowding on the rail network.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. This will be focused on routes in and out of, and between, major cities. An increase in the number of trains and carriages will increase capacity across the rail network and in turn reduce congestion, delays and overcrowding. Evidence: Modelling of HLOS 2 schemes shows that all schemes combined will have a benefit cost ratio of 4.1. These benefits include time savings, crowding relieve and decreasing congestion for road users. Network Rail intends to lengthen the trains using some lines along some

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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										parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: new links and an increase in the capacity of existing lines will reduce congestion and overcrowding.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. This will increase capacity across the rail network and in turn reduce congestion and overcrowding. A reduction in congestion, delays and an increase in capacity is likely to result in increased journey time reliability. Evidence: Modelling of HLOS 2 schemes shows that all schemes combined will have a benefit cost ratio of 4.1. These benefits include time savings, crowding relieve and decreasing congestion for road users. The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds. It is also expected that an additional 700 trains will be able to run each day by 2019, allowing additional capacity for 44 million passengers per year. It will also potentially create between 20,000 and 30,000 jobs (Network Rail, 2013, Northern Hub Factsheet). The North Doncaster Chord (part of the East Coast Mainline between Yorkshire and London) will divert slow-moving freight trains from a key pinch point, thus allowing additional passenger trains to use the line. This increase in the frequency of passenger trains will improve long distance journeys and in turn will improve access to employment centres (Mott MacDonald and Network Rail, 2011. North Doncaster Chord Environmental Statement Non-Technical Summary).
Rail electrification: increase capacity and reliability and therefore reduce journey times.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a very extensive programme of electrification of the rail network. Electrification has been shown to improve acceleration and deceleration times and have greater reliability due to lower failure rates compared to diesel trains. In addition, electric trains have increased capacity due to the lack of requirement for power cars that diesel trains need. This therefore results in reduced journey times and congestion, and increased journey time reliability on electrified lines. Evidence: Network RUS Electrification, Network Rail, 2009. Electric trains have a lower failure rate compared to diesel trains and overall electrification improves system reliability. However, failures of overhead equipment can cause delays on electrified routes. Furthermore, electric

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										trains do not require a separate power car, which in turn increases the capacity of the train. Electric trains accelerate and decelerate quicker than diesel trains, which over long journeys, improves journey times.
SRFIs: modal shift from road to rail reduces congestion on the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. They are likely to result in a modal shift of freight from road to rail thereby reducing the number of lorries on the SRN, which in turn reduces levels of congestion, delays and increases reliability. Evidence: The Environmental Statement for Daventry International Rail Freight Terminal highlights that the modal shift of freight from road to rail reduces congestion and increases journey time reliability.

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AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in road capacity across SRN results in improved transport access to regeneration areas, employment centres and areas of high unemployment.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the road network. It is likely that this will result in improved access to employment centre and regeneration areas. Road infrastructure measures including Smart Motorways, trunk road upgrades and pinch point investments are considered likely to result in reductions in congestion, in turn leading to increased access to regeneration areas, employment centres, deprived areas and areas of high unemployment. Impacts will be largely dependent on the location of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that the implementation of the road infrastructure measures supported by Alternative 1 could reduce congestion on the SRN by 11.4% compared to 2040 baseline levels (central scenario). This reduction in congestion is likely to increase the capacity of the road network and therefore improve access. The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies anecdotal evidence which suggests that a number of major schemes have helped to facilitate local and regional economic development by reducing congestion and improving journey time reliability. These major road schemes include the following: bypasses, road widening, junction improvements and A-road upgrades to motorways. Environmental Impact Reports (EIR) from previous schemes. For example, the M25 J30/A13 Corridor Stage 1 EIR (grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 80-160 due to lessening of transport constraints. In addition, the Birmingham Box Managed Motorway Scheme EIR predicted that the scheme would have a positive impact on regeneration areas in the West Midlands as it would make it easier for people to access employment opportunities.
Increasing the cost of motoring: discourage people from using the road network and therefore reduce congestion which results in improved transport access to regeneration areas, employment centres and areas of high unemployment.	Indirect	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Reversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. The increase in the cost of motoring would be likely to discourage people from using vehicles on the SRN and encourage a shift to other modes of transport, thereby reducing congestion on the road network. This reduction in congestion would be likely to result in improved access to regeneration areas, deprived areas, employment centres and areas of high unemployment. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic and congestion levels on the SRN will be 9.1% and 15.8% less than the baseline scenario by 2025 respectively[1]. This reduction in congestion is likely to increase the capacity of the road network and therefore improve access.

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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Additional train movements on existing rail network and more carriages on trains: improvements to the railway network increases access to regeneration areas, employment centres and areas of high unemployment.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. This will be focused on routes in and out of, and between, major cities. The improvement of existing lines in terms of capacity and reliability are likely to result in improved access to regeneration areas, deprived areas and areas of high unemployment through improved journey times. Impacts will be dependent on the location of developments. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New rail links, new chords and track widening: improvements to the railway network increases access to regeneration areas, employment centres and areas of high unemployment.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening. These new rail links are likely to increase the accessibility to and from employment and regeneration areas due to the facilitation of new rail services, and increase in capacity on existing lines, and, in limited cases, a greater proximity to the rail network. Impacts will be dependent on the location of developments. Evidence: The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds. It is also expected that an additional 700 trains will be able to run each day by 2019, allowing additional capacity for 44 million passengers per year. It will also potentially create between 20,000 and 30,000 jobs (Network Rail, 2013, Northern Hub Factsheet). The North Doncaster Chord (part of the East Coast Mainline between Yorkshire and London) will divert slow-moving freight trains from a key pinch point, thus allowing additional passenger trains to use the line. This increase in the frequency of passenger trains will improve long distance journeys and in turn will improve access to employment centres (Mott MacDonald and Network Rail, 2011. North Doncaster Chord Environmental Statement Non-Technical Summary).
Door-to-door Strategy measures and cycling	Direct	Small positive (+)	Longer term (20+	Medium (50-75%)	Medium	Small	Various across	Permanent	Irreversible	Alternative 1 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g.

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measures: improvements to modal integration leading to improved access.			years)				England			The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to facilitate the use of the national networks for non-car users, which can help with access to regeneration areas, and employment centres for those living in high unemployment and deprived areas. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income and that poor transport impacts social exclusion and deprivation. By improving accessibility to national networks through the use of non-car modes, accessibility to the jobs, services and social networks are likely to be improved.

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AoS19: To contribute towards the improvement of accessibility to rural areas

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in road capacity across SRN results in improved access.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Medium	Medium	Whole SRN	Permanent	Irreversible	Overall, Alternative 1 interventions aim to increase capacity across the SRN. It is likely that this will result in improved access to rural areas and green spaces from regionally/nationally strategic locations. For example, Smart Motorways, very limited trunk road upgrades, and limited pinch point investments are considered likely to reduce congestion and journey times and therefore improve accessibility to rural areas. Impacts will be largely dependent on the location of developments. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that the implementation of the programmes supported by Alternative 1 could reduce congestion on the SRN by 11.4% compared to 2040 baseline levels (central scenario). This reduction in congestion is likely to increase the capacity of the road network and therefore improve access. HA Post Opening Project Evaluations (POPEs) show that trunk road upgrades along the A30 from Bodmin to Indian Queens has resulted in a 19% increase in traffic using the route and more reliable journey times compared to the previous route.
New links and bypasses: additional routes increase access to and from rural areas.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. Where these new links and bypasses are located close to or within rural areas, access to the SRN for those living in, or wishing to visit rural areas is improved. Impacts will be dependent on the location of developments. Evidence: The A249 Iwade to Queenborough Improvement involved improved access between north Kent and the Isle of Sheppey via a new bridge. The scheme has been crucial for promoting economic growth in these areas (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013). This scheme has therefore improved access to rural areas. HA Post Opening Project Evaluations (POPEs) show that new road schemes increase capacity of the road network e.g. the A38 Dobwalls bypass in Cornwall is attributed to a 4.4% rise in traffic using the A38 corridor and the A5 Nesscliffe bypass in Shropshire has increased levels of vehicles using the road by 5% between the first year and fifth year since opening.
Increasing the cost of motoring: impact on those living in and visiting rural areas that rely on access by car.	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Small	Large	Various across England	Permanent	Irreversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN The increase in the cost of motoring would be more likely to impact those who rely on cars compared to those who have the option to use alternative modes of transport. This would be of a disadvantage to those people who may not have other transport options. This is likely to negatively impact the accessibility to rural areas, for both those living in these communities and those who wish to visit these areas, particularly if there are no other alternative modes of transport available. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025, traffic and congestion levels on the SRN will be 9.1% and 15.8% less than the baseline scenario

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										by 2025 respectively[1]. An increase in the cost of motoring would increase the costs to road users. A survey conducted as part of the RAC Cost of Motoring report (2010) shows that motorists consider the cost of motoring to be of most concern when considering driving. Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) explains that people in rural areas in Scotland have a greater reliance on cars and are more likely to drive every day and drive to work.
New rail links, new chords and track widening, and additional train movements on existing rail network and more carriages on trains, and rail electrification: improvements to the railway network increases accessibility.	Direct	Large positive (++)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords and track widening, as well as a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. It also supports a very extensive programme of electrification. The improvement of existing lines in terms of capacity and reliability, and the new rail links are likely to result in improved access to rural communities. Impacts will be dependent on the location of developments. Evidence: A report commissioned by The Scottish Government (Review of Economic Assessment in Rural Transport Appraisal, 2009) identifies that improvements in frequency of rural rail, ferry and bus services have been seen to increase usage by up to 42%. The Control Period 4 (CP4) Delivery Plan 2009 (Network Rail, 2009) states that investment in the railway network will result in a bigger railway network and enhancements to the network to increase capacity and capability. Network improvements will be carried out in rural areas. For example in the rural North West, there is an increased demand on the route for freight but the route is primarily used for commuters from rural areas to Carlisle. Improvements will be made to the network to enable more frequent trains to run during peak times and to increase speeds. This will improve access to rural areas.
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access to rural areas.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to facilitate the use of the national networks for non-car users, which can help with access to rural areas and green spaces from regionally/nationally strategic locations. Evidence: The Door to Door Strategy (DfT, 2013) states that parking at railway stations is an important factor for many people when choosing whether or not to use public transport. This is particularly true in rural areas. In some areas, the demand for parking spaces often exceeds capacity. The strategy outlines improvements to the walking and cycling network, which it is hoped will help to facilitate access to national networks, particularly rail. In turn, this suggests that in rural areas where demand often exceeds capacity at train stations, improvements may improve access to and from rural areas.

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 1 infrastructure interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on severance across the wider network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 1 interventions aim to increase capacity on the road network. Increased capacity of the network will increase traffic due to higher demand, therefore, more vehicles will be using the SRN. These increased traffic levels are likely to have a cumulative impact on severance across the wider network with potentially greater impacts on severance at locations where individual interventions increase traffic. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that traffic on the SRN will increase by 0.33% by 2040 with the implementation of Alternative 1 (central scenario). Guidelines from the Institute of Environmental Assessment for assessing Road Traffic (1993) suggest that an increase in traffic flows along road networks increases severance as there is increased difficulty with crossing a heavily trafficked road. The dualling of the A43 increased traffic flows by 60% between 2004 and 2009.
New links and bypasses: additional routes impact severance within communities by introducing physical barrier.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. These new roads can result in severance where they are located within communities due to the physical barrier created by the road which may reduce the ease of Non-Motorised User movements along or across national network. However Alternative 1 commits to mitigating the impacts of severance of new schemes where possible. Evidence: HA Post Opening Project Evaluations (POPEs) show that severance has been increased in some locations e.g. upgrades of the A1(M) Wetherby to Walshford which included 3.3 miles of new dual three-lane carriageways, showed that severance was increased as the scheme severed two public rights of way, although it should be noted that short diversions were implemented.
New links and bypasses: additional routes impact severance within communities by reducing traffic on existing roads.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. This is likely to reduce severance within urban areas such as towns and villages where bypasses take traffic away from a town or village centre. Evidence: A breakdown of the Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013 shows that 23 out of 25 bypass schemes had a positive impact on severance in local communities. HA Post Opening Project Evaluations (POPEs) show that severance has been reduced e.g. the A38 Dobwalls bypass POPE shows that 75% of residents living in Dobwalls feel that conditions for cyclists and pedestrians are better within the village and the A60 Haydon Bridge bypass has reduced severance in the village of Haydon and increased the journey ambience of pedestrians and cyclists within the village.
Implementation of mitigation measures for existing road developments: reduced impact on severance within communities.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Irreversible	Alternative 1 supports the enhancement of existing schemes in order to mitigate existing severance issues. This includes measures to cycle-proof the SRN. This is likely to positively impact on communities where severance is problematic. Evidence: The A19 Black Swan Bridge provides a grade separated crossing

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										of an existing junction which restricted turning movements and had a high rate of accidents. The previous scheme was not suitable for safe pedestrian crossings. The POPE for the scheme shows that it has had a beneficial impact on severance. Prior to the scheme, there were no facilities for pedestrians, equestrians or cyclists to cross the A19 at this location, with the nearest crossing being 2.2 miles to the north. The scheme provided a crossing for non-motorised users, however North Yorkshire County Council have observed that the crossing has a low level of use, although there has been an increase is usage of the local lanes by cyclists and horse riders (Post Project Evaluation Report (POPE) for A19 Black Swan Bridge). Other HA Post Opening Project Evaluations (POPEs) show that severance has been reduced with junction upgrades e.g. the A1 Peterborough to Blyth grade separated junctions have had a slight beneficial impact on severance as at all junctions, as there have been improved and safer crossing provisions for pedestrians and cyclists. A number of schemes identified by the Heart of the South West Local Transport Board (2013) including improvements to Cattledown Roundabout, Plymouth and Yeovil Western Corridor to provide improved facilities for cyclists and pedestrians will reduce severance.
New rail links: additional lines impact severance within communities.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links and new chords. This is likely to increase severance within communities and therefore have a negative impact in areas where improvements are proposed. Evidence: A report commissioned by DfT (Understanding Community Severance, 2005) highlights that new transport schemes such as railways can have detrimental social impact on communities due to the creation of a real or perceived barrier which people may have to cross in order to reach services and facilities. However, it does note that the magnitude of severance is likely to depend on the nature and location of the crossings provided.
SRFIs: severance due to additional road and rail links to the site.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 1 supports the development of SRFIs across England. SRFIs are likely to require new road and rail links to the site which may impact on severance due to increasing traffic and creating a physical barrier between communities. Evidence: The Environmental Statement for an SRFI in St Albans indicates that upgrades to the existing road network and new roads will be required in order to facilitate the SRFI. The transport assessment included within the ES shows that there is either a neutral or slight adverse impact on severance as a result of the SRFI.

