

A303 Stonehenge

Amesbury to Berwick Down

Preliminary Environmental Information Report

February 2018



Table of Contents

Chapter		Pages
1	Introduction	7
	1.1 Overview and need for the proposed scheme	7
	1.2 The purpose of the report	7
	1.3 Legislative and policy framework	8
	1.4 The Applicant	10
	1.5 Stakeholder engagement	10
	1.6 Structure of this PEI Report	11
	1.7 The EIA team	13
	1.8 Next steps	13
2	The Proposed Scheme	15
	2.1 Project location	15
	2.2 Description of the proposed scheme	15
	2.3 Construction	25
3	Assessment of Alternatives	31
	3.1 Scheme history	31
	3.2 Selection of the proposed scheme	31
	3.3 Development of the proposed scheme	34
	3.4 Appraisal of options presented for consultation	35
4	Environmental Assessment Methodology	40
	4.1 General approach	40
	4.2 Study area and site boundary	41
	4.3 Existing baseline and future conditions	42
	4.4 Potential significant effects and mitigation	42
	4.5 Major events	46
	4.6 Human health	47
5	Air Quality	49
	5.1 Introduction	49
	5.2 Stakeholder engagement	49
	5.3 Assessment assumptions and limitations	50
	5.4 Study area	51
	5.5 Baseline conditions	52
	5.6 Potential impacts	55
	5.7 Design, mitigation and enhancement measures	56
	5.8 Assessment of effects	57

5.9	Corridors for utility connections	61
6	Cultural Heritage	62
6.1	Introduction	62
6.2	Stakeholder engagement	62
6.3	Assessment assumptions and limitations	63
6.4	Study area	63
6.5	Baseline	64
6.6	Potential impacts	70
6.7	Design, mitigation and enhancement measures	71
6.8	Assessment of effects	72
6.9	Corridors for utility connections	77
7	Landscape and Visual Effects	79
7.1	Introduction	79
7.2	Stakeholder engagement	79
7.3	Assessment assumptions and limitations	80
7.4	Study area	80
7.5	Baseline conditions	80
7.6	Potential impacts	94
7.7	Design, mitigation and enhancement measures	95
7.8	Assessment of effects	98
7.9	Corridors for utility connections	101
8	Biodiversity	104
8.1	Introduction	104
8.2	Stakeholder engagement	104
8.3	Assessment assumptions and limitations	105
8.4	Study area	106
8.5	Field surveys	106
8.6	Biodiversity receptors	109
8.7	Biodiversity enhancement measures and opportunities	141
8.8	Assessment of effects	142
8.9	Corridors for utility connections	143
9	Noise and Vibration	146
9.1	Introduction	146
9.2	Stakeholder engagement	146
9.3	Assessment assumptions and limitations	147
9.4	Study area	147
9.5	Baseline conditions	148

9.6	Potential impacts	150
9.7	Design, mitigation and enhancement measures	150
9.8	Assessment of effects	151
9.9	Corridors for utility connections	154
10	Geology and Soils	156
10.1	Introduction	156
10.2	Stakeholder engagement	156
10.3	Assessment assumptions and limitations	156
10.4	Study area	157
10.5	Baseline conditions	157
10.6	Potential impacts	163
10.7	Design, mitigation and enhancement measures	166
10.8	Assessment of effects	169
10.9	Corridors for utility connections	170
11	Road Drainage and the Water Environment	172
11.1	Introduction	172
11.2	Stakeholder engagement	172
11.3	Assessment assumptions and limitations	173
11.4	Study area	173
11.5	Baseline conditions	174
11.6	Potential impacts	188
11.7	Design, mitigation and enhancement measures	189
11.8	Assessment of effects	192
11.9	Corridors for utility connections	205
12	Materials	206
12.1	Introduction	206
12.2	Stakeholder engagement	206
12.3	Study area	207
12.4	Baseline conditions	207
12.5	Potential impacts	209
12.6	Design, mitigation and enhancement measures	210
12.7	Assessment of effects	211
13	People and Communities	213
13.1	Introduction	213
13.2	Stakeholder engagement	213
13.3	Assessment assumptions and limitations	213
13.4	Study area	214

13.5	Baseline conditions	214
13.7	Design, mitigation and enhancement measures	221
13.8	Assessment of effects	222
13.9	Corridors for utility connections	224
14	Climate	226
14.1	Introduction	226
14.2	Stakeholder engagement	226
14.3	Study area	227
14.4	Baseline conditions	227
14.5	Potential impacts	229
14.6	Design, mitigation and enhancement measures	231
14.7	Assessment of effects	233
15	Cumulative, In-combination and Project-wide Effects	236
15.1	Introduction	236
15.2	Cumulative effects	236
15.3	In-combination effects	239
15.4	Project-wide effects	240
15.5	Human Health	240
16	Summary of effects	242
	References	245
	Glossary	253
	Abbreviations	256
	Figures	260
	Appendix 1.A Competent Expert Table	263
	Appendix 7.A Schedule of Representative Viewpoints (VP) to be read with Figure 7.4.	267
	Appendix 10.A Land Contamination Methodology Tables	271
	Appendix 11.A Environment Agency Surface Water Flood Risk Map	273
	Appendix 11.B Environment Agency Product 4 Information	274

1 Introduction

1.1 Overview and need for the proposed scheme

- 1.1.1 The A303/A358 corridor is a vital connection between the South West and the South East. While most of the road is now dual carriageway, there are still over 35 miles (56km) of single carriageway. These sections act as bottlenecks for users of the route resulting in congestion, particularly in the summer months and at weekends. This causes delays to traffic travelling between the M3 and the South West and increases the risk of accidents.
- 1.1.2 The A303 Stonehenge – Amesbury to Berwick Down Scheme (the proposed scheme) is part of a wider package of proposals for the A303/ A30 / A358 corridor designed to transform connectivity to and from the South West by creating a high-quality dual-carriageway along the corridor. The A303 / A30 / A358 Corridor improvements were identified in the 2016-2021 National Infrastructure Delivery Plan as one of the country's top five projects or programmes within the road sector.
- 1.1.3 The existing A303 passes through the Stonehenge section of the Stonehenge, Avebury and Associated Sites World Heritage Site (the WHS), passing approximately 165 metres from the Stonehenge monument itself (hereafter referred to as the Stones). It is noted that the WHS comprises two distinct components – Avebury to the north and Stonehenge to the south. The proposed scheme crosses the Stonehenge component only (see Figure 1.1) and all subsequent references to “the WHS” in this Preliminary Environmental Information Report refer to the Stonehenge component.
- 1.1.4 Objectives for the proposed scheme have been formulated both to address identified problems and to take advantage of the opportunities that new infrastructure would provide. The objectives are defined in the Department for Transport's (DfT's) Client Scheme Requirements (CSRs) which respond directly to the need for change:
- a) Transport – To create a high quality reliable route between the South East and the South West that meets the future needs of traffic;
 - b) Economic growth – To enable growth in jobs and housing by providing a free-flowing and reliable connection between the South East and the South West;
 - c) Cultural heritage – To help conserve and enhance the World Heritage Site and to make it easier to reach and explore; and
 - d) Environment and community – To improve biodiversity and provide a positive legacy for nearby communities.