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AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 1infrastructure interventions on SRN: increase in capacity across the whole SRN results in improved access across the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Medium	Whole SRN	Permanent	Irreversible	Overall, Alternative 1 interventions aim to increase capacity across the SRN. It is likely that this increased capacity will result in improved access to the SRN and the jobs, services and social networks it provides. For example, Smart Motorways, trunk road upgrades, and pinch point investments are considered likely to result in reductions in congestion, in turn leading to increased access to the SRN. Evidence: TASM Modelling of an Alternative 1 investment scenario forecasts that traffic on the SRN will increase by 0.33% by 2040 with the implementation of Alternative 1. However, even with an increase in traffic, TASM shows that congestion will reduce by 11.4% on the SRN by 2040 compared to 2040 baseline levels. This reduction in congestion and increase in capacity is likely to result in better access to the SRN. The A5 Weeford to Fazeley Improvement has brought about improved journey times and journey time reliability and the scheme has facilitated access to employment and services as a result of this (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013) . Environmental Impact Reports (EIR) from previous schemes. For example, the M25 J30/A13 Corridor Stage 1 EIR (grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 80-160 due to lessening of transport constraints. The Birmingham Box Managed Motorway Scheme along the M6 J5-8 EIR predicts that the scheme would have a positive impact on regeneration areas in the West Midlands as it would make it easier for people to access employment opportunities.
New links and bypasses: additional routes increase access to SRNs.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Whole SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. These new links and bypasses will increase access to the SRN for all, including the most disadvantaged sections of the community. Evidence: The A249 Iwade to Queenborough Improvement involved improved access between north Kent and the Isle of Sheppey via a new bridge. The scheme has been crucial for promoting economic growth in these areas (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013). The M25 J30/A13 Corridor Stage 1 Environmental Impact Report (grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has the potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 80-160 due to lessening of transport constraints.

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Tolling on limited number of new links and bypasses: impact on costs to road users.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Very limited locations across SRN	Permanent	Irreversible	Alternative 1 supports very limited new links and bypasses. These new links and bypasses will increase access to the SRN for all, including the most disadvantaged sections of the community. However, the Government will consider tolling as an option for funding new road capacity in very limited circumstances which may have a negative impact on the most disadvantaged groups. Evidence: The proposed A14 toll as outlined in the Cambridge to Huntingdon Improvement A14 (Highways Agency, 2013) would be operational between the Ellington and Swavesey junctions but not the A14 to the east of Swavesey or any part of the A1. Tariffs have not yet been agreed, but it is proposed that between £1.00 and £1.50 would be charged for cars and other light vehicles and between £2.00 and £3.00 for HGVs/ The charge would apply between 6am and 10pm.
Increasing the cost of motoring: impact on access to the SRN for disadvantaged groups.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Irreversible	Alternative 1 supports a moderate increase in the cost of motoring to help manage demand on the SRN. The increase in the cost of motoring would be more likely to impact disadvantaged sections of the community such as those who rely on cars for daily living or those on low incomes. This would be likely to create a disproportionate impact on those who are unable to afford the increase in the cost of motoring, therefore impacting on their accessibility to the SRN ad the jobs, services and social networks they provide. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025 would result in a sizable increase in the costs to road users[1]. The RAC Cost of Motoring Index 2010 that motorists consider the cost of motoring to be of most concern when considering driving. Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income. In Scotland, 37% of households with an annual net income of less than £10,000 own a car, compared to 98% of households with an annual net household income of over £40,000. Poor transport impacts social exclusion and deprivation.
New rail links, new chords and track widening: improvements to the railway network impacts on access to jobs, services and social networks.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the rail network	Permanent	Irreversible	Alternative 1 supports a large programme to provide major new links, new chords, track widening and a very extensive programme of electrification. The improvement of existing lines in terms of capacity and reliability, and the new rail links are likely to result in an increased level of public transport services and access to the rail network and the jobs, services and social networks it creates. Evidence: Control Period 4 (CP4) Delivery Plan 2009. Network Rail, 2009. Investment in the railway network will result in a bigger railway network and enhancements to the network to increase capacity and capability. CP4 includes an Access for All programme whereby accessibility will be improved in around 100 stations across England, Wales and Scotland.

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

*It should be noted that the evidence cited is for illustrative purposes only and, whilst it may not be representative of all schemes nor all potential impacts arising from these schemes, from professional judgement and experience is considered to support the general assessment of impacts made in this assessment table.

Additional train movements on existing rail network and more carriages on trains: improvements to the railway network impacts on access to jobs, services and social networks.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the rail network	Permanent	Reversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through provision of more trains and longer trains. This will be focused on routes in and out of, and between, major cities. An increase in the capacity of existing trains and lines is likely to result in an increase in access to jobs, services and social networks. Evidence: Network Rail intends the trains using some lines along some parts of the network. For example, for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access to national networks, even for the most disadvantaged.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income. In Scotland, 37% of households with an annual net income of less than £10,000 own a car, compared to 98% of households with an annual net household income of over £40,000. Poor transport impacts social exclusion and deprivation. By improving accessibility to national networks through the use of non-car modes, accessibility to the jobs, services and social networks are likely to be improved for the most disadvantaged. Furthermore, the Door-to-Door Strategy (DfT, 2013) highlights the point that the cost of travel is important for users of national networks and that by integrating the door-to-door strategy as a whole, journeys for non-car users will be more affordable.

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AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Smart Motorways: increasing capacity on the road may impact disadvantaged groups who lack confidence using the road network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across SRN	Permanent	Reversible	Alternative 1 supports a large programme of Smart Motorways. This is likely to increase capacity and therefore the number of vehicle movements on the SRN. This may impact upon vulnerable social groups who lack confidence in using heavily trafficked roads. However it is acknowledged that the reduction in congestion as a result of the implementation of Smart Motorways may also impact positively on vulnerable social groups. Evidence: A study published by the Highways Agency (Future Managed Motorways Concept: Equality Impact Assessment 2012) to assess the impacts of future Smart Motorway schemes on vulnerable groups identifies that older people, younger people (i.e. novice drivers), disabled people and pregnant women are likely to be at the greatest disadvantage as a result of a Smart Motorways programme. Evidence collected shows that older people with physical and sensory impairments lack confidence when driving and this in turn means they take shorter journeys (50% of drivers aged 75 or over say they are more cautious when using heavily trafficked roads), younger people tend to avoid busy motorways because they feel they lack the necessary skills and 40% of women surveyed say that they avoided motorway driving in the first year after passing their driving tests. Furthermore, the use of hard should running may impact vulnerable groups, for example some women, older people and younger people have serious concerns over breaking down on the motorway.
Road infrastructure measures including new links and bypasses: Compulsory Purchase Orders (CPOs) may be required for these measures and therefore impact properties and their residents adjacent to the road network.	Direct	Large negative (--)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports very limited new road infrastructure measures, including very limited new links and bypasses. These measures are likely to require land take and there is the possibility that CPOs may be used to acquire land where improvements are to be carried out outside of the highway boundary. This will disproportionately impact on residents whose properties are bought. Evidence: Compulsory Purchase Orders may be enforced if a proposed road scheme is considered to be in the public interest. For example, the A21 Tonbridge to Pembury Dualling Scheme requires the demolition of private properties where appropriate compensation will be provided through the CPO process. In addition, the construction of the A380 Kingskerswell Bypass requires the demolition of eleven properties. Nine of the properties are owned by Devon County Council, however, the owners of the two properties not owned by the authority would be compensated in the land purchase procedures. For access to a new railway station in Wellingborough, pasture land, a public footpath and part of the River Ise were acquired by CPO.
Tolling on limited number of new links and bypasses: impact on costs to road users.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Very limited locations across SRN	Permanent	Irreversible	Alternative 1 support very limited new links and bypasses which are likely to improve access to network for all social groups. However, the Government will consider tolling as an option for funding new road capacity in very limited circumstances which may have a negative impact on the most financially disadvantaged groups.

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										Evidence: The proposed A14 toll as outlined in the Cambridge to Huntingdon Improvement A14 (Highways Agency, 2013) would be operational between the Ellington and Swavesey junctions but not the A14 to the east of Swavesey or any part of the A1. Tariffs have not yet been agreed, but it is proposed that between £1.00 and £1.50 would be charged for cars and other light vehicles and between £2.00 and £3.00 for HGVs. The charge would apply between 6am and 10pm.
Increasing the cost of motoring: impact on access to the SRN for different social groups.	Indirect	Large negative (--)	Longer term (20+ years)	High (>75%)	Small	Large	Various across the rail network	Permanent	Irreversible	Alternative 1 supports the use of financial instruments to help manage demand for use of the SRN. The increase in the cost of motoring would be more likely to impact disadvantaged groups such as those who rely on cars for daily living or those on low incomes. This would be likely to disproportionately disadvantage those who are unable to afford the increase in the cost of motoring. Evidence: Modelling from DfT forecasts that with an increase in the cost of motoring of between 25 and 28% by 2025 would result in a sizable increase in the costs to road users[1]. A survey conducted as part of the report shows that motorists consider the cost of motoring to be of most concern when considering driving. Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income. In Scotland, 37% of households with an annual net income of less than £10,000 own a car, compared to 98% of households with an annual net household income of over £40,000. Poor transport impacts social exclusion and deprivation.
New rail links, new chords and track widening, and additional train movements on existing rail network and more carriages on trains: improvements to the railway network impacts on disabled groups.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across rail network	Permanent	Irreversible	Alternative 1 supports a large programme to make better use of existing railway lines, including through the provision of more trains and longer trains. It also supports a large programme to provide major new links, new chords and track widening. This includes some additional trains serving new and existing routes and some station improvements. These upgrades will need to be inclusive in their design and will need to comply with the Rail Vehicle Accessibility (Interoperable Rail System) Regulations (RVAR) 2008, Rail Vehicle Accessibility (Non Interoperable Rail System) Regulations (RVAR) 2010 and The Equality Act 2010 whereby station operators must take reasonable steps to ensure that they do not discriminate against disabled people. These upgrades are likely to positively impact disabled people who may have previously found it difficult to access trains and stations. Evidence: As part of the Railways for All Strategy 2006, Access for All funding is being used to provide an accessible route at more than 150 of the busiest inaccessible stations by 2015. Furthermore, as part EU guidelines and under the RVAR 2008 and RVAR 2010 Regulations, all rail vehicles must be accessible by no later than January 1st 2020.
Door-to-door Strategy measures and cycling measures: improvements to	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport. This is likely to facilitate the use of the national network for non-car

[1] Based on the baseline in the Road Traffic Forecasts 2013, rather than the NPS baseline. There is very little difference between the Road Traffic Forecasts 2013 baseline and the NPS baseline, so results should be quantitatively similar.

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modal integration leading to improved travel alternatives provision for non-car users.										users. Evidence: The Door-to Door Strategy (DfT, 2013) shows that improvements at every stage of the journey will improve access to national networks, primarily rail services, by improving the integration between cycling and rail, for example.

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AoS23: To contribute towards improving health and public health

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Door-to-door Strategy measures and cycling measures: improvements to health due to facilitation of cycling and walking.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 1 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport. This is likely to facilitate the use of the national network for non-car users and the encouragement of walking and cycling is likely to have a beneficial impact on health. Evidence: The link between physical activity and health is described in Health Impact Assessment of Transport Initiatives, A Guide, Transport Scotland, 2007.

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Alternative 2 Detailed Impact Assessment Tables

AoS1: To contribute towards the reduction of noise levels from road and rail national networks

Impacts	Direct / Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction (i.e. noise disturbance).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. Construction impacts due to noise will affect local receptors including people, dwellings and wildlife; however these are likely to be largely mitigated by standard best practice construction and will be temporary impacts. Evidence: ESs for SRFIs, e.g. the St. Albans ES for the construction of an SRFI stated that recommended limits could be exceeded in respect of some properties for short periods of time during construction of the earth mounds, the new relief road/Radlett Road roundabout, and the rail links to the MMR. ESs for road widening schemes e.g. the ES for the A453 Widening M1 Junction 24 to A52 Nottingham stated the HA would follow a Construction Environmental Management Plan which outlined the methodology for minimising environmental impacts during works. However, the ES stated there would inevitably be localised increases in noise and dust during site clearance works, earthworks, bridge construction and the construction of the carriageway; and due to the daily movement of construction traffic around the site.
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts from noise on sensitive receptors.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall the Alternative 2 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase in unlikely to be evenly distributed. The increase in traffic will impact on noise levels from national networks, although the extent of impacts will largely depend on the location of developments. Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast, but the amount of additional traffic and therefore noise may increase less than proportionally to the additional investment (see e.g. “Transport demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale). The Calculation of Road Traffic Noise (Department of Transport, Welsh Office and HMSO, 1988) Charts 2 and 3 illustrates the relationship between an increase in traffic flows and an increase in traffic noise.

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Road infrastructure measures: including pinch point investments, motorway widening and trunk road upgrades: noise sources moving closer to sensitive receptors (e.g. people and wildlife) and increased volumes of traffic.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening and trunk road upgrades and a large programme of pinch point investments. This may result in vehicles moving closer to receptors. There may be an impact on sensitive receptors due to closer proximity to noise source and increased volumes of traffic. Also, new roads or bypasses introduce a new source of noise to a new location. This is likely to negatively impact the exposure of people, dwellings and wildlife to transport noise close to the SRN. In terms of motorway widening, this will move traffic closer to receptors only by a relatively small distance, i.e. the width of an additional lane, this impact will be small. Evidence: Design Manual for Roads and Bridges: Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques Part 5 HD 213/11 Revision 1 Noise and Vibration (2011) states that horizontal alignment of a road impacts sensitive receptors i.e. moving the route closer to the receptor will increase noise levels and vice versa. Furthermore it states that "At a distant reception point the noise level is attenuated by a number of additional factors, including the distance from the noise source, the nature of the intervening ground surface and the presence of obstructions."
Motorway widening: impact on receptors due to increase in road traffic on the motorway causing additional traffic noise.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening. Motorway widening has been shown to reduce congestion and keep traffic flowing. Reduced congestion leads to increased speeds and higher speeds are associated with greater levels of traffic noise. Therefore faster flowing traffic is likely to negatively impact the exposure of people, dwellings and wildlife to transport noise close to the SRN. Evidence: Design Manual for Roads and Bridges: Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques Part 5 HD 213/11 Revision 1 Noise and Vibration (2011) states that "the effect of the speed of vehicles on noise level is one of the most fundamental in the noise prediction process. Above 40 km/hr, noise level increases with the speed of the vehicle and a reduction in speed will normally cause a reduction in noise level."
Programme of maintenance on the SRN, including resurfacing: impact on noise levels.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of road resurfacing on the SRN. The introduction of low noise road surfacing is likely to have a substantial benefit with regards to the exposure of people, dwellings and wildlife to transport noise, where it is replacing existing concrete roads or previously unmodified surfaces. Evidence: Department for Transport: Guidance on Noise Nuisance from Trunk Roads and Motorways (Chapter 6: Making Life Better for Communities) states that the noise arising from the newest quieter surfaces, compared to the more traditional ones, is about the same as if the amount of traffic had been halved. The ES for the A1 Bramham to Wetherby Upgrading Scheme predicts that modern thin wearing course (TWC) surfaces (Low Noise Surface) would be 2.5 dB quieter (where speeds are >75 km/h) than hot rolled asphalt with a 2mm texture depth, as measured by a sand patch test.

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Rail electrification: impact on noise levels.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. This will have a small beneficial impact on noise levels across England due to the replacement of diesel engines by electrification. Evidence: The Atkins study for RSSB of 2007 stated the Calculation of Railway Noise (CRN) factors for a Pendolino EMU (a type of electric high-speed train used in the UK) as +10.7dB and the equivalent figure for a Voyager Diesel Multiple Unit of +13.8dB.
SRFIs: noise impacts associated with the operation of SRFIs.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative noise impacts due to the increased exposure of people, dwellings and wildlife to transport noise. Evidence: Documents in support of planning applications for currently proposed SRFIs predict localised noise impacts e.g. the St. Albans ES for construction of an SRFI states that road traffic, both within the site and on adjacent road links on the public highway; rail traffic on lines within the site and on the Midland Main Line; and site activity are likely to result in increases in noise. However, with appropriate mitigation in place, overall, the proposed scheme is expected to result in the noise climate remaining in the 'reasonable' category.

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AoS2: To contribute towards improving local air quality

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction of road, rail and SRFI developments: emissions (particularly dust) during construction of infrastructure.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs.. Air quality may temporarily decline in the local area of any infrastructure upgrades due to an increase emissions of air pollutants, particularly dust during construction, however, this is only for the short term, and can usually be largely mitigated. An increase in emissions of air pollutants may impact upon human health. Evidence: Air quality assessments within Environmental Statements (e.g. M6 J10a-13, M1 J1-13), for road schemes predict temporary impacts during construction but these are not considered likely to be significant. Air quality assessment within Environmental Statement for SRFIs e.g. DIRFT III, Chapter K, states that due to the large scale and long duration of construction activities the potential dust emission classification for construction activities is large. Predicted impacts within a worst-case sensitivity analysis suggested that impacts after construction are likely to be at worst slight adverse at two receptors.
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and associated emissions to air, and therefore impacts on air quality.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall Alternative 2 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic is likely to impact on emissions of air pollutants, and in turn human health, although the extent of the impact on local air quality will largely depend on the location of developments. Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. The modelling forecasts NOx emissions to be 0.76% higher in the Do NPS scenario with regard to the baseline by 2040. In addition, PM10 is expected to be 1.10% higher in the Do NPS scenario with respect to the baseline by 2040. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast, but the amount of additional traffic and therefore the increase in aggregate emissions may increase less than proportionally to the additional investment (see e.g. “Transport Demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale).

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New links and bypasses: impact on air quality due to reductions in emissions related to congestion and queuing.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 2 supports some new links and bypasses. Air quality in bypassed villages can improve through substantial reductions in traffic volumes. In addition, new link roads are often targeted to reduce congestion, and a more continuous flow of traffic can lead to a reduction in queue lengths which is likely to reduce the size of areas affected by poor air quality. Furthermore, Alternative 2 includes measures to accompany new road developments should they be likely to worsen air quality in the areas in which they are located. Evidence: The Post Opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) identifies that 22 out 32 bypasses assessed had a beneficial impact on air quality. Furthermore the POPE of Major Schemes Summary Report for the A43 Improvements shows that air quality in the bypassed villages of Syrensham and Silverstone has improved through substantial reductions in traffic volumes.
Road infrastructure measures including motorway widening, trunk road upgrades, pinch point investments, motorway widening, new link roads and bypasses: exposure to reduced air quality due to source of air emissions moving closer to receptors.	Direct	Neutral (/)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening and trunk road upgrades, a large programme of pinch point investments and some new link roads and bypasses. This may decrease the distance between the source of emissions and receptors, particularly where roads are in close proximity to residential areas. However, smoother flowing traffic and a reduction in congestion may lead to a reduction in air pollutant emissions. Impacts are likely to be dependent on individual schemes i.e. in some locations, impacts on air quality may worsen whereas in other locations, impacts on air quality may improve. This may have impacts on human health, Alternative 2 includes measures to accompany new road developments with potential air quality problems. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) shows that out of 79 road schemes assessed, 13 had an adverse impact on air quality, 17 had a neutral impact and 49 had a beneficial impact, This shows that there are both beneficial and adverse impacts associated with road infrastructure schemes. It should be noted that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. In terms of motorway widening, out of 12 schemes assessed, 4 had a negative impact on air quality, 5 had a neutral impact and 3 had a beneficial impact. It should be noted that the report did not specify the individual impacts of different schemes for example, if air quality impacts were as a result of the source of emissions moving closer to receptors.

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Additional train movements on existing rail network and more carriages on trains: impact on air quality as a result of more trains and carriages.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Reversible	Alternative 2 supports a small programme to make better use of existing railway lines, including through the provision of more trains and longer trains where economically viable. The addition of any diesel trains on existing railway lines is likely to increase air pollutant emissions as there will be a higher number of trains and therefore rail traffic. The addition of carriages is also likely to increase air pollutant emissions as trains will burn more fuel per journey. This may impact upon human health. Evidence: The Rail Command Paper (DfT, 2012. Reforming our railways: Putting our customers first) gives details on the use of both electric and diesel trains. Whilst there is a programme of electrification outlined for the future and the benefits of electrification are discussed, including the benefits for air quality, the Command Paper also highlights that "many parts of the rail network will continue to rely on diesel rolling stock for the foreseeable future".
New chords and track widening: impact on air quality as a result of new chords and track widening.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. The development of new rail links is likely to introduce new sources of air pollutants to new areas, therefore, there is potential for negative impacts due to this rail activity. The impact will depend on the nature of the trains using the new chords i.e. whether they are diesel or electric, as electric trains are zero emissions at the point of use, whereas diesel trains emit pollutants to air. It is understood that a large proportion of the new chords and widened track proposed will be electrified, however, where this is not the case there will be a small negative impact on air quality and potentially human health. Evidence: The Rail Command Paper (DfT, 2012. Reforming our railways: Putting our customers first) gives details on the use of both electric and diesel trains. Whilst there is a programme of electrification outlined for the future (Great West Mainline and the TransPennine route) and the benefits of electrification are discussed, including the benefits for air quality, the Command Paper also highlights that "many parts of the rail network will continue to rely on diesel rolling stock for the foreseeable future".
Rail electrification: impacts on local air quality due to electrification of diesel powered rail lines.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. Electric trains perform better than diesel trains in terms of air pollutant emissions. They are zero emissions at the point of use. This helps improve air quality, and in turn human health, in areas of high pollution such as city centres and main line stations. Evidence: Rail modelling of HLOS electrification predicts that with the electrification proposed in the NPS, NOx emissions would reduce by 29.3% in 2018/19 compared to 2010/11 levels, PM emissions would reduce by 49.0% and SO_2 emissions would fall by 99.2% over the same time period. There would be a slight increase in emissions of NOx, PM and SO_2 as a result of electricity generation by 38.4%, 14.7% and 5.3% respectively over the same time period. This would result in a slight increase in NOx emissions, but a substantial reduction in both PM and SO_2 emissions. The Network RUS Electrification (Network Rail, 2009) states that a significant proportion of passengers and the majority of freight is carried by diesel operations which is more costly and produces

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										more emissions than its electric equivalent.
SRFIs: modal shift from road to rail reduces road traffic emissions on the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs can reduce congestion both locally and nationally. For the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is substantially lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Where rail is used instead of road, there is a large reduction in emissions to air for each tonne transported. Therefore the development of SRFIs should lead to a benefit in air quality terms due to the reduction in air pollutant emissions from road traffic. This may impact upon human health. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that rail freight produces fewer harmful gases than road freight in terms of other emissions that impact upon people's health – less than a tenth of the nitrogen oxide and fine particulates of road haulage per tonne carried when compared to road transport. This document also states that the modal shift of road to rail will greatly reduce congestion.

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AoS3: To contribute towards the reduction of greenhouse gas emissions

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction including embodied carbon (i.e. construction materials) and operational carbon (e.g. energy used).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. The construction of infrastructure will involve the use of large amounts of material (both raw and recycled). Carbon embodied in materials for construction and maintenance work will vary across interventions, however, it is likely that the materials used will be sourced in accordance with industry standard good practice guidelines to ensure efficient use of materials. The carbon footprint as a result of fitting materials and site energy usage is likely to vary across schemes. Evidence: Huang et al (Measuring the carbon footprint of road construction using CHANGER, 2012) states that several elements and their impacts are found to contribute to the variation in CO_2 per kilometre construction, namely the amount of traffic and increased capacity, current condition (e.g. foundation, pavement), materials used, construction technique, drainage and structures (type, number, etc.). Moreover, a Carbon Calculation Tool has been developed to enable the Highways Agency to identify the carbon footprint associated with the Highways Agency's activities. The tool provides a means of capturing the volume of carbon produced through construction, maintenance and operational activities undertaken by the Highways Agency itself, and its main contractors. It takes into account energy, materials, transport and waste removal. Network Rail also state in their Sustainable Development Strategy (2013-2024) that they aim to take a whole life approach to resource use in our asset management, so that virgin material requirements and waste production are minimised, and the carbon embedded in new infrastructure is measured and reduced. In addition, they aim to use low carbon energy sources to minimise rail's carbon footprint.
Road infrastructure measures including pinch point investments, new links and bypasses and trunk road upgrades: increased speeds due to reduction in congestion as a result of increased capacity on the wider network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Permanent	Irreversible	Alternative 2 supports a large programme of pinch point investments including junction improvements, extensive trunk road upgrades and some new links and bypasses. This will increase the capacity of the whole network, increasing traffic and the number of vehicles on the network, but also reducing overall congestion. This may increase traffic speed, therefore increasing GHG emissions as vehicles emit more emissions at higher speeds. Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. The modelling forecasts CO_2 emissions to increase by 0.43% by 2040. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast, therefore there are likely to be more CO_2 emissions from traffic. This is likely to result in an increase in emissions across the whole network. In 2009, total GHG emissions from transport (including international transport) were 165.8 $MtCO_2e$, accounting for 27% of total UK GHG emissions (607.2 $MtCO_2e$).

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										Domestic transport accounted for 20% of total UK GHG emissions. Road transport accounted for 93% of all domestic transport GHG emissions, with 58% for car & taxis, 17% for heavy goods vehicles, 12% for light vans and 4% for buses & coaches (UK transport greenhouse gas emissions, Department for Transport). The POPE (five years after study) Report for the A11 Roudham Heath to Attleborough Improvements states that there has been a net increase of 9,175 tonnes of carbon in the first five years after opening, as a result of building the scheme. This is, however, to be expected on a scheme of this type, where average speeds have increased from around 40mph to around 70mph. The Highways Agency Scheme Evaluation Table shows that the majority of road schemes resulted in an increase in carbon emissions. However, there were also some cases where carbon emissions were reduced as a result of new road developments. These developments include examples from trunk road upgrades and new links and bypasses.
Rail infrastructure measures: impacts on greenhouse emissions due to new chords and track widening and making use of existing rail infrastructure.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. It also supports a small programme to make better use of existing railway lines, including through the provision of more trains and longer trains. There are likely to be increases in embodied carbon due to new infrastructure, however a moderate number of new chords and track widening are unlikely to make a significant contribution to modal shift from car to rail. Evidence: The Network Rail (Nuneaton North Chord) Order states that the wider Nuneaton to Peterborough gauge enhancement scheme, of which the Nuneaton North Chord is one part, will negate the need for 225,000 HGV road vehicle movements, reducing pressure on the road network, reducing air pollution and reducing carbon emissions.
Rail electrification: reduction in greenhouse gas emissions due to electrification of diesel powered rail lines.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. Electric trains perform better than diesel trains in terms of emissions to air. They are zero emissions at the point of use. This helps improve air quality and reduce greenhouse gas emissions in areas of high pollution such as city centres and main line stations. Evidence: The Network RUS Electrification (Network Rail, 2009) states that a significant proportion of passengers and the majority of freight is carried by diesel operations which is more costly and produces more emissions than its electric equivalent. Electrification has a potentially significant role to play in reducing carbon emissions from rail transport as well as improving air quality and reducing noise. Electric trains, on average, emit 20 to 30 per cent less carbon than diesel trains.. Rail modelling of HLOS electrification schemes shows that the implementation of these schemes compared to the 'do minimum scenario' would result in an overall decrease in CO_2 emissions of 7.3% by 2018/19. As rail GHG emissions accounts for only 1.8% of all domestic transport GHG emissions (UK transport greenhouse gas emissions, Department for Transport, 2009), this is likely to be of small positive magnitude.
SRFIs: modal shift from road to rail reduces road traffic	Direct	Small positive (+)	Longer term (20+	High (>75%)	Large	Large	Various across	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs can reduce congestion both locally and nationally. For the purpose of this

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emissions on the wider network.			years)				England			assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Where rail is used instead of road, there is a large reduction in CO_2 emissions for each tonne transported. Therefore the development of SRFIs should lead to a benefit in air quality terms due to the reduction in GHG emissions from road traffic. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that there could potentially be a 76% reduction in CO_2 emissions per tonne transported when using rail instead of road. This document also states that the modal shift of road to rail will greatly reduce congestion, where each freight train could take approximately 60 lorry journeys off the road. It is considered that overall the impact of modal shift is likely to result in 20-24 lorries being taken off the road, taking into account transport to and from SRFIs.
Door-to-door Strategy measures and cycling measures: improvements to cycling and walking facilities encourage more people to make journeys using sustainable transport modes.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across England	Permanent	Irreversible	Alternative 2 supports measures to encourage people to use more sustainable modes of transport. This is likely to reduce GHG emissions from transport if more people cycle or walk, especially for short journeys. Evidence: 21% of CO_2 emissions in the UK are as a result of domestic transport, with passenger cars accounting for over half of these emissions. 10 million tonnes of CO_2e are emitted per annum in the UK by transport for journeys between 2 and 5 miles. 3 in 10 motorists claim that they would reduce their car use and one half of cyclists would increase the amount they cycle if better cycling provisions (such as dedicated cycle paths) were implemented (DfT, 2011. Creating Growth, Cutting Carbon). This would be likely to reduce carbon emissions from transport and have a wider environmental benefit.