1.2 The purpose of the report

- 1.2.1 This document is a Preliminary Environmental Information Report (“PEI Report”) which presents a description of the proposed scheme, the likely significant environmental effects based on the preliminary environmental information available at the time, measures to avoid or reduce such effects and the

alternatives considered. This is to support consultees in developing an informed view of the likely significant environmental effects of the proposed scheme.

- 1.2.2 We are continuing to gather environmental information, identifying the potential impacts of the proposed scheme, and developing measures to avoid or reduce adverse impacts - a process known as environmental impact assessment (EIA). The results of the full EIA will be presented in an Environmental Statement (ES) submitted with the required Development Consent Order (DCO) application.
- 1.2.3 This PEI Report has been prepared to assist consultees in understanding the potential impacts of the proposed scheme and the mitigation measures currently proposed. It forms part of the consultation material provided for the statutory consultation process under the Planning Act 2008 (as amended, including by The Highway and Railway (Nationally Significant Infrastructure Project) Order 2013) (Ref 1.1) (PA 2008). Further details are provided under sub-section 1.7 Next Steps.

1.3 Legislative and policy framework

Planning Act 2008

- 1.3.1 The proposed scheme is defined as a Nationally Significant Infrastructure Project (NSIP) under Section 14(1)(h) and Section 22 of the PA 2008 by virtue of the fact that:
- it comprises the construction of a highway;
 - the highway to be constructed is wholly in England;
 - the Secretary of State is the highway authority for the highway; and
 - the speed limit for any class of vehicle on the highway is to be 50 miles per hour or greater, and the area for the construction of the highway is greater than 12.5 hectares.
- 1.3.2 In accordance with the legislation, a DCO is required to allow the construction and operation of the proposed scheme.

The EIA Regulations

- 1.3.3 The proposed scheme is considered to be 'EIA development' and specifically a Schedule 1 development and will therefore be subject to an EIA, and reported within an ES. The proposed scheme is Schedule 1 development as it satisfies Clause 7 (3) of Schedule 1 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) (Ref 1.2) on the basis that it is:

“Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length”.

- 1.3.4 In accordance with Regulation 8(1)(b) of the EIA Regulations, Highways England has notified the Secretary of State for Transport (Secretary of State) in a letter to the Planning Inspectorate (The Inspectorate) dated 20th October 2017 that an ES presenting the findings of the EIA will be submitted with the DCO application.
- 1.3.5 An EIA Scoping Report was submitted to The Inspectorate on 20th October 2017 and can be viewed at the following link:

<https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/TR010025/TR010025-000032-Scoping%20Report.pdf>
- 1.3.6 The Inspectorate reviewed and consulted on the EIA Scoping Report and published a Scoping Opinion on 30th November 2017 which can be viewed at the following link:

<https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/TR010025/TR010025-000039-STON%20-%20Scoping%20Opinion.pdf>
- 1.3.7 Highways England acknowledges the comments of The Inspectorate given within the Scoping Opinion and also notes the comments provided by the statutory consultees to The Inspectorate in Appendix 2 to the Scoping Opinion along with the late consultation response published on 30th November. Both the Scoping Opinion and the comments from the consultees have been considered in undertaking the ongoing EIA and in preparing this PEI Report.
- 1.3.8 Highways England is maintaining ongoing dialogue with The Inspectorate and other relevant statutory stakeholders in relation to the scope of EIA in order to ensure that the scope of the EIA is proportionate and meets the requirements of the EIA Regulations. The scope of the EIA for each topic is being agreed with the relevant statutory stakeholders and this will be reported in the ES.

The decision maker and planning policy

- 1.3.9 The Localism Act 2011 provided the authority for Secretary of State to be responsible for the processing of DCO applications for NSIPs, with the power to appoint The Inspectorate. In its role, The Inspectorate will examine the DCO application for the proposed scheme and then will make a recommendation to the Secretary of State who will then decide whether to grant a DCO.
- 1.3.10 In accordance with section 104(2) of the PA 2008, the Secretary of State is required to have regard to the relevant National Policy Statement (NPS), amongst other matters, when deciding whether or not to grant a DCO. The relevant NPS for the proposed scheme is the National Policy Statement for National Networks (NPSNN) (Ref 1.3).
- 1.3.11 The Secretary of State will also consider other important and relevant national and local planning policy. The National Planning Policy Framework (NPPF) published in March 2012 (Ref 1.4) is relevant national planning policy.
- 1.3.12 The local planning policy relevant to the proposed scheme consists of the following adopted plans:

- a) Wiltshire Council Core Strategy Development Plan Document adopted January 2015 (Ref 1.5);
- b) Saved policies of the North Salisbury Local Plan 2011 adopted in 2003 (Ref 1.6);
- c) Wiltshire and Swindon Waste Core Strategy Development Plan Document 2006-2026 adopted 2009 (Ref 1.7); and
- d) Wiltshire and Swindon Minerals Core Strategy Development Plan Document 2006-2026 adopted 2009 (Ref 1.8).

1.3.13 The EIA Scoping Report submitted to The Inspectorate described the national and local planning policies relevant to the assessment with a summary provided for each environmental topic. These policies will be restated in the ES. The purpose of considering relevant planning policy during the EIA is twofold:

- a) To identify policy that could influence the sensitivity of receptors (and therefore the significance of effects) and any requirements for mitigation; and
- b) To identify planning policy that could influence the methodology of the EIA. For example, a planning policy may require the assessment of a particular impact or the use of a particular methodology.

1.4 The Applicant

1.4.1 Highways England is the Applicant, and the Strategic Highways Company as defined in the Infrastructure Act 2015, and is charged with modernising and maintaining England's strategic road network, as well as running the network and keeping traffic moving.

1.5 Stakeholder engagement

Context

1.5.1 Stakeholder engagement for the proposed scheme is based on the following principles:

- a) Early and ongoing engagement to inform and influence the proposed scheme development process;
- b) Seeking an appropriate level of feedback at each stage in the iterative design process and ensuring that comments received are taken into consideration;
- c) Building of long term relationships with key stakeholders throughout the different stages of the proposed scheme to help better understand their views;
- d) Where possible and practicable ensuring concerns are addressed; and
- e) Ensuring appropriate statutory consultation is undertaken in accordance with requirements of the PA 2008 and associated guidance.

Consultation to date

- 1.5.2 Non-statutory public consultation on two route options, Option '1N' and Option '1S' took place between January and March 2017. Both options involved a 2.9 km tunnel, but with northern and southern options to bypass Winterbourne Stoke. The purpose of this consultation was to seek feedback from the stakeholders, including the local community, on the two options identified via the options identification and selection process.
- 1.5.3 The responses to this consultation were considered in identifying the Preferred Route as documented in the consultation report (Ref 1.10) and the Preferred Route Announcement Brochure (Ref 1.11).
- 1.5.4 In addition to the non-statutory public consultation, ongoing engagement has taken place between the project team and key stakeholders, including local landowners, Wiltshire Council, environmental bodies and heritage groups.
- 1.5.5 Working groups have been set up with key stakeholders associated with a number of technical disciplines, including heritage, landscape and biodiversity. These are advisory groups and allow the project team to work closely with stakeholders as the proposed scheme design develops. Stakeholder engagement activities undertaken for each of the technical topics considered herein are presented within Chapters 5 to 14 of this PEI Report.
- 1.5.6 Section 1.7 explains how this PEI Report forms part of the material provided for the statutory consultation on the proposed scheme, and how responses to the statutory consultation will be considered within the DCO application process.

1.6 Structure of this PEI Report

- 1.6.1 The main text of this PEI Report divides into four parts:
- a) Chapters 1 to 4 describe the proposed scheme, the alternatives considered and the approach taken to the EIA (including consideration of Major Events and Health Impacts).
 - b) Chapters 5 to 14 present a preliminary assessment of the likely significant effects of the proposed scheme in relation to ten specialist topics covering particular aspects of the environment.
 - c) Chapter 15 considers the potential inter-relationships between the topics covered in Chapters 5 to 14, and between the proposed scheme and other developments in the surrounding area, which together have the potential to generate cumulative effects.
 - d) Chapter 16 presents a summary of the preliminary assessment of likely significant environmental effects.
- 1.6.2 The specialist topics covered in Chapters 5 to 14 of this PEI Report are:
- a) Chapter 5: Air quality
 - b) Chapter 6: Cultural Heritage
 - c) Chapter 7: Landscape

- d) Chapter 8: Biodiversity
- e) Chapter 9: Noise and Vibration
- f) Chapter 10: Geology and Soils
- g) Chapter 11: Road Drainage and the Water Environment
- h) Chapter 12: Materials
- i) Chapter 13: People and Communities
- j) Chapter 14: Climate

1.6.3 A separate document has also been prepared to provide a non-technical summary (NTS) of this PEI Report.

1.6.4 References, a glossary and a list of abbreviations are included at the end of this PEI Report.

1.6.5 Regulations 12 and 14, and Schedule 4 of the EIA Regulations set out the information which is to be included in the PEI Report. In accordance with Regulation 12 (2) (b), this PEI Report presents information which “is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)”. Table 1.1 identifies where the information defined by Regulation 14(2) can be found within this PEI Report.

Table 1.1: Location of information within this PEI Report

Specified Information	Location within the PEI Report
(2) An environmental statement is a statement which includes at least–	
a) a description of the proposed development comprising information on the site, design, size and other relevant features of the development;	Chapter 2 – The Proposed Scheme
b) a description of the likely significant effects of the proposed development on the environment;	Chapters 5 - 14
c) a description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;	Chapters 5 - 14
d) a description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment;	Chapter 3 - Assessment of Alternatives
e) a non-technical summary of the information referred to in subparagraphs (a) to (d); and	Non-technical Summary
f) any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.	Chapters 1 - 14

1.7 The EIA team

1.7.1 The EIA Regulations require that the ES is prepared by 'competent experts'. The EIA is being undertaken by AECOM on behalf of Highways England. AECOM has been awarded the EIA Quality Mark from the Institute of Environmental Management and Assessment (IEMA), demonstrating competency in ES preparation. At the individual level, the EIA is being undertaken by competent experts with the relevant and appropriate experience in their respective topics. The professional qualifications and experience of each of the EIA technical leads are summarised in Appendix 1.A.

1.8 Next steps

- 1.8.1 As noted at sub-section 1.2, this PEI Report has been prepared to support consultees in developing an informed view of the likely significant environmental effects of the proposed scheme.
- 1.8.2 An eight week consultation on the proposed scheme runs from Thursday 8th February to Friday 6th April 2018 to enable people to review the proposals and provide feedback. Highways England invites comments on the proposed scheme and the environmental issues addressed in the PEI Report.
- 1.8.3 Further details on the consultation and downloadable copies of the full PEI Report, the non-technical summary of the PEI Report, the draft Environmental Masterplan, the consultation booklet and response form and further information on the proposed scheme can be downloaded at:
- www.highways.gov.uk/A303Stonehenge/consultation
- 1.8.4 To support the consultation a series of events are being held where people will be able to view information on the proposed scheme, speak to members of the project team and provide responses to the consultation.
- 1.8.5 Copies of the consultation documents are also available for viewing at a number of locations. Full details of the consultation events and locations where copies of the consultation documents can be viewed are available in the Statement of Community Consultation (SoCC) which is available on the project website (see link above).
- 1.8.6 Responses to the consultation can be made by completing the response form online or by email or letter using any of the following addresses:
- a) Online: www.highways.gov.uk/A303Stonehenge/consultation
 - b) Email: A303Stonehenge@highwaysengland.co.uk
 - c) Post: completed feedback forms can be sent by Freepost (you do not need a stamp) to the following address: Freepost A303 Stonehenge Consultation
- 1.8.7 Following the consultation, Highways England will review all of the responses received. Comments will be taken into account when considering the need for further assessment or modification to the proposed scheme design or mitigation measures.

- 1.8.8 The comments received will also be used to produce a Consultation Report in accordance with section 37 of the PA 2008, which will be submitted to The Inspectorate with the DCO application. The Consultation Report will summarise the views and comments received, and outline how regard has been had to those comments in the proposed scheme design and the EIA.
- 1.8.9 Following submission of the DCO application, The Inspectorate will consider, on behalf of the Secretary of State, whether the application should be accepted for examination. If the application is accepted, consultees including the general public will then be able to make relevant representations about the proposed scheme and its potential impacts. The documents accompanying the DCO application will be publicly available on The Inspectorate's website, and consultees will be able to submit comments to The Inspectorate. These comments will then be considered as part of the examination into the DCO application. Following examination, The Inspectorate will make a recommendation to the Secretary of State, who will then decide whether to grant a DCO.
- 1.8.10 If the DCO is granted, construction is planned to start in 2021 and the proposed scheme is due to open to traffic in 2026.

2 The Proposed Scheme

2.1 Project location

- 2.1.1 The A303 forms one of two strategic routes between the South East and South West regions, the other being the M4/M5. Together with the A30 and A358, the A303 plays a vital role in supporting the economy of the South West peninsula and the wider South West region. The section of the A303 addressed by the proposed scheme, and considered within this PEI Report, is between Amesbury and Berwick Down, approximately 11.5km north of the town of Salisbury, in the county of Wiltshire. The proposed scheme location is shown in Figure 2.1.
- 2.1.2 The Preferred Route for the proposed scheme was announced by the Secretary of State on 12th September 2017. The proposed scheme would be approximately 8 miles (13km) long and would comprise the construction of a new two lane dual carriageway between Amesbury and Berwick Down. At the western end, the proposed scheme would pass just to the south of the Parsonage Down National Nature Reserve (NNR) and to the north of the village of Winterbourne Stoke, crossing the River Till which is a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC). It would then pass through the WHS. Located within the WHS and to the south of the proposed scheme is the Normanton Down RSPB Reserve. At the eastern end, the proposed scheme would mostly follow the line of the existing A303, passing to the north of the historic town of Amesbury and across the River Avon which is also a SSSI and SAC.
- 2.1.3 The land likely to be required temporarily and/or permanently for the construction, operation and maintenance of the proposed scheme is shown in Figure 2.2. It is important to note that the land required may eventually be slightly less than shown due to design and construction methodology development. The maximum area of land likely to be required has therefore been assessed. A more detailed explanation of the study area and the site boundary is provided at section 4.2.