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AoS4: To protect and enhance landscape quality, townscape quality and to enhance visual amenity

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts on landscape and townscape quality and visual amenity during construction (e.g. noise and light disturbance).	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across England	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs, all of which may have construction impacts on landscape character, views, townscape, visual amenity or tranquillity. Construction impacts that may affect landscape, townscape or visual amenity are likely to include noise, light pollution, and large construction vehicles. These impacts are likely to be largely mitigated and occur on a short term basis. Evidence: Landscape can be negatively impacted during the life cycle of a project, which includes the construction phase, Guidelines for Landscape and Visual Impact Assessment (Third Edition, Consultation Draft) Landscape Institute (n.d.).
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall Alternative 2 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in levels of road traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to negative impacts on landscape character, views, visual amenity and tranquillity on the wider network, although the extent of the impacts will largely depend on the location of developments. Evidence: TASM Modelling of a NPS investment scenario forecasts an increase in traffic. In the Do NPS central scenario, 1.03% more traffic on the SRN is forecast by 2040 with respect to the baseline. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast and therefore there is likely to be a slightly larger impact on landscape quality. The amount of additional traffic may increase less than proportionally to the additional investment (see e.g. “Transport Demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale). Lancashire County Council (n.d.) A Landscape Strategy for Lancashire states that increases in traffic, litter, signage and built development may threaten visual amenity and landscape character.
Road infrastructure measures including motorway widening, trunk road upgrades, new roads and pinch point investments: visual impacts on local landscape and townscape from associated infrastructure (e.g. additional lanes, gantries, lighting).	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of trunk road upgrades and motorway widening, some limited new roads and a large programme of pinch point investments. These will result in small negative impacts on landscape character, views, townscape and tranquillity due to the introduction of new infrastructure into the landscape and associated loss of views. This could vary between schemes due to lighting provision within designated landscape areas. Additional lanes, gantries and other new features may also have more locally significant adverse impacts Evidence: HA publication IAN 161/13 states that with reduced verge width it may not always be possible to mitigate localised impacts by landscape planting as it may not be maintainable. In such instances consideration must be given to others forms of screening. Combining

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										noise barriers with visual barriers, where both are warranted, is one option to achieve efficiencies in the design. The M25 (J16-23) widening scheme AST states that continuous lighting (previously intermittent), gantries and signage bring the greatest change in landscape character and increased perception of urbanisation in the countryside, including in Chilterns Area of Outstanding Natural Beauty. The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 79 road schemes assessed, 61 had an adverse impact on landscape, 15 had a neutral impacts and 3 had a beneficial impact. It should be noted that the report did not specify the individual impacts of different schemes and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
New chords and track widening: visual impacts on local landscape and townscape.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Medium	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. These measures are likely to result in large negative impacts on landscape character, views, townscape and tranquillity due to the introduction of new infrastructure into the landscape and associated loss of views. Evidence: Network Rail (Ordsall Chord) Order states that during operation, there will be potential visual effects on receptors from viaduct widening and a new section of railway and associated new bridges (Network Arch and replacement Pedestrian and Cycle Bridge) crossing the River Irwell. The Environmental Statement Non-Technical Summary for the proposed Ipswich Chord states that there would be significant visual effects upon the Railway Cottages and the users of the River Gipping footpath/ cycleway during and immediately after the construction phase. Landscape planting mitigation would be developed, however, permanent adverse effects upon the railway cottages and the River Gipping footpath/ cycle path in the immediate vicinity of the new river bridge would remain and cannot be mitigated for. Moreover, the Environmental Statement Non-Technical Summary for the North Doncaster Chord states that the operation effect on landscape and visual amenity as a result of the North Doncaster Chord scheme will have some significant effects. This is because two significant structures, namely the viaduct and highway bridge, will be constructed in a relatively rural landscape.
Rail electrification: visual impacts from new rail infrastructure and overhead power lines.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. Overhead Line Electrification System (OLE) and gantries would be prominent in flat rural areas but be an impact of lower magnitude in urban areas. Potential visual receptors are residential areas, road users and users of public right of ways. Evidence: The Environmental Statement for the Great Western Main Line Electrification Project (April, 2013) identifies the landscape and visual impacts associated with permanent and temporary structures such as feeder stations, switching stations, support structures and bridge works. Significant effects are predicted as likely to occur where OLE bridgeworks affect viaducts as these locations are likely to be more prominent, increasing the magnitude of impacts and potentially affecting sensitive

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										receptors. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that areas such as the Reading Urban Fringe, Thatcham to Theale Corridor and several other locations will experience slight to moderate adverse effects on landscape as a result of the scheme.
SRFIs: localised impacts on landscape and townscape	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on landscape character, views, townscape and tranquillity; due to the introduction of new infrastructure into the landscape/townscape and associated loss of views. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some large localised landscape and visual impacts. e.g. DIRFT III. The appraisal of landscape character effects for this project concludes that the initial development will result in a substantial adverse effect on the immediate landscape at Year 0, and negligible to minor adverse effect on the landscape beyond. By Year 15, this is likely to result in a moderate adverse effect once structural planting has established. Beyond the site, the proposals will have only a negligible or minor adverse effect by year 15.

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AoS5: To protect and conserve heritage assets in a manner appropriate to their significance

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on heritage assets.	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Whole SRN	Permanent	Irreversible	Overall Alternative 2 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to negative impacts on the setting of sites, features or areas of cultural heritage value, and designated sites on the wider network, although the extent of the impacts will largely depend on the location of developments. Evidence: TASM Modelling of an NPS investment scenario forecasts an increase in traffic i.e. in the Do NPS central scenario, 1.03% more traffic on the SRN is forecast by 2040 with respect to the baseline. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast and therefore there is likely to be a slightly larger impact on landscape quality. The amount of additional traffic and impacts on heritage assets may increase less than proportionally to the additional investment (see e.g. "Transport Demand to 2025 and the economic case for road pricing and investment" which demonstrates that transport investment could exhibit diminishing returns to scale). Transport and the Historic Environment (English Heritage, 2004) explains that increasing levels of traffic are gradually eroding the quality of the historic environment, through both road building and traffic blight.
Motorway widening: impact on setting of sites, features and areas of historical and cultural value due to associated infrastructure (e.g. gantries).	Indirect	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening, which involves the construction of an additional lane and associated infrastructure such as gantries. Impacts are likely to be limited to receptors off site, such as the effects on the setting of any adjacent listed building, and designated sites such as Scheduled Monuments, Conservation Areas, or historic landscapes. Impacts would be through local visual intrusion on their setting, but are unlikely to be significant, due to the fact that the motorway already exists at that location. Evidence: The M25 (J27-30) widening scheme Environmental Statement Non-Technical Summary states that the scheme could result in slight adverse impacts to known archaeological sites and areas of general archaeological potential, and slight adverse impacts to listed buildings due to increased visibility of the motorway and its associated infrastructure.
Implementation of motorway widening, new links and bypasses and trunk road upgrades: impact on sites, features and areas of historical and cultural value due to development on previously undeveloped land outside of HA boundary.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening, trunk road upgrades including installing dual lanes and grade separation and some new links and bypasses. Where dual lanes and grade separation is undertaken outside of the existing highway boundary, there is the potential to damage previously undiscovered buried archaeological resource and sites, features and areas of historical and cultural value. It should be noted that most motorway widening projects are contained within the 'disturbed' highway boundary, however there is potential to damage previously unrecorded remains i.e. buried archaeology resource.

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										This impact is likely to be larger than Smart Motorways due to the acquisition of undeveloped land potentially outside of the HA boundary. The extent of impacts will depend on the location of developments. Evidence: The M25 (J16-23) widening scheme AST states that there are potential impacts on previously unrecorded remains. Existing motorway construction would have extensively damaged remains within the Secretary of State land, although there may be localised survival, while outside of the boundary survival is likely to be good. The A21 Tonbridge to Pembury Dualling AST states that there is likely to be large adverse impacts as the scheme would require demolition of two Grade II listed buildings & four historic buildings.
New links and bypasses and trunk road upgrades: impacts on setting of sites, features and areas of historical and cultural value due to associated infrastructure (e.g. gantries).	Indirect	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of trunk road upgrades including installing dual lanes and grade separation and some new links and bypasses. These will result in potentially negative impacts on the setting of sites, features and areas of cultural and heritage value, and designated sites due to visual impact, noise and lighting from new infrastructure. The extent of impacts will depend on the location of developments. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 80 road schemes evaluated, 43 had an adverse impact on heritage, 27 had a neutral impact and 10 had a beneficial impact. It should be noted that the report did not specify the type of heritage impacts from different schemes and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways.
Additional train movements on existing rail network and more carriages on trains: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across rail network	Permanent	Reversible	Alternative 2 supports a limited programme to make better use of existing railway lines, including through provision of more trains and longer trains where commercially viable. The addition of trains and carriages to existing railway lines is likely to have a small negative impact on sites, features and areas of heritage value, and designated sites due to the increase in noise, artificial light and visual impact impacting on setting. The extent of impacts will depend on the location of developments. Evidence: The Initial Environmental Report for Piccadilly Platforms 15 and 16 and Oxford Road Interventions (2012) states that whilst impacts from the development on setting are not likely to be significant, there may still be some indirect impacts on setting as a result of longer and more frequent trains.

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New chords and track widening: impacts on sites, features and areas of historical and cultural value.	Direct	Large negative (--)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. Where development is undertaken outside of the existing railway boundary, there is the potential to damage previously undiscovered buried archaeological resource, sites, features and areas of historical and cultural value, and designated sites. The extent of impact will depend on the locations of developments. Evidence: Network Rail (Ordsall Chord) Order states that the proposed development has the potential to impact directly and physically upon eight historic buildings during the construction phase. This will include the demolition of the Girder Bridge and Prince's Bridge, the removal of part of the Zig Zag viaduct, and the removal of a cast iron span at the Castlefield end of the MSJ&R viaduct. However, it also states that there will be no significant impacts on sub-surface heritage assets of archaeological interest during the operation of the proposed development. The Environmental Statement Non-Technical Summary for the North Doncaster Chord states that there will be significant residual effects on cultural heritage (despite following mitigation during the construction phase) as a result of the loss of sections of historic field boundaries and a parish boundary.
New chords and track widening: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Large negative (--)	Longer term (20+ years)	Low (25-50%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. These measures are likely to result in large negative impacts on the setting of sites, features and areas of cultural and heritage value, and designated sites due to visual impact, noise and lighting from new infrastructure. The extent of impacts will depend on the location of developments. Evidence: Network Rail (Ordsall Chord) Order states that 13 heritage assets, in the form of historic buildings, in the vicinity of the scheme may be impacted upon in terms of visual impacts as a result of changes to their settings. The 13 assets are subject to permanent adverse effects as a result of changes to setting due to the presence of new structures and modifications to existing structures. The Environmental Statement Non-Technical Summary for the North Doncaster Chord states that the visual setting of the former railway cottages at Joan Croft Junction will be affected by the operation of the new viaduct and highway bridge. There will also be a significant adverse effect during operation as a result of the changes to the setting of the unlisted buildings of local historic interest at Joan Croft Junction.
Rail electrification: impact on heritage assets due to overhead power line installation.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Medium	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. This may require the installation of overhead power lines, therefore, current infrastructure will need to be able to accommodate this change. Direct impacts are likely to sites or features heritage value, and designated sites such as bridges that may be demolished or altered to allow sufficient room for the OLE to pass underneath. Evidence: The Environmental Statement Non-Technical Summary for the Great Western Main Line Electrification Project (April, 2013) states that there may be direct impacts to heritage assets such as bridges to allow sufficient room for the Overhead Line Electrification System to pass underneath. The ES for the Great Western Main Line Electrification

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										Project (West Berkshire Council) states that the existing canopies at Pangbourne Station would require cutting back to facilitate the Overhead Line Electrification System. This would be a minor adverse impact affecting the historic character of the station, resulting in a permanent slight adverse effect. Furthermore, Frouds Lane Overbridge (No. BHL 4551) would be demolished and reconstructed. This would be a permanent major adverse impact.
Rail electrification: impacts on setting of sites, features and areas of historical and cultural value due to overhead power lines.	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Medium	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network, which will require overhead power lines. This could lead to localised negative impacts on landscape and townscape. This could be significant if located in or close to designated areas such as Areas of Outstanding Natural Beauty, National Parks, etc. The extent of impacts will depend on the locations of developments. Evidence: The Environmental Statement Non-Technical Summary for the Great Western Main Line Electrification Project (April, 2013) states that there will be indirect effects to the setting of heritage assets close to the railway, particularly Gwent Levels which is a Registered Landscape of Outstanding Historic Interest in Wales. The ES for the Great Western Main Line Electrification Project (West Berkshire Council) states that the addition of OLE equipment along the Gatehampton Viaduct (No. MLN1 4412) would affect its visual character. The addition of Overhead Line Electrification System equipment would constitute a permanent minor adverse impact on this high value structure, resulting in a slight adverse effect.
SRFIs: impacts due to construction on previously undeveloped land.	Direct	Large negative (--)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on buried archaeological resource. Impacts may be worse if development were to take place on previously undeveloped land. The extent of impacts will depend on the locations of developments. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some localised impacts on buried archaeology e.g. DIRFT III states that the development of the SRFI site would gave a medium adverse direct impact on an earthwork ridge, a ploughed-out ridge and furrows as a result of machine stripping during construction which would remove assets within central and southern parts of the site. Furthermore, there would be a high adverse impact on a number of archaeological assets including ditches, pits, post-holes, barns and several buildings as these would need to be removed or demolished in order for the construction of the SRFI.
SRFIs: impacts on setting of sites, features and areas of historical and cultural value due to operational activities on site (e.g. noise and lighting).	Indirect	Large negative (--)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to localised negative impacts on landscape and townscape. This could be significant if located in or close to designated sites such as Areas of Outstanding Natural Beauty, National Parks, etc. The extent of impacts will depend on the locations of developments. Evidence: Documents in support of planning applications for currently proposed SRFIs predict some localised impacts on cultural heritage e.g. DIRFT III Cultural Heritage and Archaeological Assessment states that

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										there would be a low adverse impact on Motte and Bailey Castle, a Scheduled Ancient Monument due to changes in setting. Furthermore, there would be a number of impacts on undesignated sites due to changes in views as a result of the construction of the SRFI. Furthermore, it was anticipated that there would be a medium adverse impact on the character and setting of the historic landscape during operation of the site

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AoS6: To preserve, protect and enhance biodiversity

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI: impacts during construction (e.g. noise and light disturbance).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs, all of which are likely to have construction impacts on biodiversity. Construction impacts are likely to include emissions of air pollutants, for example, dust , habitat loss due to construction compounds and haul roads (land take), light pollution, etc., however, these are likely to be largely mitigated by construction best practice and occur on a short term basis. Evidence: The main impacts arising during the construction phase of the A453 Widening M1 Junction 24 to A52 Nottingham included: direct habitat loss to sites and habitats; direct harm (including mortality) to species; indirect effects on sites through losses of connecting habitats, foraging habitats and ecological networks and corridors; severance and fragmentation effects on other habitats and species; and potential for habitat degradation through pollution during construction, particularly uncontrolled discharges to watercourses.
Cumulative impact of Alternative 2 interventions on SRN: increase in road traffic across SRN impacts biodiversity.	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Whole SRN	Permanent	Irreversible	Overall Alternative 2 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to indirect impacts on habitat quality due to light and noise pollution as a result of increased road traffic on the wider network. The extent of the impacts will largely depend on the location of developments Evidence: TASM Modelling of a NPS investment scenario forecasts an increase in traffic i.e. in the Do NPS central scenario, 1.03% more traffic on the SRN is forecast by 2040 with respect to the baseline. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast, and therefore there is likely to be a slightly larger impact on biodiversity. However, the amount of additional traffic may increase less than proportionally to the additional investment (see e.g. “Transport Demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale). Increased traffic increases the risk of animals being killed by crossing a road which cuts across their traditional territory or foraging routes. For example, badgers will generally continue to travel along established runs, regardless of the presence of a new road, unless prevented from doing so. With regards to flora, air pollutants from road traffic may have effects on local habitats and species, for example certain ferns and lichens are particularly vulnerable to elements of vehicle emissions.