2.2 Description of the proposed scheme

- 2.2.1 The development of the proposed scheme design is an ongoing, iterative process with the environmental assessment. It is being informed by existing knowledge of environmental constraints, as well as the environmental assessment of emerging design proposals and ongoing engagement with stakeholders. This PEI Report and the assessments within it have been based on the design of the proposed scheme being consulted upon, as described below and presented in Figure 2.2. The assessments are based upon the maximum area of land likely to be required and also include consideration of the options consulted upon and so cover what can be regarded as a realistic ‘worst case’ assessment of the impacts associated with the proposed scheme.
- 2.2.2 The further development of the proposed scheme design will consider the feedback received during consultation and ongoing assessments, to produce a preliminary design which will be used as the basis of the DCO application. As such the draft design described below will be subject to refinement prior to the DCO application. The preliminary design, and the assessment of its likely significant environmental effects, will be presented in the ES submitted with the DCO application.

- 2.2.3 The proposed scheme is described briefly below in three route sections:
- a) a western section, from the western tie-in at Berwick Down to the Longbarrow Junction;
 - b) the section within the WHS including a tunnel with its western and eastern approaches; and
 - c) an eastern section over Countess Roundabout, including minor works to the east of the Solstice Park Junction.
- 2.2.4 The descriptions include reference to a number of design options, which are also summarised at the end of the section. Following this options summary, other features of the highway design are described. An overview of the approach to construction is then provided.

Western section

- 2.2.5 The proposed scheme would commence on the existing A303 approximately 800m east of Yarnbury Castle and would closely follow the existing A303 alignment, south of Parsonage Down National Nature Reserve (NNR), for approximately 1.2km (Figure 2.4). It would then continue in a north easterly direction providing a bypass to the north of the village of Winterbourne Stoke.
- 2.2.6 A 'green bridge' (see Figure 2.4) will be constructed over the new A303 northwest of Scotland Lodge Farm near the southeast corner of Parsonage Down. In addition to pedestrian, cycle and agricultural access, this bridge will provide ecological connectivity across the proposed scheme. This bridge would form part of a green non-motorised user (NMU) route and agricultural access route which would run between hedges and/or earthwork bunds from a layby on the existing A303 to Parsonage Down.
- 2.2.7 Local access from Winterbourne Stoke, northwards towards Shrewton, is provided by the B3083. This access would be maintained by the provision of a single span bridge to carry the new A303 over the B3083. The proposed new bridge would be located some 50m to the west of the existing B3083. This location would necessitate the realignment of some 400m of the B3083, but would enable the B3083 to be kept open to traffic throughout the construction period other than for discrete periods to allow short duration specific activities to be undertaken (e.g. construction of tie-ins etc.). The structure would comprise a single span structure with splayed wing walls, blending in with the surrounding embankment earthworks. The clear span of the bridge would accommodate both the re-aligned B3083 and a segregated verge on the east side to allow cattle movements across the new alignment. The minimum headroom would be 5.3m.
- 2.2.8 The proposed scheme would continue in an easterly direction, crossing the River Till valley on a new twin deck, five span viaduct. The River Till viaduct would carry the proposed A303 over the River Till SAC and SSSI and its floodplain. The viaduct would be designed to minimise impacts on the river below. It would be a twin deck structure, with each deck approximately 14m wide and 212m in length. The road level on the bridge would be approximately 10m above the River Till where it crosses the river channel. The location of the piers has been optimised so that they are not within the SAC or SSSI and to allow the existing bridleway (WST04) from Winterbourne Stoke to remain at its current location (Figure 2.4).

The proposed scheme currently includes two options for the southern parapet of the bridge, one of which is to retain an open aspect to match the northern parapet and the alternative is to include an opaque barrier on the southern parapet to help screen vehicles and vehicle noise from locations to the south. These options are discussed further in Section 3.4 below.

- 2.2.9 A second green bridge at the Winterbourne Stoke Public Right of Way (PRoW) 6B (see Figure 2.4) would maintain the existing PRoW over the new A303 alignment and as with other green bridges would provide for ecological connectivity across the proposed scheme.
- 2.2.10 Continuing to the east, the proposed scheme would cross the line of the existing A303 approximately 600m west of the existing A360 Longbarrow roundabout. A new grade separated junction with the A360 is proposed to the west of the WHS boundary (Figure 2.4). This junction, known as the Longbarrow Junction, would accommodate free-flowing traffic on the A303. The junction would consist of two roundabouts connected together by a short length of dual carriageway, carried over the A303 on a new green bridge with earth bunds on each side, to help mitigate visual impact and to provide ecological connectivity. The structure would be a single span bridge, with headroom of at least 5.3m.
- 2.2.11 The roundabouts and connecting road will be at, or slightly below, existing ground level. A link to the de-trunked A303 to the west accessing Winterbourne Stoke would also be provided from the new Longbarrow Junction, maintaining the northern and southern links to the A360 and access to the proposed new section of the A303.

Tunnel and approaches

- 2.2.12 As the proposed scheme crosses the line of the existing A360, it enters into the WHS. At this location a further green bridge is proposed. In addition to an NMU route and the agricultural and ecological benefits common to the other green bridges, this bridge would also provide visual connectivity between barrow groups to the north and south of the proposed scheme. The proposed scheme currently includes two options for the location of this green bridge, one of which is on the existing A360 alignment (as shown on Figure 2.4) whilst the alternative is to provide an otherwise identical bridge approximately 150m further east. These options are discussed further in Section 3.4 below.
- 2.2.13 The proposed scheme then follows closely the line of the existing A303. The proposed alignment over the first 1.2km of this section would be in a cutting varying in depth between 7m and 10m, and deepening to almost 17m on the immediate approach to the tunnel portal. The top 2.5m of the cutting would have a 1 in 2 slope running for the length of the cutting. The proposed scheme currently includes two options for the profile of the bottom of the cutting, one of which is to use vertical retaining walls (as shown on Figure 2.4) to minimise WHS landtake, whilst the alternative would use grassed slopes and require slightly more landtake from the WHS. These options are discussed further in Section 3.4 below.
- 2.2.14 The western tunnel portal (Figure 2.4) would be located within the WHS, north west of Normanton Gorse, and would be located approximately 1.2km east of the existing Longbarrow Roundabout and immediately to the south of the existing

A303. The proposed scheme currently includes two options for the western tunnel portal, one of which is to use a fully grassed canopy, with tunnel service buildings and store rooms located outside the canopy (as shown on Figure 2.4). The alternative would be to have a short length at the entrance to the canopy with openings to provide the necessary ventilation for the store rooms. This would allow the store rooms and the associated layby to be concealed under the canopy. These options are discussed further in Section 3.4 below.