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Motorway widening: direct impacts on biodiversity (e.g. habitat loss).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening. Whilst motorway widening schemes are largely located within existing highways boundaries, the additional infrastructure required can lead to some limited loss of habitat and direct disturbance to flora and fauna. It can also lead to permanent changes to operation such as lighting can impact on biodiversity e.g. continuous lighting can replace intermittent lighting which may have slight adverse impacts to wildlife. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact.. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The M25 (J27-30) widening scheme Environmental Statement Non-Technical Summary states that existing vegetation would be removed within the motorway fence line. Moreover, the M25 (J16-23) widening scheme AST states that habitat availability will decrease and the net result will be a 15% reduction in habitat overall including those of local and regional value. The M25 (J16-23) widening scheme AST states that bats, birds and aquatic species would experience permanent slight adverse effects from increased lighting resulting in reduced habitat quality which is most prominent in areas currently unlit.
Motorway widening: indirect impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening. This will largely take place within the existing highway boundary, they can a move sources of disturbance (i.e. vehicles) closer to ecological receptors. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact.. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The M25 (J27-30) widening scheme Environmental Statement Non-Technical Summary states that existing vegetation would be removed within the motorway fence line. As disturbance from the motorway already impacts on the existing habitats and species, slight adverse impacts upon habitats and certain species is predicted, such as bats and birds, as a result of the increase in habitat edge effects and upgraded lighting.
Road infrastructure measures including pinch point investments and trunk road upgrades: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of trunk road upgrades, some limited new roads and a large programme of pinch point investments. These interventions are considered likely to result in large direct impacts on biodiversity, particularly habitat loss due to land take. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes

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										(>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The A1 Elkesley Grade Separated Junction AST states that the scheme resulted in a direct loss of a small extent of habitats that are common to the area and of relatively low value. There is the potential to impact on protected reptiles (if present) and ubiquitous nesting birds. The A595 Parton to Lillyhall Improvement ES states that the proposed scheme could have significantly adverse impacts on broadleaved woodland due to the loss of mature, possibly ancient woodland. The loss of terrestrial and pond habitat leading to potential fragmentation of great crested newt populations, could have permanent effects on population viability. The A3 Hindhead ES states that over the whole scheme, the negative impacts arise primarily through the loss of habitat in Boundless Copse and Tyndall's Wood, and the subsequent impacts on species of conservation importance, both through direct habitat loss and through disturbance and mortality arising from the operation of the new A3 carriageway.
Road infrastructure measures including pinch point investments, trunk road upgrades, new links and bypasses: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Reversible	Alternative 2 supports an extensive programme of trunk road upgrades, some new links and bypasses and a large programme of pinch point investments. These interventions are considered likely to result in indirect impacts on habitat quality due to light and noise generated on national networks as a result of increased proximity of traffic and associated infrastructure to the ecological receptors. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The POPE One Year After evaluation of the A27 Southerham to Beddingham Improvements stated that construction noise, vibration, and general activity would all be likely to have short term impacts on ecology within the area, particularly on ecologically sensitive areas such as the Beddingham Level Grazing Marshes SNCI, and on sensitive bird species such as the Skylark and Yellowhammer. Given the nature conservation value of the ditches in Beddingham Grazing Marsh and Glynde Reach SNCI is high, indirect impacts such as light, noise, water pollution to this site were considered to be slight adverse without mitigation.

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Road infrastructure measures including pinch point investments, trunk road upgrades, new links and bypasses: habitat isolation and severance.	Direct	Large negative (--)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of trunk road upgrades, some new links and bypasses and a large programme of pinch point investments. These interventions are considered likely to lead to severance and fragmentation effects on habitats and species, due to the introduction of new infrastructure in the form of new roads, junctions and lanes. Evidence: The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies that out of 78 road schemes assessed, 49 had an adverse impact on biodiversity, 3 had a beneficial impact and 26 had a neutral impact.. It should be noted that the exact nature of these biodiversity impacts were not specified in the report and that these figures include assessments of the following road schemes: bypasses, road widening, junction improvements and A-road upgrades to motorways. The AST for the A453 Widening between the M1 and the A52 states that the habitat loss and severance caused by widening of the road during the construction phase would not increase during the operational phase, however the impact of the severance in the water vole ditches between Thrumpton and Barton-in Fabis would be on-going. This was deemed to be a permanent adverse effect, significant at the local level.Highways Agency: A Review of Bat Mitigation in Relation to Highway Severance describes how roads can have several adverse effects on bat populations including: direct loss of foraging habitat and/or decline in quality (e.g. through change in land use or pollution) affecting insect abundance, direct loss of roosts, severance of flight commuting routes for foraging and dispersal, and bat/vehicle collision mortalities.
Road infrastructure measures including pinch point investments, trunk road upgrades and new links and bypasses: potential reduction in air quality	Indirect	Small negative(-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Reversible	Alternative 2 supports an extensive programme of trunk road upgrades, some new links and bypasses and a large programme of pinch point investments. These interventions are considered likely to increase capacity on the SRN. This, in turn is likely to result in an increase in emissions of air pollutants. Some ecological designations are sensitive to changes in air quality, and as a result, there may be some small negative impacts on sensitive ecological areas as a result in the increase in traffic, where these areas are close to the SRN. Evidence: DMRB HA 207/07 Air Quality (2007) states that some air pollutants will also have an impact on vegetation which can damage vegetation or affect plant health and productivity, with the pollutant of greatest concern being NOx. Furthermore, Natural England's Microeconomic Evidence for the Benefits of Investment in the Environment 2 (MEBIE2) (NERR057) (2014) highlights that air pollution can impact on plant health and agricultural productivity.
Additional train movements on existing rail network and more carriages on trains: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Reversible	Alternative 2 supports a small programme to make better use of existing railway lines, including through provision of more trains and longer trains where commercially viable. The addition of trains and carriages to existing railway lines is likely to have a small negative impact on biodiversity due to an increase in noise and lighting generated on national networks. Evidence: English Nature (Rail construction and operational effects on

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										biodiversity and geological interests, 2002) highlights that secondary impacts of linear projects such as railways include noise, artificial lighting and wildlife casualties. Railways provide corridors for a wide range of flora and fauna and enhance connectivity between sites. It is thought that this is because of the relative lack of human disturbance. However, the attraction of animals to railway corridors is also likely to lead to an increase in mortality due to rail movements. In turn, this indicates that an increase in train movements and disturbance is likely to lead to a negative impact on biodiversity. Furthermore, the Bat Conservation Trust (Bats and lighting in the UK, 2008) notes that artificial lighting can delay bats from emerging from their roosts and shortens the amount of time spent foraging and can impact the feeding behaviour of bats. They also note that bright light may reduce social flight activity.
New chords and track widening: impacts on biodiversity (e.g. habitat loss).	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. These interventions are considered likely to result in large direct impacts on biodiversity, particularly habitat loss due to land take. Evidence: The Ecological Impact Assessment for the new Croxley rail link demonstrated that the proposed development would not have a significant effect on habitats of greater than local importance. However, in terms of species, it was predicted that: the loss of existing planting would fragment existing commuting routes for bats and reduce foraging habitat and there could be disturbance of a badgers. This includes the disturbance of a sett located 30m away from the proposed link and the risk that badgers could be killed or harmed as a result of collisions and that some badgers may be deterred from using established commuting routes where this would require them to cross a newly active railway corridor (Mouchel, 2011. Croxley Rail Link Environmental Statement).
New chords and track widening: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. These interventions are considered likely to result in indirect impacts on habitat quality due to light and noise pollution from national networks as a result of new rail activity and increased proximity to ecological receptors. Evidence: English Nature (Rail construction and operational effects on biodiversity and geological interests, 2002) highlights that secondary impacts of linear projects such as railways include noise, artificial lighting and wildlife casualties. Railways provide corridors for a wide range of flora and fauna and enhance connectivity between sites. It is thought that this is because of the relative lack of human disturbance. However, the attraction of animals to railway corridors is also likely to lead to an increase in mortality due to rail movements. In turn, this indicates that an increase in train movements and disturbance is likely to lead to a negative impact on biodiversity. Furthermore, the Bat Conservation Trust (Bats and lighting in the UK, 2008) notes that artificial lighting can delay bats from emerging from their roosts and shortens the amount of time spent foraging and can impact the feeding behaviour of bats. They also note that bright light may reduce social flight activity.
New chords and track widening: habitat isolation and severance.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. These interventions are considered likely to lead to severance and fragmentation effects on habitats and species, due to the introduction of

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										new infrastructures such as tracks and platforms. Evidence: The Ecological Impact Assessment for the new Croxley rail link demonstrated that the proposed development would not have a significant effect on habitats of greater than local importance. However, in terms of species, it was predicted that: the loss of existing planting would fragment existing commuting routes for bats and reduce foraging habitat and there could be disturbance of a badgers. This includes the disturbance of a sett located 30m away from the proposed link and the risk that badgers could be killed or harmed as a result of collisions and that some badgers may be deterred from using established commuting routes where this would require them to cross a newly active railway corridor (Mouchel, 2011. Croxley Rail Link Environmental Statement).
Rail electrification: severance flight paths and direct mortality of birds and bats due to overhead cabling.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Medium	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of railways which will require the installation of new infrastructure. Schemes may cause localised disruption to bat commuting routes where line side vegetation is cleared, and there may be a potential risk of collision with overhead lines or supports by bats or birds. Evidence: The Great Western Main Line Electrification Project (April, 2013) states that the works may cause noise or visual disturbance of notable animals using habitats on or adjacent to line, including the presence of construction staff, machinery, and lighting. This disturbance may potentially affect habitat such as flight paths for birds and bats. The Scheme may also cause localised disruption to bat commuting routes where line side vegetation is cleared, introducing potential risk of collision with overhead lines or supports by bats or birds.
SRFIs: impacts on biodiversity (e.g. habitat loss).	Direct	Large negative (--)	Short term (0-5 years)	Medium (50-75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and are likely to lead to some direct habitat loss during their construction. However, it is considered unlikely that this will be high value habitat should the development occur on previously developed land. Evidence: Environmental Statements for SRFIs e.g. DIRFT III states that the majority of habitats south of the Clifton Brook Tributary are to be lost to facilitate the proposed development. The nature and scale of the proposed development are such that this level of habitat loss is necessary in order to provide sufficient area for the development footprint. Construction of the proposed development will result in the direct loss (on a phased basis) of all semi-improved grassland, hedgerows and ponds south of Lilbourne Meadows, as well as extensive areas of improved pasture.

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SRFIs: impacts on biodiversity (e.g. noise and light disturbance).	Indirect	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Reversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and will operate 24 hours a day. They will include use of artificial lighting and will generate noise, however these would be designed to industry standards to minimise impacts. Evidence: Environmental Statement for SRFIs e.g. DIRFT III states that operational impacts on bats could arise through the inappropriate positioning of lighting (Myotis sp. and Brown Long-eared bats being particularly susceptible to lighting), which could impact on bat foraging areas and commuting corridors, an impact considered to be of minor adverse significance at the international level. Best practice measures for the lighting industry will be followed, with reference to guidelines produced by the Institution of Lighting Professionals. Careful design of the lighting scheme will ensure that potential impacts on important bat foraging areas and commuting corridors are avoided.
SRFIs: habitat isolation and severance.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are substantial developments and may lead to some habitat severance and/or isolation. However, it is considered unlikely that the land will be high value habitat. Evidence: ESs have identified potential for habitat fragmentation due to the development of SRFIs. DIRFT III, for example, states that there will be loss and severance of the hedgerows as part of the construction of the proposed development which may inhibit foraging and commuting opportunities for bats, however, this has been classed as minor significance due to the low level of activity at the proposed site.

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AoS7: To ensure the protection of water resources (quantity)

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI new infrastructure: impacts on water use.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	Construction works use water and therefore small magnitude, localised adverse impacts on both surface and groundwater resources (quantity) are expected for the infrastructure measures proposed. These are likely to be site specific and will be largely mitigated through standard procedures incorporated into the design. Evidence: Water use in the Highways Agency supply chain includes water embodied within materials and products associated with their services and that used during construction. Using the Highways Agency Water Footprint for 2009/10, Managing Agent Contractor (MAC) and Design, Build, Finance and Operate (DBFO) schemes used in the region of 400,000-530,000m^3 of water per annum. During the construction process, the primary uses of water were for dust suppression and wheel washing. Research undertaken by the Strategic Forum for Construction estimates that the construction industry uses approximately 14 million m^3 of water per year in England and Wales which accounts for approximately 0.12% of total water use.

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AoS8: To encourage the protection of water quality

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 2 interventions on SRN: increase in road traffic across SRN increases risk of impacts to water quality.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Whole SRN	Permanent	Reversible	Overall Alternative 2 interventions aim to increase capacity on the SRN. Increased capacity of the network will result in a small increase in traffic across the network due to higher demand, although the traffic increase is unlikely to be evenly distributed. The increase in traffic may lead to an increased risk of localised negative impacts on both surface and groundwater quality across the wider network. The extent of the impacts will largely depend on the location of developments Evidence: TASM Modelling of a NPS investment scenario forecasts that in the central scenario, there will be 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast, and therefore there is likely to be a slightly larger impact on water quality. However, the amount of additional traffic may increase less than proportionally to the additional investment (see e.g. "Transport Demand to 2025 and the economic case for road pricing and investment" which demonstrates that transport investment could exhibit diminishing returns to scale). DMRB, Volume 11, Section 3, Part 10 HD 45/09. Road Drainage and the Water Environment states that where traffic levels are high the level of contamination increases and therefore, the potential for unacceptable harm being caused to the receiving water also increases.
New road and rail infrastructure: introduction of new potential sources of pollution increases risk of impact on water quality.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. There are potential risks to both surface and groundwater resources associated with highways and rail activity, including the increase in impermeable surfaces which increase runoff (and sediments/contaminants) to watercourses. In some instances, the inclusion of catch pits, balancing ponds and interceptors, would result in a slight benefit to water quality and conveyance of flow, however, this benefit over baseline conditions would only occur when existing schemes are being upgraded rather than for new infrastructure. Evidence: The Highways Agency DMRB Volume 11 HD45/09 states that pollution from road drainage can arise from a variety of sources including general vehicle and road degradation, incomplete fuel combustion, leaks of oil, fuel or other pollutants, fires and atmospheric deposition. Road runoff may also contain runoff from adjacent properties or agricultural land. CIRIA C643 (The Potential for Water Pollution from Railways) states that the operation of a railway, both historic and current, has the potential to give rise to pollution as water drains from the railway into watercourses. The A1 Elkesley Grade Separated Junction AST states that the scheme could potentially lead to negative impacts on the water quality within the River Poulter and local groundwater through contaminated runoff. Attenuation has been suggested to alleviate these negative impacts.

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New road, rail and SRFI infrastructure: physical impact on hydrology and hydrogeology	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. This new infrastructure has the potential to impact upon hydrology and hydrogeology due to infrastructure such as culverts being constructed in order to allow the construction of roads, railways and SRFIs. Evidence: DMRB Volume 11 HD45/09 outlines potential impacts arising from road infrastructure on floodplains and water courses. The construction of a new road forms a barrier that may cross existing drainage routes. Existing land drainage should be kept separate from the road drainage where possible, using culverts and ditches beneath the road. Flood defences and other structures such as weirs should be considered when infrastructure is being designed.
SRFIs: introduction of new potential sources of pollution impacts water quality.	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Small	Medium	Various across England	Permanent	Reversible	Alternative 2 supports the development of SRFIs across England. SRFIs and new rail alignments are considered likely to have a small adverse impact on water quality over a small spatial extent. However, Alternative 2 supports the protection of surface and groundwater quality through the requirement for mitigation measures, for example, for SRFIs, areas for storage and unloading with appropriate drainage facilities should be clearly marked. Therefore, negative impacts would be minimised wherever possible. Evidence: The St. Albans SRFI Environmental Statement states that the quality of water discharging from paved areas into sewers and watercourses could be adversely affected by the presence of pollutants and sediment, affecting the River Ver. An increase in the quantity of suspended solids such as silt and particles of rubber could be expected in the sewers and watercourses, caused by discharges from roads and paved areas. Dissolved material such as hydrocarbons can be expected from oil on carriageways. Spillages may also have the potential to cause damage to controlled waters.