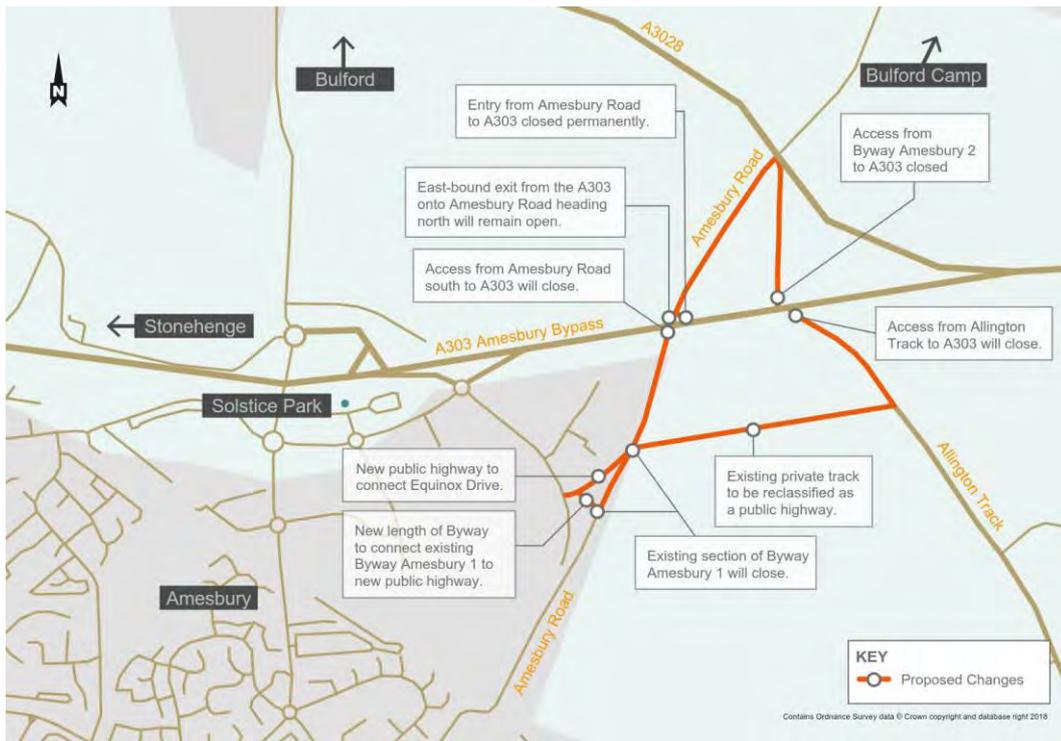
- 2.2.15 The proposed scheme would then continue in tunnel in an easterly direction following an alignment that is broadly similar to the existing A303 but at a depth of between 16 and 50m. The proposed tunnel would be a twin-bore tunnel approximately 1.9 miles (approximately 3.0km) in length.
- 2.2.16 Each tunnel bore would be of approximately 11.5m internal diameter and approximately 13m external diameter, with a separation of some 13m between the two tunnels.
- 2.2.17 The two bores would be connected underground by a series of cross passages at regular intervals to allow for the safe evacuation of road users in the event of an incident in one of the bores.
- 2.2.18 The tunnel would contain a number of mechanical and electrical, operational and safety systems. The items of plant required to power and control these systems would be housed within tunnel service buildings located at the tunnel portals.

Eastern section

- 2.2.19 The tunnel would emerge at the eastern tunnel portal which would be located to the east of the King Barrow Ridge and The Avenue (Figure 2.4) and just to the north of the existing A303. The portal approach would be in deep cutting similar to the western tunnel portal approach section of road.
- 2.2.20 The proposed scheme would then closely follow the line of the existing A303 to Countess Roundabout. This is the first roundabout for motorists heading to the South West along the existing A303 and it is currently a major bottleneck.
- 2.2.21 A new flyover above the existing roundabout would separate traffic going east-west along the A303 from traffic going north-south along the A345 Countess Road, with slip roads accommodating traffic movements between the two roads. The new flyover would accommodate the existing lanes of roundabout traffic beneath the bridges, with a widened outside verge to accommodate a combined footway and cycle track, and a widened inside verge to accommodate circulatory sightlines. The minimum headroom would be 5.3m. The junction changes would significantly improve the bottleneck and reduce journey times.
- 2.2.22 The proposed scheme currently includes two options for the new Countess Junction, one of which is to use two single span bridges above the existing roundabout, with the centre of the roundabout filled and landscaped (as shown on Figure 2.4). Retaining walls would be required at this junction to support the A303 between the slip-roads. The alternative would be to use an open viaduct to provide the flyover across an open roundabout. These options are discussed further in Section 3.4 below.

- 2.2.23 There are two existing subways between the eastern tunnel portal and Countess Junction, which would be removed. These are both unpleasant for users and are perceived as unsafe for vulnerable people, particularly during hours of darkness. Two pedestrian crossings would be added to cross the A345 and would not affect the traffic flows on the A303.
- 2.2.24 The proposed scheme would tie in with the existing A303 close to the existing River Avon Bridge, to the west of Solstice Park junction. There will be a number of changes to existing rights of ways to accommodate this, as follows:
- a) To the north of the A303, the existing entry from Amesbury Road onto the A303 would be closed permanently. Instead, this traffic would be accommodated at the Double Hedges junction where the A3082 joins the A303 east-bound although cars would be prohibited from travelling southwards from the A3028 junction.
 - b) The east-bound exit from the A303 onto Amesbury Road heading north would remain open.
 - c) The access onto the PRoW AMES2 and BULF12 from the A303 between Amesbury Road and the A3082 would also close.
 - d) To the south of the A303, the junctions between the A303 and both PRoW AMES1 and Allington Track east of Solstice Park would close. A new route would be created along the private lane between Allington Track and PRoW AMES1 and then along a short length of byway to terminate at a new T-junction on Equinox Drive in Solstice Park. This new route would provide an alternative to the previous access arrangements through the closed junctions. Allington Track between the upgraded byway and the A303, and byway AMES1 between the A303 and AMES29 would both be stopped up permanently.
- 2.2.25 These changes at the eastern end of the proposed scheme are summarised in Figure 2.3 below:

Figure 2.3: Changes to rights of way at eastern end of proposed scheme



Options

2.2.26 The proposed scheme described above identifies five design components for which distinct options have been retained and for which views are sought during consultation. These are summarised in the table below:

Table 2.1: Options for Consultation

Design component	Options
River Till Viaduct (southern parapet)	a) open conventional parapet; or b) parapet modified by inclusion of opaque noise / visual barrier along edge of viaduct (south side)
Green Bridge at or near A360	a) On existing A360 alignment; or b) Approximately 150m east of existing A360 alignment
Approach to Western Portal	a) Vertical retaining walls for the lower two thirds and rolling grass slope above; or b) Shallower grassed slopes for the full depth
Western Portal	a) Fully grassed over canopy, with buildings external to canopy; or b) Part of the canopy with ventilation openings, with buildings concealed under the canopy.
Countess Junction	a) flyover with two single-span bridges over the existing lanes of the roundabout, connected by a landscaped embankment; or b) flyover as a multi-span viaduct across the whole of an open roundabout.