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AoS9: To contribute towards increased resilience on national networks

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road, rail and SRFI infrastructure measures: impact on the climate change resilience of the SRN and the rail network through introduction of upgraded adaptation measures within new infrastructure.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across the SRN	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. Alternative 2 requires consideration of potential impacts of climate change in all new infrastructure proposals, which will improve resilience of both new and existing routes. Due to recent events, it could be considered that rail is at greater risk from climate change impacts compared to roads. Evidence: Highways Agency Climate Change Adaptation Framework (2009) states that options assessments will be undertaken for the road network and these options include future-proof designs whereby a precautionary approach will be adopted so that the asset/activity will perform satisfactorily throughout its life in the event of climatic changes towards extreme predictions. Network Rail recognise that a change in climate will have an impact on their assets and activities and in order to address this, they will consider design and build options to ensure long term resilience of railway infrastructure. Further research from the RSSB recommends designing and building for long term resilience (National Rail Climate Change Adaptation Report (2011) and Rail Safety and Standards Board (RSSB) Adapting to Extreme Climate Change Tomorrow's Railway and Climate Change Adaptation (2011)). Network Rail (2014) details that in February 2014, the Great West Mainline at Dawlish was severely impacted by an extreme weather event, with part of the railway collapsing into the sea. Between February and April, the Great West Mainline was closed at Dawlish, disrupting journeys for passengers travelling to Newton Abbot, Plymouth and stations in Cornwall. SRFIs incorporate both rail and road infrastructure and therefore resilience measures will be similar to those above.
Road infrastructure including motorway widening, pinch point investments, trunk road upgrades, new roads and new bypasses: impact on resilience to accidents and incidents of the SRN.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across the SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of motorway widening and trunk road upgrades, a large programme of pinch point investments and some new links and bypasses. The programme of trunk road upgrades, new roads, road widening and pinch point investments mean that when an incident does occur, the speed with which national networks are re-opened after security and other incidents on them is greater, and national networks are likely to return to normal traffic flow more quickly than would be the case without the upgrades. Evidence: Post opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), a total number of 138 accidents have been prevented in the opening year which equates to a saving of an average of 3.1 per scheme. The M1 (J25-28)

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										widening scheme AST states that the scheme will have a positive effect on accidents, with accident savings over the 60 year period of 848 personal injury accidents. A total of 8 fatal casualties, 113 serious casualties and 699 slight casualties will be prevented over this time period resulting in benefits of £53.9 million. Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes including trunk road upgrades and new links and bypasses.

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AoS10: To minimise the impact on soil and land resources including contamination and loss

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: localised impacts on soil and land resources, arising from limited road and rail alignments and SRFIs: loss (if greenfield sites).	Direct	Small negative (-)	Longer term (20+ years)	Low (25-50%)	Large	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. New infrastructure that is proposed on greenfield sites may result in localised adverse impacts, and possibly the loss of soil and land resources. The probability of infrastructure being built on greenfield sites is limited as most work will be carried out within or near to the existing highway or railway boundary. Evidence: Industry Profile – Railway Land (Department of Environment, 1995) identifies contamination risks associated with railways. The on-line dualling of the A21 between Tonbridge and Pembury impacts on ancient woodland, other nature conservation sites, a Scheduled Ancient Monument, Listed Buildings and an Area of Outstanding Natural Beauty. In addition, the A11 Fiveways to Thetford Improvement AST states that there would be slight adverse impacts through the loss of woodland and farmland.
New road, rail and SRFI infrastructure: impacts from ground contamination (e.g. mobilisation of contaminants, brownfield sites).	Direct	Small negative (-)	Longer term (20+ years)	Negligible (<25%)	Medium	Large	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. This includes new infrastructure that could be developed on greenfield or brownfield sites. Such development inherently results in risks relating to ground contamination. However, the development of brownfield sites operates within strict controls and impacts are likely to be mitigated to an acceptable level for all developments. However, an inherent risk of contamination still remains. It should be noted that impacts are likely to be largely dependent on the location of developments. Evidence: Design Manual for Roads and Bridges Volume 4: Geotechnics and Drainage. (HD 22/08) states that a discussion of potential contamination and proposed remediation requirements (if required) shall be included in the Geotechnical Design Report. This includes a summary of the findings and conclusions of the risk assessments including the site remediation requirements that have been agreed with regulatory authorities.

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AoS11: To minimise the use of previously undeveloped land

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: road and rail alignments along with SRFIs may be built on previously undeveloped land.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Medium	Large	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. Road and rail alignments and widening schemes and SRFIs may involve the use of previously undeveloped land. Evidence: The report, 'Keeping Britain Moving', produced by McKinsey & Company (2011) states that around 75% of all UK transport projects are built on brownfield land, compared with about 55%in continental Europe or the United States.

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AoS12: To encourage the use of recycled materials in the construction of infrastructure, whilst reducing, re-using or recycling the waste generated from construction

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure including road resurfacing: use of materials in the construction phase impacts on the waste infrastructure.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. The construction of infrastructure will involve the use of large amounts of material (both raw and recycled). The material used will be sourced in accordance with industry standard good practice guidelines to encourage the use of recovered materials. Evidence: Non-statutory guidance for Site Waste Management Plans (Defra) aims to improve materials resource efficiency, by promoting the economic use of construction materials and methods so that waste is minimised and any waste that is produced can be re-used, recycled or recovered in other ways before disposal options are explored. The Highways Agency A421 Improvement used 450,000 tonnes of recycled aggregates in the build, including the asphalt surface, avoiding the need for traditional quarried materials (The Green Construction Board, 2013).

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AoS13: To contribute towards reducing the risk of flooding in the hinterland

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
New road, rail and SRFI infrastructure: disturbance to local flood regime and drainage hydrology due to building of new infrastructure (or introduction of additional impermeable surfaces) impacts on the risk of flooding.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. There is a requirement for a Flood Risk Assessment to be undertaken at each development site. The design of all new infrastructure will incorporate mitigation measures relating to any adverse impacts on local hydrology. This will impact upon people, property and ecosystems. Evidence: The AST for the A6 Clapham Bypass scheme states that even with mitigation, there may still be an impact on flood risk as the scheme is within a floodplain and also bridges a river. A moderate adverse impact was predicted overall.

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AoS14: To reduce accidents and incidents on national networks and reduce risk to the users of road and rail network

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction of new road, rail and SRFI infrastructure: disruption during the construction period likely to cause congestion which may lead to additional accidents and incidents.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across England	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and supports the development of SRFIs. This includes a programme of resurfacing. The construction phases of these works are likely to lead to localised disruption and congestion on the road network, which can in turn lead to an increase in levels of accidents and incidents. Evidence: Institute for Road Safety Research (SWOV), 2010. Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity decreases with increasing congestion levels, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease.
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN leads to increased traffic resulting in an increase in accidents and incidents	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall Alternative 2 interventions aim to increase capacity on the road network. Increased capacity of the network will increase traffic due to higher demand, therefore, more vehicles will be using the SRN. These increased traffic levels are likely to have a cumulative impact on the levels of accidents and incidents across the wider network. Evidence: TASM Modelling of a NPS investment scenario forecasts that traffic on the SRN will increase by 1.03% by 2040 with the implementation of the NPS. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast, and therefore there is likely to be a slightly larger impact on accidents and incidents. However, the amount of additional traffic may increase less than proportionally to the additional investment (see e.g. "Transport Demand to 2025 and the economic case for road pricing and investment" which demonstrates that transport investment could exhibit diminishing returns to scale). Research conducted by SWOV shows that crash frequency increases with increasing congestion levels, however accident severity decreases with increasing congestion levels, primarily due to a reduction in speed. Analysis carried out in York by York City Council shows that as traffic volumes increase, accidents are also likely to increase, however, they suggest that as congestion gets very bad the accident rate doesn't increase and in some cases, may decrease. The Institute for Road Safety Research (SWOV), 2010.
Programme of maintenance on the SRN, including resurfacing: reduce likelihood of accidents and incidents due to optimum	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of road resurfacing on the SRN. This is likely to reduce the levels of accidents on the SRN as a result of an improved road surface. Evidence: The RAC Foundation The Economics of Road Maintenance

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road surfacing from a safety perspective.										(2013) suggests that poor road maintenance can lead to an increase in accidents on the road network. The Design Manual for Roads and Bridges (DMRB) Volume 7 HD37/06 details the standards with which new road surfacing must comply in terms of skid resistance. Therefore, new road surfaces will comply with the latest standards and are likely to be an improvement over existing surfacing, thereby reducing the risk of accidents and incidents on the SRN.
Road infrastructure including pinch points, trunk road upgrades and motorway widening: reduce the number and severity of accidents and incidents on the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Permanent	Irreversible	Alternative 2 supports an extensive programme of trunk road upgrades, motorway widening and a large programme of pinch point investments. New highways developments provide an opportunity to make significant safety improvements. Some developments have safety as a key objective, but even where safety is not the main driver of a development, there will be the opportunity to introduce the most modern and effective safety measures. Furthermore, motorway widening schemes are likely to reduce levels of accidents and incidents on national networks as a result of improvements to traffic flow and congestion. Therefore, this is likely to reduce the risk of accidents and incidents on the SRN. Evidence: The M1 (J25-28) widening scheme AST states that the scheme will have a positive effect on accidents, with accident savings over the 60 year period of 848 personal injury accidents. A total of 8 fatal casualties, 113 serious casualties and 699 slight casualties will be prevented over this time period resulting in benefits of £53.9 million. Post opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), a total number of 138 accidents have been prevented in the opening year which equates to a saving of an average of 3.1 per scheme. HA Post Opening Project Evaluations (POPEs) show safety benefits of various infrastructure upgrades, e.g. M62 Junction 6 upgrade led to 5.6 less accidents per year, and dualling of the A30 Bodmin to Indian Queens led to annual saving of 84 Personal Injury Accidents compared to 5 years before opening. Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes and is not limited to trunk road upgrades.
New links and bypasses: reduction in flows on alternative links where new link is introduced thereby reducing the probability of incidents and accidents.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 2 supports some new links and bypasses. Where these new roads take traffic off alternative routes (i.e. bypasses), especially where the traffic is reduced in town and village centres, there is likely to be a reduction in levels of accidents and incidents on the roads where traffic has been reduced. In addition, new highways developments provide an opportunity to make significant safety improvements. Some developments have safety as a key objective, but even where safety is not the main driver of a development, there will be the opportunity to introduce the most modern and effective safety measures. Therefore, overall, new road links are likely to reduce the risk of accidents and incidents on the SRN. Evidence: HA Post Opening Project Evaluations (POPEs) show safety benefits of various infrastructure upgrades, e.g. A21 Lamberhurst Bypass

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										new dual carriageway led to halving of accident rate along former route and the A500 Basford, Hough and Shavington Bypass new dual carriageway led to a 50% reduction in PIAs and casualties on the old A500. Furthermore, the Highways Agency Scheme Evaluation shows that the majority of road schemes saw a reduction in the number of personal injury accidents as a result of road improvement schemes. This includes a variety of road schemes and is not limited to new links and bypasses.
SRFIs: modal shift from road to rail reduces accidents and incidents on the wider road network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are expected to result in a modal shift from road to rail and the resulting reduction of large freight vehicles on the road is likely to reduce the levels of accidents and incidents on the SRN. Evidence: The Value and Importance of Freight (Network Rail, 2010) states that each freight train could take approximately 60 lorry journeys off the road. However, for the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is significantly lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. It has been estimated that the use of rail for freight movements reduces road casualties by 500 per year (Network Rail, Value and Importance of Freight, 2010). This is also noted in the Daventry International Rail Freight Terminal Needs Case.

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AoS15: To contribute towards the reduction of crime and fear of crime among vulnerable groups and transport user types

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
All Alternative 2 interventions: it is considered unlikely that there will be any impacts on crime or fear of crime as a result of the interventions contained within Alternative 2.	N/A									

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AoS16: To contribute towards the maximisation of user benefits on the National Networks

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction: road resurfacing and the construction of infrastructure measures causing disruption during the construction period and this is likely to cause congestion and therefore increased journey times which reduces user benefits.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across the SRN	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and the development of SRFIs. This includes an extensive programme of resurfacing .The disruption caused by this resurfacing programme is likely to impact on user benefits due to increased journey times. Evidence: Press releases from the Highways Agency show that the majority of resurfacing takes place overnight which is likely to reduce the impacts on congestion on the SRN. However, during these overnight periods, the roads are often closed and traffic is diverted to alternative routes which would also have an impact on congestion on local roads.
Cumulative impact of Alternative 2 interventions on SRN: reduction in congestion across the SRN reduces journey times and improves journey time reliability, therefore improving user benefits.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall Alternative 2 interventions aim to increase capacity on the road network. Increased capacity is likely to reduce congestion due to smoother flow of traffic and reduced journey times leading to user benefits across the wider network. For example, road infrastructure measures including trunk road upgrades, pinch point investments and some new links and bypasses and motorway widening are likely to increase capacity which reduces congestion and journey times, resulting in user benefits. Evidence: TASM modelling of a do NPS investment scenario forecasts that in the central scenario, there will by 1.03% more traffic on the SRN in 2040 in the Do NPS with respect to the baseline. However, even with an increase in traffic, the central scenario shows that congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. As Alternative 2 supports a significant increase in the roads programme with increased capacity compared to the NPS, the reduction in congestion is likely to increase beyond the Do NPS forecast, but the reduction in congestion may increase less than proportionally to the additional investment (see e.g. “Transport demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale). This reduction in congestion will improve journey times across the SRN and in turn create benefits for users. The Post opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), the total journey time savings amounts to 1.89 million vehicle hours or 42,000 hours per scheme. The A55/A483 segregated left turn from the A483 from Chester to the A55 east was completed due to the build-up of substantial queues and the resultant delays in evening peak traffic leaving Chester. Journey time delays reduced from 53.9 minutes pre-opening to 29.5 minutes post-opening during the AM peak (Post Project Evaluation Report (POPE) for A55/A483 improvement). HA Post Opening Project Evaluations (POPEs) for trunk road upgrades and new roads, e.g. M40/A404 Handy Cross new junction led to journey time savings of 6 minutes, and, dualling

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										of three sections of the A43 led to journey time savings of 6-9 minutes.
Additional train movements on existing rail network and more carriages on trains: an increase in rail movements will reduce journey times and overcrowding on the rail network and therefore improve user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Reversible	Alternative 2 supports a limited programme to make better use of existing railway lines, including through the provision of more trains and longer trains where commercially viable. An increase in the number of trains is likely to increase the level of service and therefore reduce journey times for some users and therefore positively impact on user benefits. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New chords and track widening: an increase in capacity of existing lines will reduce journey times and overcrowding on the rail network and therefore improve user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. This is likely to increase capacity of the rail network and therefore result in improved levels of service and journey time savings, which will positively impact on user benefits. Evidence: The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds (Network Rail, 2013, Northern Hub Factsheet). The Nuneaton North Chord has recently opened and therefore actual impacts of the development have not been assessed. However, the Needs Case for the project anticipated that the provision of a new section of track to allow increased freight trains to use the line and increase the reliability of passenger trains. This would allow 24 freight trains per day to travel between Felixstowe and Nuneaton (compared to up to 10 trains per day previously). Furthermore, the freeing up of the line for passenger trains would benefit users of the line by £482 million and non-users by £135 million through reduced congestion on the roads (Network Rail, 2010. Nuneaton North Chord Order Statement of Case of the Applicant).
Rail electrification: minor increase in capacity and reliability to reduce journey times and in turn improve	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. Electrification has been shown to improve acceleration and deceleration times and have greater reliability due to lower failure rates compared to diesel trains. In addition, electric trains have increased

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user benefits.										capacity due to the lack of requirement for power cars that diesel trains need. This therefore results in user benefits due to the reduced journey times on electrified lines. Evidence: Network RUS Electrification, Network Rail, 2009. Electric trains have a lower failure rate compared to diesel trains and overall electrification improves system reliability. However, failures of overhead equipment can cause delays on electrified routes. Furthermore, electric trains do not require a separate power car, which in turn increases the capacity of the train. Electric trains accelerate and decelerate quicker than diesel trains, which over long journeys, improve journey times.
SRFIs: modal shift from road to rail reduces congestion on the SRN and therefore reduces journey times, in turn improving user benefits.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. They are likely to result in a modal shift of freight from road to rail thereby reducing the number of lorries on the SRN which reduces congestion and results in user benefits of reduced journey times. Evidence: Each freight train takes approximately 60 lorries of the road (Network Rail, Value and Importance of Freight, 2010). However, for the purpose of this assessment, it is assumed that each freight train takes approximately 20-24 lorries off the road. This is substantially lower than the number of lorries removed over the length of the rail haul as it takes into account the road connections into the SRFIs. Furthermore, the Environmental Statement for Daventry International Rail Freight Terminal highlights that the modal shift of freight from road to rail reduces congestion and this therefore benefits users of the SRN as journey times are reduced.