2.2.27 The potential environmental impacts associated with the options summarised in Table 2.1 are considered further within Chapter 3 Assessment of Alternatives.

Highway design

2.2.28 The following highway design principles have been applied in the development of the proposed scheme:

- a) The design is based on good practice, as embodied in the Design Manual for Roads and Bridges (DMRB).
- b) An 'earthworks balance' is sought to minimise importing or exporting earthworks materials to/from the site.
- c) Roadside features such as lighting would be minimised to reduce visual impacts, whilst remaining consistent with safety requirements.

2.2.29 The A303 outside of the tunnel would be a high quality dual carriageway formed of two carriageways each 9.3m wide (comprising two 3.65m wide running lanes and a further 1m hard strip on either side), typically with a 2.5m-3.5m verge. The verge width would be increased as required to provide the appropriate unobstructed visibility around curves. Further localised increases in verge width to accommodate highway features such as signs, vehicle restraint systems, communication equipment and laybys have been included where required.

2.2.30 The central reserve width would be 2.5m as a minimum, although this would be increased as required to provide the appropriate visibility around curves and locally on the approaches to the tunnel.

2.2.31 Within the tunnel the verge widths would be reduced and no hard strip provided. A 1.5m wide emergency walkway would be provided along each side of each carriageway.

2.2.32 Telecommunications networks would be provided along the length of the proposed scheme within the highway verges, consisting of a fibre network installed in a ducted network. Optical fibre equipment cabinets would be installed at intervals to support the transmission network requirements.

2.2.33 A number of laybys would be located throughout the length of the proposed scheme. These would generally be outside the WHS, other than a layby at each tunnel portal which would be required for emergency refuge and for access to tunnel service buildings.

2.2.34 Vehicle restraint systems would be provided in accordance with the required standards. For the majority of the length of the scheme there would be a concrete vertical safety barrier along the central reserve.

2.2.35 Equipment to enable operational monitoring and control of traffic during incidents and maintenance would be located along the length of the scheme. Further details of the equipment will become available as the proposed scheme design evolves.

Emergency/maintenance crossing points

- 2.2.36 When one tunnel bore is closed during planned maintenance or an incident occurs in a bore, the vehicles that would usually travel through that bore would be diverted into contra flow travelling in the open bore. Cross over points would therefore be required to allow this. These would be located on the main carriageway at both Longbarrow Junction and Countess Junction. To support the operation of these cross overs, temporary lighting and signage would be provided as required.

Lighting

- 2.2.37 Given the WHS context, street lighting is an important consideration within the proposed scheme design and its application will be subject to good practice associated with any appropriate safety assessments. There will be no permanent surface lighting associated with the proposals within the WHS.
- 2.2.38 The tunnel would be lit and the existing lighting at the Countess Roundabout will be retained.
- 2.2.39 The proposed Longbarrow Junction would be unlit, subject to the results of a supporting safety assessment.

Drainage

- 2.2.40 Road drainage for the proposed scheme would be managed predominantly by infiltration, using a series of retention and infiltration basins. Details of the proposed drainage will be developed in discussions with the Environment Agency.

Earthworks and landform

- 2.2.41 The proposed scheme would require a number of embankments and cuttings to be formed to accommodate the horizontal and vertical alignment as shown in Figures 2.4.
- 2.2.42 Earth retaining structures would be required in the form of embedded retaining walls or reinforced concrete structures.
- 2.2.43 In addition to earthworks to support and facilitate the alignment of the proposed dual carriageway, there would be additional earthworks such as earth bunds (including 'false cuttings') to provide mitigation.
- 2.2.44 The current landscape proposals include the following:
- a) The grading back of cut slopes in order to integrate the highway earthworks into the adjacent landform. This would include the deep cutting south of Parsonage Down.
 - b) The regrading of embankments in order to integrate the highway earthworks into the adjacent landform. The main area for earthwork regrading would be to the north of Scotland Lodge, which is to the west of the Till Valley. Here an embankment would be graded out on the northern side of the proposed scheme to tie the embankment into the adjacent valley and hillsides and regraded on the southern side. Other areas of landscaping would be

provided north east of Winterbourne Stoke and at Longbarrow Junction as shown on Figure 2.4.

- c) Earth banks or bunds of approximately 2m in height, known as 'false cuttings', would be included along sections of the proposed scheme to the west and east of the Till Valley. These would be associated with the regrading of the embankments described above and would help reduce views of the traffic on the proposed scheme as well as reduce noise levels to the surrounding area. Similar bunds will also be provided over the green bridges.
- d) The graded out cutting slopes and regraded embankments would, in most locations, be returned to agricultural use. Within the vicinity of Parsonage Down however, it is proposed to develop species-rich chalk grassland as explained further in sub-section 2.3.
- e) Within the WHS, the cuttings would include a shallow 2.5m deep cut slope above the lower retaining structure. The top of the cut slopes would be rounded off to ensure a better integration with the adjacent landform.

Existing A303

2.2.45 The existing A303 would be subject to changes between the western tie-in with the new alignment and the eastern tunnel portal. The overall approach would be to downgrade the route, but this would vary across the length depending upon local requirements, for example, the need to maintain local access. From west to east, the proposed approach at each section can be summarised as:

- a) Western tie-in to existing layby west of Winterbourne Stoke: This stretch of the existing A303 would be downgraded to a Private Means of Access (PMA) and NMU right of way to connect with new rights of way matching this status, along the southern and northern boundaries of the new alignment, and a private means of access to enable agricultural vehicle access to agricultural buildings and fields west of Winterbourne Stoke.
- b) Layby west of Winterbourne Stoke to east to the proposed Longbarrow Junction: The A303 would be de-trunked, but retained for local access to Winterbourne Stoke and properties as far west as the layby, with a new tie-in to the southern side of the new Longbarrow junction. A segregated cycleway would be provided between Winterbourne Stoke and the new Longbarrow Junction.
- c) Proposed Longbarrow Junction to existing Longbarrow Roundabout: This short length of the existing road would largely be removed and lost within the new junction and associated landscaping works. A new NMU right of way would be created along the southern boundary of the proposed A303, to link with the proposed NMU route along the line of the old A360 (see sub-section on PRow below).
- d) Existing Longbarrow Roundabout to Stonehenge Cottages: This section of the existing A303 runs through the WHS and would be converted to a 'green' byway, open to NMUs. Agricultural and statutory utility access would need to be maintained, but vehicular access for this would be gate controlled. The extent of the removal and the finish of the route would be

subject to agreement with stakeholders. The beneficial effects associated with the removal of the existing A303 through the WHS, including enabling a new cycle route between Winterbourne Stoke and Amesbury, are considered elsewhere within this PEI Report.

- e) Stonehenge Cottages to Eastern portal: This short section of the existing A303 would be downgraded with private means of access to Stonehenge Cottages and NMU access maintained from Amesbury, along Stonehenge Road to connect with the new NMU route described above. The short existing section of the dual carriageway west of and above the eastern portal would be downgraded to agricultural access use.