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AoS17: To contribute towards the improvement of levels of congestion and reliability on the National Networks

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Construction: road resurfacing and infrastructure measures lead to disruption during construction period and this is likely to cause congestion and therefore decreased journey time reliability.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Large	Various across SRN	Temporary	Reversible	Alternative 2 supports an expanded roads programme and a smaller rail programme relative to the NPS and the development of SRFIs. This includes a programme of resurfacing. The disruption caused by this resurfacing and infrastructure programme is likely to negatively impact on congestion and delays during construction periods and therefore journey times and reliability. Evidence: Press releases from the Highways Agency show that the majority of resurfacing takes place overnight which is likely to reduce the impacts on congestion on the SRN. However, during these overnight periods, the roads are closed and traffic is diverted on to alternative routes. This therefore could have an impact on congestion and therefore journey time reliability on local roads. In terms of motorway construction there are usually certain procedures in place: hard shoulder closures, narrower lanes and safety barriers are in place as a 50mph speed restriction is implemented for the safety of drivers and road workers. This can lead to increased congestion and slow moving traffic, for example, the AST for the M25 Junction 5-7 Managed Motorway – All Lane Running states that there will be delays to all business users during construction and future maintenance of the scheme.
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity of the SRN reduces congestion.	Direct	Large positive (++)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall the Alternative 2 interventions aim to increase capacity on the road network. Increased capacity is likely to reduce congestion and increase reliability due to smoother flow of traffic and reduced journey times across the wider network. For example motorway widening trunk road upgrades, pinch point investments and some new links and bypasses are considered likely to result in large direct impacts on congestion, due to increased speeds and therefore journey time savings and increased journey time reliability. Evidence: TASM Modelling of a NPS investment scenario forecasts that traffic on the SRN will increase by 1.03% by 2040 with the implementation of the NPS. However, even with an increase in traffic, TASM shows that congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. As Alternative 2 supports a significant increase in the roads programme with increased capacity compared to the NPS, the reduction in congestion is likely to increase beyond the Do NPS forecast, but the reduction in congestion may increase less than proportionally to the additional investment (see e.g. “Transport demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale). This is likely to improve journey times across the wider network and in turn increase reliability on the SRN. Post opening Project Evaluation of Local Network Management Schemes (POPE of LNMS) 9th Annual Evaluation Report (2012) details that for 45 large Local Network Management Schemes (LNMS, schemes costing between £1 million and £10 million), the total journey time savings amounts to 1.89 million vehicle hours or 42,000 hours per scheme.

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										A55/A483 segregated left turn from the A483 from Chester to the A55 east was completed due to the build-up of substantial queues and the resultant delays in evening peak traffic leaving Chester. Journey time delays reduced from 53.9 minutes pre-opening to 29.5 minutes post-opening during the AM peak (Post Project Evaluation Report (POPE) for A55/A483 improvement). HA Post Opening Project Evaluations (POPEs) show journey time reliability and congestion benefits for various infrastructure projects e.g. A500 Basford, Hough and Shavington Bypass new dual carriageway led to a reduction in journey times of 4-4.5 minutes compared to the previous road despite levels of traffic having increased by 10% in the vicinity of the scheme. Along the A47 Thorney Bypass new dual carriageway journey times have improved by 1.5-2 minutes for users of the A47 and traffic within the village of Thorney has reduced by between 86% and 95%. In terms of motorway widening schemes, the M25 (J16-23) widening scheme Environmental Statement Non-Technical Summary states that benefits of the scheme include improved reliability of the time it takes to make a journey; improved safety on the motorway; reduced congestion; and improved driver information.
Additional train movements on existing rail network and more carriages on trains: an increase in capacity will reduce congestion and overcrowding on the rail network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a limited programme to make better use of existing railway lines, including through the provision of more trains and longer trains where commercially viable. An increase in the number of trains and carriages will increase capacity across the rail network and in turn reduce congestion and overcrowding. Evidence: Modelling of HLOS 2 schemes shows that all schemes combined will have a benefit cost ratio of 4.1. These benefits include time savings, crowding relieve and decreasing congestion for road users. Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New chords and track widening: increase in the capacity of existing lines will reduce congestion and overcrowding.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. This will increase capacity across the rail network and in turn reduce congestion and overcrowding. A reduction in congestion and an increase in capacity is likely to result in increased journey time reliability. Evidence: Modelling of HLOS 2 schemes shows that all schemes combined will have a benefit cost ratio of 4.1. These benefits include time savings, crowding relieve and decreasing congestion for road users.

*It should be noted that the evidence cited is for illustrative purposes only and, whilst it may not be representative of all schemes nor all potential impacts arising from these schemes, from professional judgement and experience is considered to support the general assessment of impacts made in this assessment table.

										The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds. It is also expected that an additional 700 trains will be able to run each day by 2019, allowing additional capacity for 44 million passengers per year. It will also potentially create between 20,000 and 30,000 jobs (Network Rail, 2013, Northern Hub Factsheet). The North Doncaster Chord (part of the East Coast Mainline between Yorkshire and London) will divert slow-moving freight trains from a key pinch point, thus allowing additional passenger trains to use the line. This increase in the frequency of passenger trains will improve long distance journeys and in turn will improve access to employment centres (Mott MacDonald and Network Rail, 2011. North Doncaster Chord Environmental Statement Non-Technical Summary).
Rail electrification: increase capacity and reliability and therefore reduce journey times.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme of electrification of the rail network. Electrification has been shown to improve acceleration and deceleration times and have greater reliability due to lower failure rates compared to diesel trains. In addition, electric trains have increased capacity due to the lack of requirement for power cars that diesel trains need. This therefore results in reduced journey times and congestion, and increased journey time reliability on electrified lines. Evidence: Network RUS Electrification, Network Rail, 2009. Electric trains have a lower failure rate compared to diesel trains and overall electrification improves system reliability. However, failures of overhead equipment can cause delays on electrified routes. Furthermore, electric trains do not require a separate power car, which in turn increases the capacity of the train. Electric trains accelerate and decelerate quicker than diesel trains, which over long journeys, improve journey times.
SRFIs: modal shift from road to rail reduces congestion on the SRN.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Medium	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. They are likely to result in a modal shift of freight from road to rail thereby reducing the number of lorries on the SRN, which in turn reduces levels of congestion and increases journey time reliability. Evidence: The Environmental Statement for Daventry International Rail Freight Terminal highlights that the modal shift of freight from road to rail reduces congestion and increases journey time reliability.

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AoS18: To contribute towards better strategic transport access to regeneration areas, employment centres and areas of high unemployment

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 2 interventions on SRN: increase in road capacity across SRN results in improved access.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall, Alternative 2 supports an increase in capacity across the SRN. It is likely that this will result in improved access to employment centres and regeneration areas. Road infrastructure measures including motorway widening, trunk road upgrades and pinch point investments are considered likely to result in reductions in congestion, in turn leading to increased access to regeneration areas, employment centres and, deprived areas and areas of high unemployment. Impacts will be largely dependent on the location of developments. Evidence: TASM Modelling of a NPS investment scenario forecasts that the implementation of the programmes supported by the NPS could reduce congestion on the SRN by 39.8% compared to 2040 baseline levels. As Alternative 2 supports a significant increase in the roads programme, and therefore capacity, compared to the NPS, congestion is likely to decrease beyond the Do NPS forecast. This is likely to improve access as a result of improved access to transport across the wider network. The Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis (2013) identifies anecdotal evidence which suggests that a number of major schemes have helped to facilitate local and regional economic development by reducing congestion and improving journey time reliability. These major road schemes include the following: bypasses, road widening, junction improvements and A-road upgrades to motorways. Environmental Impact Reports (EIR) from previous schemes, for example, the M25 J30/A13 Corridor Stage 1 EIR (grade separation and trunk road widening) have shown that the scheme has had a positive effect on journey times and has potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 80-160 due to lessening of transport constraints. In addition, the Birmingham Box Managed Motorway Scheme EIR predicted that the scheme would have a positive impact on regeneration areas in the West Midlands as it would make it easier for people to access employment opportunities.
Additional train movements on existing rail network and more carriages on trains: improvements to the railway network increases access to regeneration areas, employment centres and areas of high unemployment.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across the rail network	Permanent	Reversible	Alternative 2 supports a limited programme to make better use of existing railway lines, including through the provision of more trains and longer trains where commercially viable. The improvement of existing lines in terms of capacity and reliability are likely to result in improved access to regeneration areas, deprived areas and areas of high unemployment through improved journey times. Impacts will be dependent on the location of developments. Evidence: Network Rail intends to lengthen the trains using some lines along some parts of the network. For example, between Cannon Street and Charring Cross, trains will be lengthened from 10 to 12 carriages and for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South

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										London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New chords and track widening: improvements to the railway network increases access to regeneration areas, employment centres and areas of high unemployment.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. These measures are likely to increase the accessibility to and from employment and regeneration areas due to the facilitation of new rail services, and increase in capacity on existing lines, and, in limited cases, a greater proximity to the rail network. Impacts will be dependent on the location of developments. Evidence: The Northern Hub proposals which include new lines (the Ordsall Chord), widening of tracks, station improvements and electrification will improve the railway network in the north west of England. Network Rail expects that the improvements will reduce journey times between Manchester and Liverpool by 10-15 minutes and by 10 minutes between Manchester and Leeds. It is also expected that an additional 700 trains will be able to run each day by 2019, allowing additional capacity for 44 million passengers per year. It will also potentially create between 20,000 and 30,000 jobs (Network Rail, 2013, Northern Hub Factsheet). The North Doncaster Chord (part of the East Coast Mainline between Yorkshire and London) will divert slow-moving freight trains from a key pinch point, thus allowing additional passenger trains to use the line. This increase in the frequency of passenger trains will improve long distance journeys and in turn will improve access to employment centres (Mott MacDonald and Network Rail, 2011. North Doncaster Chord Environmental Statement Non-Technical Summary).
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 2 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to facilitate the use of the national networks for non-car users, which can help with access to regeneration areas, and employment centres. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income and that poor transport impacts social exclusion and deprivation. By improving accessibility to national networks through the use of non-car modes, accessibility to the jobs, services and social networks are likely to be improved.

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AoS19: To contribute towards the improvement of accessibility to rural areas

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 2 interventions on SRN: increase in road capacity across SRN results in improved access.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall, Alternative 2 supports an increase in capacity across the SRN. It is likely that this will result in improved access to rural areas and green spaces from regionally/nationally strategic locations. For example, motorway widening, trunk road upgrades, and pinch point investments are considered likely to reduce congestion and journey times and therefore improve accessibility to rural areas. Impacts will be largely dependent on the location of developments. Evidence: TASM Modelling of a NPS investment scenario forecasts that the implementation of the programmes supported by the NPS could reduce congestion on the SRN by 39.8% compared to 2040 baseline levels. As Alternative 2 supports a significant increase in the roads programme, and therefore capacity, compared to the NPS, congestion is likely to decrease beyond the Do NPS forecast. This is likely to improve access for rural areas as a result of improved journey times across the wider network. HA Post Opening Project Evaluations (POPEs) show that trunk road upgrades along the A30 from Bodmin to Indian Queens has resulted in a 19% increase in traffic using the route and more reliable journey times compared to the previous route.
New links and bypasses: additional routes increase access to and from rural areas.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Large	Medium	Various across SRN	Permanent	Irreversible	Alternative 2 supports some new links and bypasses. Where these new links and bypasses are located close to or within rural areas, access to the SRN for those living in, or wishing to visit rural communities is improved. Impacts will be dependent on the location of developments. Evidence: The A249 Iwade to Queenborough Improvement involved improved access between north Kent and the Isle of Sheppey via a new bridge. The scheme has been crucial for promoting economic growth in these areas (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013). This scheme has therefore improved access to rural areas. HA Post Opening Project Evaluations (POPEs) show that new road schemes increase capacity of the road network e.g. the A38 Dobwalls bypass in Cornwall is attributed to a 4.4% rise in traffic using the A38 corridor and the A5 Nesscliffe bypass in Shropshire has increased levels of vehicles using the road by 5% between the first year and fifth year since opening.
New chords and track widening, and additional train movements on existing rail network and more carriages on trains, and rail electrification: improvements to the railway network increases accessibility.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. It also supports a limited programme to make better use of existing railway lines, including through the provision of more trains and longer trains where commercially viable. The improvement of existing lines in terms of capacity and reliability are likely to result in improved access to rural communities. Impacts will be dependent on the location of developments. Evidence: A report commissioned by The Scottish Government (Review of Economic Assessment in Rural Transport Appraisal, 2009) identifies that improvements in frequency of rural rail, ferry and bus services have been

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										seen to increase usage by up to 42%. Control Period 4 (CP4) Delivery Plan 2009. Network Rail, 2009. Investment in the railway network will result in a bigger railway network and enhancements to the network to increase capacity and capability. Network improvements will be carried out in rural areas. For example in the rural North West, there in an increased demand on the route for freight but the route is primarily used for commuters from rural areas to Carlisle. Improvements will be made to the network to enable more frequent trains to run during peak times and to increase speeds. This will improve access to rural areas.
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access to rural areas.	Direct	Small positive (+)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 2 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. This is likely to facilitate the use of the national networks for non-car users, which can help with access to rural areas and green spaces from regionally/nationally strategic locations. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) explains that people in rural areas in Scotland have a greater reliance on cars and are more likely to drive every day and drive to work. Improvements to the facilities for non-car users to access national networks would improve accessibility in rural areas.