Public Rights of Way

2.2.46 The proposed scheme would cut across a number of existing PRoWs including Byways Open to All Traffic (BOATs), bridleways and public footpaths. Provision is made within the proposed scheme to maintain the existing function of the PRoWs with suitably located overbridges. However, the proposed scheme also includes new NMU routes to improve accessibility and connectivity for communities including Winterbourne Stoke and Amesbury. These are shown on Figure 2.4 and from west to east, are:

- a) a new cycleway on the northern side of the new alignment, west of Winterbourne Stoke to Yarnbury Castle, which would tie in to PRoW SLAN3 north of the A303;
- b) a new NMU route along the southern side of the new alignment, which would tie in with PRoW SLAN3 south of the A303;
- c) a new NMU route with agricultural access from the existing layby on the A303, running north across the new green bridge north-west of Scotland Lodge Farm, which would enable access to the arable land parcels on the north side of the new alignment and the Parsonage Down NNR;
- d) a new segregated cycleway, east from Winterbourne Stoke to the new Longbarrow Junction, connecting with the new 'green' byway through the WHS via the new green bridge at Longbarrow roundabout. The new cycleway and the new NMU route through the WHS would enable cycle journeys between Winterbourne Stoke and Amesbury;
- e) a new NMU route along the existing A360 alignment, where removed, crossing the new A303 alignment at the location of the existing Longbarrow Roundabout, and extending to the Stonehenge Visitor Centre to the north and PRoW 12 to the south; and
- f) a new 'green' byway will be created through the WHS along the route of the existing A303, connecting with Stonehenge Road at the eastern end of the proposed scheme.

2.2.47 It is currently possible to gain access between BOATs AMES11 and AMES12 along the existing A303, however this vehicular access will be removed. Consideration is currently being given to the provision of a new BOAT route linking the existing two BOATs created approximately 300m to the south. Should

such a link be included in the design for the DCO application, it will be fully assessed in the ES.

Environmental Masterplan

- 2.2.48 The draft integrated Environmental Masterplan (EMP) presented in Figure 2.4 identifies the mitigation measures which would form part of the proposed scheme, including the green bridges and new NMU routes described above as well as areas of habitat creation, such as landscaping and a new area of chalk grassland adjacent to Parsonage Down NNR (see excavated materials in section 2.3 below). The EMP is embedded mitigation and as such the measures within it are assumed to be in place, prior to the assessment of any long-term operational impacts.
- 2.2.49 Planting of native trees and shrubs, in combination with new native hedgerows would be used where appropriate, outside of the WHS. These would have a visual screening function in places and in other locations would be used to help integrate the proposed scheme into the landscape. Planting would reflect the existing pattern of vegetation along the road corridor.

High load route

- 2.2.50 The existing A303 on the approaches to the proposed scheme area is identified as a high load route for vehicles with a maximum height of 6.1m. A restriction on abnormal height vehicles in the new tunnel would mean that only normal height vehicles can use the new tunnel. The high load route would therefore be diverted from the new Longbarrow Junction, north on the A360 and B3086, then east on The Packway and A3028, and south on Salisbury Road to Solstice Park. This route functions in both directions.

Diversions route

- 2.2.51 In the event of the emergency closure of both bores of the proposed tunnel, traffic would be diverted along the high load route, but using the A345 rather than the A3028 to re-join the A303 at Countess Roundabout.

2.3 Construction

Construction activities

- 2.3.1 The approach to construction described below is indicative and subject to change but it is representative of the likely approach to be adopted.
- 2.3.2 It is anticipated that the proposed scheme would be constructed as two overlapping elements:
- a) The first main element of works, and the one which defines the whole construction duration, would be the construction of the tunnel. A Tunnel Boring Machine (TBM) is likely to be used and the current assumption is that it would start boring at the western end of the tunnel and continue eastwards. It would then be turned around to construct the second bore from east to west. Excavated material arising from the tunnel would be extracted at the western portal for both tunnel bores and transported to a treatment area. Alternative drive strategies or tunnel construction methods may be viable.

- b) The other main element of the works would be the construction of the surface roads, bridges and junctions.

2.3.3 The indicative likely site boundaries shown in Figure 2.4 allow for temporary traffic management areas, temporary working and storage areas, material stockpiles, haul roads, and provision for site compounds to be used during the construction of the proposed scheme. However, these may be subject to change as a more detailed understanding of the construction methodology develops.

Construction programme

2.3.4 Construction is planned to start in 2021 and the proposed scheme is due to open to traffic in 2026. Further detail on the main phases of the construction programme will be provided in the ES.

Construction compounds and site accesses

2.3.5 The main construction compounds are likely to be located to the west of the existing Longbarrow Junction and they would all be located outside of the WHS. Primary access to these compounds is likely to be off the A360.

2.3.6 The size of the main site offices compound would be approximately 6.0 ha and would include temporary site offices, parking, and welfare facilities.

2.3.7 The main production area for the tunnel construction would cover an additional area of approximately 7 ha. This area would include a treatment plant to treat the excavated material from the tunnel, a facility to produce the prefabricated primary tunnel lining, storage area, a batching plant and aggregate storage.

2.3.8 Additional satellite offices and compounds would also be required. It is likely that a satellite office and compound area would be required at the western end to serve the River Till viaduct construction and the western section of the proposed scheme.

2.3.9 It is also likely that a further satellite office and compound area would be required in the vicinity of the Countess Roundabout area to serve the eastern end of the proposed scheme.

2.3.10 The exact locations and extents of the compound areas will be refined during ongoing definition of the construction approach and when finalised will be fully assessed in the ES.

Material storage and stockpiles

2.3.11 Various stockpile areas would be required for topsoil and other materials needed to be retained on site for re-use within the works. These would be located along the proposed scheme within the site boundary, but outside of the WHS. The topsoil stockpiles would generally be located at the perimeter of working areas so that they would also screen the works from the public. They would be sown with grass seed to reduce their visual impact. The stockpiles would be approximately 2m to 3m in height. The footprint of the stockpiles would generally be returned to their former use.

Haul routes (on-site)

- 2.3.12 Generally, construction plant would travel along the proposed scheme using the footprint of the proposed embankments and cuttings. However, a haul road for earthmoving equipment such as dump trucks would also be required from Longbarrow Junction to the landscape area east of Parsonage Down. The haul route would be constructed from site won chalk fill. Its route would run adjacent to, but outside of the main earthworks. Haul road maintenance and dust control measures would be adopted.
- 2.3.13 A temporary bridge would be required over the River Till SAC for the haul route. To minimise adverse impacts this bridge would be raised above the valley floor with supports located outside the designated area of the SAC.
- 2.3.14 All haul routes would be removed upon completion of the earthworks and the land reinstated to its former use.

Construction traffic (off-site)

- 2.3.15 Most of the material excavated at the eastern end would be used to construct the embankments for the Countess Roundabout flyover; however there would be some surplus chalk material that would need to be transported during off-peak periods along the A303 from this eastern section of the works towards the Parsonage Down area.
- 2.3.16 Earthworks material would generally be retained and re-used within the project, but there may be some small quantities of contaminated material that would need to be transported to licensed waste management facilities.
- 2.3.17 Other construction traffic would consist of vehicles delivering the products required for the construction of the proposed scheme, including concrete, bitumen, aggregates, pipes and steel. Some deliveries would arrive as abnormal loads, such as large construction plant.