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AoS20: To contribute to reduced severance of transport routes and recreational areas as a result of national network development and operations

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN leads to increased traffic and therefore impacts on severance across the wider network.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Whole SRN	Permanent	Irreversible	Overall the Alternative 2 interventions aim to increase capacity on the road network. Increased capacity of the network will increase traffic due to higher demand, therefore, more vehicles will be using the SRN. These increased traffic levels are likely to have a cumulative impact on severance across the wider network. Evidence: TASM Modelling of a NPS investment scenario forecasts that traffic on the SRN will increase by 1.03% by 2040 with the implementation of the NPS. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase beyond the Do NPS forecast. However, the amount of additional traffic may increase less than proportionally to the additional investment (see e.g. "Transport Demand to 2025 and the economic case for road pricing and investment" which demonstrates that transport investment could exhibit diminishing returns to scale). Guidelines from the Institute of Environmental Assessment for assessing Road Traffic (1993) suggest that an increase in traffic flows along road networks increases severance as there is increased difficulty with crossing a heavily trafficked road.
New links and bypasses: additional routes impact severance within communities by introducing physical barrier.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 2 supports some new links and bypasses. These new roads can result in severance where they are located within communities due to the physical barrier created by the road which can impact on Non-Motorised User movements, such as walkers and cyclists. Evidence: HA Post Opening Project Evaluations (POPEs) show that severance has been increased in some locations e.g. upgrades of the A1(M) Wetherby to Walshford which included 3.3 miles of new dual three-lane carriageways, showed that severance was increased as the scheme severed two public rights of way, although it should be noted that short diversions were implemented.
New links and bypasses: additional routes impact severance within communities by reducing traffic on existing roads.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Small	Various across SRN	Permanent	Irreversible	Alternative 2 supports some new links and bypasses. This is likely to reduce severance within towns and villages where bypasses take traffic away from urban areas such as town or village centres. Evidence: A breakdown of the Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013 shows that 23 out of 25 bypass schemes had a positive impact on severance in local communities. HA Post Opening Project Evaluations (POPEs) show that severance has been reduced e.g. the A38 Dobwalls bypass POPE shows that 75% of residents living in Dobwalls feel that conditions for cyclists and pedestrians are better within the village and the A60 Haydon Bridge bypass has reduced severance in the village of Haydon and increased the journey ambience of pedestrians and cyclists within the village.

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SRFIs: severance due to additional road and rail links to the site.	Direct	Small negative (-)	Longer term (20+ years)	Medium (50-75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 2 supports the development of SRFIs across England. SRFIs are likely to require new road and rail links to the site which may impact on severance due to increasing traffic and creating a physical barrier between communities. Evidence: The Environmental Statement for an SRFI in St Albans indicates that upgrades to the existing road network and new roads will be required in order to facilitate the SRFI. The transport assessment included within the ES shows that there is either a neutral or slight adverse impact on severance as a result of the SRFI.

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AoS21: To enhance access to national networks and the jobs, services and social networks they create, including for the most disadvantaged

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Cumulative impact of Alternative 2 interventions on SRN: increase in capacity across the whole SRN results in improved access across the wider network.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Large	Whole SRN	Permanent	Irreversible	Overall, Alternative 2 supports an increase in capacity across the SRN. It is likely that this increased capacity will result in improved access to the SRN and the jobs, services and social networks it provides. For example, motorway widening, trunk road upgrades, and pinch point investments are considered likely to result in reductions in congestion, in turn leading to increased access to the SRN. Evidence: Evidence: TASM Modelling of a NPS investment scenario forecasts that traffic on that traffic on the SRN will increase by 1.03% by 2040 with the implementation of the NPS. However, even with an increase in traffic, TASM shows that congestion will reduce by 39.8% on the SRN by 2040 compared to 2040 baseline levels. As Alternative 2 supports a significant increase in the roads programme compared to the NPS, traffic is likely to increase and congestion is likely to decrease beyond the Do NPS forecast. However, the amount of additional traffic may increase less than proportionally to the additional investment (see e.g. “Transport Demand to 2025 and the economic case for road pricing and investment” which demonstrates that transport investment could exhibit diminishing returns to scale). This reduction in congestion and increase in capacity is likely to result in better access to the SRN. Evidence: The A5 Weeford to Fazeley Improvement has brought about improved journey times and journey time reliability and the scheme will have facilitated access to employment and services as a result of this (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013) . Environmental Impact Reports (EIR) from previous schemes. For example, the M25 J30/A13 Corridor Stage 1 EIR (grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 80-160 due to lessening of transport constraints.
New links and bypasses: additional routes increase access to SRNs.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Large	Medium	Whole SRN	Permanent	Irreversible	Alternative 2 supports the construction of some new links and bypasses. These new links and bypasses will increase access to the SRN for all, including the most disadvantaged sections of the community. Evidence: The A249 Iwade to Queenborough Improvement involved improved access between north Kent and the Isle of Sheppey via a new bridge. The scheme has been crucial for promoting economic growth in these areas (Post Opening Project Evaluation (POPE) for Major Schemes (>£10 million) Meta-Analysis, 2013). Economic growth is likely to result in improved access to jobs and services. Environmental Impact Reports (EIR) from previous schemes, for example, the M25 J30/A13 Corridor Stage 1 EIR (grade separation and trunk road widening) has shown that the scheme has had a positive effect on journey times and has potential to provide a boost to development in Tilbury with an increase in jobs (compared to the Core Strategy estimates) in the area of around 80-160

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										due to lessening of transport constraints.
Tolling on limited number of new links and bypasses: impact on costs to road users.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Very limited locations across SRN	Permanent	Irreversible	Alternative 2 supports the construction of some new links and bypasses. These new links and bypasses will increase access to the SRN for all, including the most disadvantaged. However, the Government will consider tolling as an option for funding new road capacity in very limited circumstances which may have a negative impact on the most disadvantaged sections of the community. Evidence: The proposed A14 toll as outlined in the Cambridge to Huntingdon Improvement A14 (Highways Agency, 2013) would be operational between the Ellington and Swavesey junctions but not the A14 to the east of Swavesey or any part of the A1. Tariffs have not yet been agreed, but it is proposed that between £1.00 and £1.50 would be charged for cars and other light vehicles and between £2.00 and £3.00 for HGVs/ The charge would apply between 6am and 10pm.
Additional train movements on existing rail network and more carriages on trains: improvements to the railway network impacts on access to jobs, services and social networks.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Large	Various across the rail network	Permanent	Reversible	Alternative 2 supports a limited programme to make better use of existing railway lines, including through the provision of more trains and longer trains where commercially viable. An increase in the capacity of existing trains and lines is likely to result in an increase in access to jobs, services and social networks. Evidence: Network Rail intends the trains using some lines along some parts of the network. For example, for some suburban routes into London via Balham, trains will be lengthened from 8 to 10 carriages. These lengthening programmes would increase capacity on some trains and railway lines (Network Rail, South London Rail Utilisation Strategy 2008). Furthermore, 80 additional carriages will be provided on trains running on the TransPennine express route from Glasgow to London and on the London Midlands route will receive up to 80 new carriages. 28 of these carriages on the London Midlands route to London Euston will enable: journey times to be reduced by up to 10 minutes during peak hours between Northampton and London, an additional 3 AM peak trains and an additional 5 PM peak trains into and out of London Euston (Department for Transport, 2012. Announcement: Extra trains and faster journey times will increase capacity).
New chords and track widening: improvements to the railway network impacts on access to jobs, services and social networks.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a small number of new chords and track widening. The improvement of existing lines in terms of capacity and reliability are likely to result in an increased access to national networks and the jobs, services and social networks they create. Evidence: Control Period 4 (CP4) Delivery Plan 2009. Network Rail (2009) shows that Investment in the railway network will result in a bigger railway network and enhancements to the network to increase capacity and capability. CP4 includes an Access for All programme whereby accessibility will be improved in around 100 stations across England, Wales and Scotland.

*It should be noted that the evidence cited is for illustrative purposes only and, whilst it may not be representative of all schemes nor all potential impacts arising from these schemes, from professional judgement and experience is considered to support the general assessment of impacts made in this assessment table.

Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved access to national networks, even for the most disadvantaged.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 2 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport e.g. The Door to Door Strategy supports rail station improvements to improve access and to support a modal shift from road to rail use. Evidence: Health Impact Assessment of Transport Initiatives A Guide (Health Scotland, MRC Social and Public Health Sciences Unit and Institute of Occupational Medicine, 2007) shows that car ownership is related to social class and income. In Scotland, 37% of households with an annual net income of less than £10,000 own a car, compared to 98% of households with an annual net household income of over £40,000. Poor transport impacts social exclusion and deprivation. By improving accessibility to national networks through the use of non-car modes, accessibility to the jobs, services and social networks are likely to be improved for the most disadvantaged. Furthermore, the Door-to-Door Strategy (DfT, 2013) highlights the point that the cost of travel is important for users of national networks and that by integrating the door-to-door strategy as a whole, journeys for non-car users will be more affordable.

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AoS22: To ensure the needs of different social groups are taken into account in national network planning and service delivery

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Road infrastructure measures including new links and bypasses: Compulsory Purchase Orders (CPOs) may be required for these measures and therefore impact properties and their residents adjacent to the road network.	Direct	Large negative (--)	Longer term (20+ years)	Medium (50-75%)	Large	Small	Various across England	Permanent	Irreversible	Alternative 2 supports an extensive programme of road developments, including trunk road upgrades and some new links and bypasses. These measures are likely to require land take and there is the possibility that CPOs may be used to acquire land where improvements are to be carried out outside of the highway boundary. This will disproportionately impact on residents whose properties are sold. Evidence: Compulsory Purchase Orders may be enforced if a proposed road scheme is considered to be in the public interest. For example, the A21 Tonbridge to Pembury Dualling Scheme requires the demolition of private properties where appropriate compensation will be provided through the CPO process. In addition, the construction of the A380 Kingskerswell Bypass requires the demolition of eleven properties. Nine of the properties are owned by Devon County Council, however, the owners of the two properties not owned by the authority would be compensated in the land purchase procedures.
Tolling on limited number of new links and bypasses: impact on costs to road users.	Direct	Small negative (-)	Longer term (20+ years)	High (>75%)	Small	Small	Very limited locations across SRN	Permanent	Irreversible	Alternative 2 supports some new links and bypasses which are likely to improve access to network for all social groups. However, the Government will consider tolling as an option for funding new road capacity in very limited circumstances which may have a negative impact on the most financially disadvantaged groups. Evidence: The proposed A14 toll as outlined in the Cambridge to Huntingdon Improvement A14 (Highways Agency, 2013) would be operational between the Ellington and Swavesey junctions but not the A14 to the east of Swavesey or any part of the A1. Tariffs have not yet been agreed, but it is proposed that between £1.00 and £1.50 would be charged for cars and other light vehicles and between £2.00 and £3.00 for HGVs/ The charge would apply between 6am and 10pm.
New chords and track widening, and additional train movements on existing rail network and more carriages on trains: improvements to the railway network impacts on disabled groups.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across the rail network	Permanent	Irreversible	Alternative 2 supports a limited programme to make better use of existing railway lines, including through the provision of more trains and longer trains where commercially viable. It also supports a small number of new chords and track widening. This includes some additional trains serving new and existing routes and some station improvements. These upgrades will need to be inclusive in their design and will need to comply with the Rail Vehicle Accessibility (Interoperable Rail System) Regulations (RVAR) 2008, Rail Vehicle Accessibility (Non Interoperable Rail System) Regulations (RVAR) 2010 and The Equality Act 2010 whereby station operators must take reasonable steps to ensure that they do not discriminate against disabled people. These upgrades are likely to positively impact disabled people who may have previously found it difficult to access trains and stations. Evidence: As part of the Railways for All Strategy 2006, Access for All funding is being used to provide an accessible route at more than 150 of the busiest inaccessible stations by 2015. Furthermore, as part EU guidelines and under the RVAR 2008 and RVAR 2010 Regulations, all rail

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										vehicles, including both existing and new vehicles, must be accessible by no later than January 1st 2020.
Door-to-door Strategy measures and cycling measures: improvements to modal integration leading to improved travel alternatives provision for non-car users.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 2 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport. This is likely to facilitate the use of the national network for non-car users. Evidence: The Door-to Door Strategy (DfT, 2013) shows that improvements at every stage of the journey will improve access to national networks, primarily rail services, by improving the integration between cycling and rail, for example.

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AoS23: To contribute towards improving health and public health

Impacts	Direct/ Indirect	Magnitude	Temporal Scale	Probability of Impact	Spatial Extent			Permanence	Reversibility	Explanation and Examples of Supporting Evidence*
					Number of impacts	Footprint/size of impact	Distribution			
Door-to-door Strategy measures and cycling measures: improvements to health due to facilitation of cycling and walking.	Direct	Small positive (+)	Longer term (20+ years)	High (>75%)	Small	Small	Various across England	Permanent	Irreversible	Alternative 2 supports measures to encourage people using national networks to make door-to-door journeys using sustainable transport. This is likely to facilitate the use of the national network for non-car users and the encouragement of walking and cycling is likely to have a beneficial impact on health. Evidence: The link between physical activity and health is described in Health Impact Assessment of Transport Initiatives, A Guide, Transport Scotland, 2007.

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APPENDIX F GLOSSARY OF KEY TERMS USED IN THE AOS

Term	Explanation
Appraisal of Sustainability (AoS)	A tool used to appraise planning policy documents in order to promote sustainable development. Social, environmental and economic aspects are all taken into consideration.
Department for Transport (DfT)	DFT is a Government department, supported by 22 agencies and public bodies.
AoS Objectives	Sustainability objectives developed at the Scoping stage against which the plan is assessed.
Habitats Regulations Assessment (HRA)	HRA is the assessment of the impacts of implementing a plan or policy on a Natura 2000 Site. Its purpose is to consider the impacts of a plan or policy against conservation objectives and to ascertain whether the plan or policy would adversely affect the integrity of the site.
Smart Motorways (SM)	Smart Motorways are made up of a number of measures to help people make their journey times more reliable by providing additional capacity when it is needed. They use a range of innovative technologies combined with new operating procedures to actively control traffic flow. Techniques such as varying speed limits and opening up the hard shoulder to traffic when needed are measures designed to improve traffic flow and reduce congestion.
Strategic Rail Freight Interchange (SRFI)	A large multi-purpose rail freight interchange and distribution centre linked into both the rail and trunk road system. It has rail-connected warehousing and container handling facilities and may also include manufacturing and processing activities.
National Policy Statement (NPS)	A policy statement, designated for the purposes of the Planning Act 2008 (as amended), relating to Nationally Significant Infrastructure Projects that has been designated as such by the relevant Secretary of State.
National Networks NPS	National Networks National Policy Statement that is the focus of this Appraisal of Sustainability.

Term	Explanation
Nationally Significant Infrastructure Projects (NSIP)	NSIPs are major infrastructure developments in such as major road projects. The thresholds which determine whether a project is classified as an NSIP are set out in the Planning Act 2008 (as amended).
Strategic Environmental Assessment (SEA)	Generic term used to describe environmental assessment as applied to policies, plans and programmes. In this report, 'SEA' is used to refer to the type of environmental assessment required under the SEA Directive.
SEA Directive	European Directive 2001/42/EC "on the assessment of the effects of certain plans and programmes on the environment".
Modal Split	The proportion of people using different transport modes.
Modal Shift	A change in the proportion of people shifting from one transport mode to another.
Strategic Road Network (SRN)	The strategic road network in England consists of most motorways and significant trunk A roads.
Ultra-Low Emission Vehicles (ULEVs)	An Ultra-Low Emission Vehicle (ULEV) is a motor vehicle that emits extremely low levels of motor vehicle emissions compared to other vehicles, for example, electric, plug-in hybrid and hydrogen-fuelled cars.
Sustainability Key Issues	Environmental, economic or social issues relevant to national networks identified at the Scoping stage and used to define the AoS objectives.