Existing A303 during construction

- 2.3.18 Appropriate traffic management measures would be put in place to ensure that traffic flows on the existing A303 and other local roads are maintained, whilst allowing safe working at the interface between the existing road network and the proposed scheme.

Plant and equipment

- 2.3.19 Construction of the proposed scheme would require a large quantity of plant and equipment. The high volume of earth to be moved would require large excavators, dump trucks, dozers, compactors plus graders, bowsers and stabilising plant. Seasonal constraints associated with working in chalk, mean that a high number of on and off movements with low loaders to deliver earth moving plant would be required. Plant numbers will be determined by the construction methodology.

Construction methods

- 2.3.20 The construction of the proposed scheme would use typical construction techniques associated with major infrastructure projects including tunnelling and piling.

Utilities

- 2.3.21 Construction of the proposed scheme is likely to require the diversion, relocation or protection of approximately 25 existing utility assets including water, wastewater, electricity, gas and telecommunications. It is likely that most of the required diversions would be done as part of an enabling or advanced works phase, prior to the main phases of construction.
- 2.3.22 A protective structure would be required to protect an existing Esso oil pipeline which is crossed by the proposed scheme. This structure would protect the pipeline against construction impact and the effects of ground settlement.
- 2.3.23 The construction site compounds for the proposed scheme would also require new 'temporary' utility connections or stand-alone provision where direct connections are not viable, for the provision of water, sewerage disposal, electricity and telecommunications. Electricity connection corridors are included at both ends of the proposed scheme and once in place the cables would be used to provide power from nearby electricity substations to the construction compounds (see Figure 2.4). An extension of the existing electricity substation at Stapleford is likely to be required and is included within the proposed scheme. The cables would typically be run along roads or tracks and be buried at a depth of about 1m. The power connections created at the start of construction would be retained to provide power for the operational development.
- 2.3.24 Further consultation with utility asset suppliers / owners / managers will be undertaken in order to finalise the utility solutions at each location.
- 2.3.25 A preliminary assessment of the likely environmental implications of the utility corridors is presented separately at the end of each Topic chapter below.

Demolition and removal of redundant A303 sections

- 2.3.26 The proposed scheme does not require the demolition of existing major structures, although the existing Countess Pedestrian Underpass would be demolished and replaced with an at grade controlled crossing of the slip-roads of the new Countess Junction. A second existing underpass in the proximity of the eastern tunnel portal would also be demolished.
- 2.3.27 Redundant sections of the A303, including that across the WHS, and other short redundant sections of road such as the A360 at Longbarrow Roundabout, would be removed. It is assumed that the existing surface layers ('blacktop') would be broken-up for transport off-site.

Excavated materials

- 2.3.28 Construction of the proposed scheme would generate a large volume of excavated material from the tunnel, and this material would generally be unsuitable for use as an engineering fill material in highway embankments.

- 2.3.29 The excavated material arising from tunnelling is likely to be in the form of a finely ground slurry or paste and would require processing to reduce the water content sufficiently to make it suitable for handling and re-use. The excavated materials processing plant is likely to be located within the main production area.
- 2.3.30 Once suitable for use the material would be used for essential landscaping mitigation and new habitat creation to increase biodiversity. The principal area of use would be the land to the east of Parsonage Down National Nature Reserve. In addition to the need for essential landscape mitigation in this area, the material would be used to create areas of new chalk grassland and other habitats and create an extension of the existing Parsonage Down habitats.
- 2.3.31 Use of excavated material from the tunnel in this way would minimise the need to transport this material on the highway network to landfill sites. This would minimise the environmental impacts associated with the construction of the proposed scheme, particularly in relation to the air quality and noise impacts of construction traffic on people and communities living along potential off-site excavated materials disposal routes. This strategy would also help reduce greenhouse gas emissions during the construction phase.
- 2.3.32 In addition to the tunnel arisings, excavation would also be required in places to form cuttings for the highway and this material would then be used to form embankments. The design aims to balance these requirements as far as practicable.
- 2.3.33 The approach to materials management is considered further in Chapter 12 Materials.

Construction Environmental Management Plan

- 2.3.34 The construction of the proposed scheme would be subject to measures and procedures defined within a Construction Environmental Management Plan (CEMP). This would include the implementation of industry standard practice and control measures for environmental impacts arising during construction, such as the control of dust and the approach to waste management on site.
- 2.3.35 An outline CEMP will be prepared as part of the development of the construction methodology, whilst measures to be included within the outline CEMP will be defined in part by the requirements for mitigation which arise from the technical assessments within the EIA. This PEI Report discusses proposed mitigation to be included in the CEMP as appropriate in relation to the preliminary assessments, and the technical assessments presented in the ES will take account of the agreed measures within the Outline CEMP as 'embedded mitigation'.

Decommissioning

- 2.3.36 It is highly unlikely that the proposed scheme would be demolished after its design life as the road would have become an integral part of nationally important infrastructure. In the unlikely event of the proposed scheme needing to be demolished, this would be part of the relevant statutory process at that time, including EIA as appropriate. Demolition of the proposed scheme is not therefore considered further in this PEI Report. Consideration is however given, where relevant, to dismantling and replacing particular elements of the proposed

scheme once they reach the end of their design life, if significant effects are likely.

3 Assessment of Alternatives

3.1 Scheme history

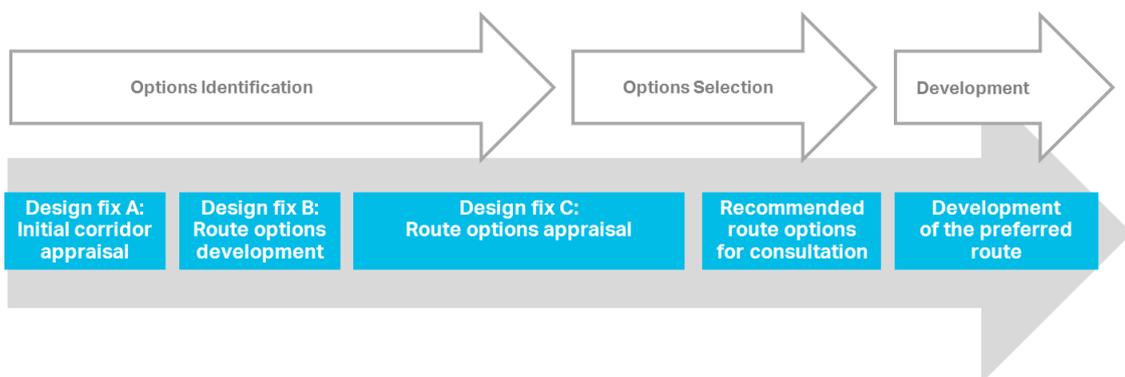
3.1.1 In 2013, HM Treasury's Investing in Britain's Future (Ref 3.1) set out a programme of infrastructure investment, including provision for a feasibility study for the A303/A30/A358 (Ref 3.2). That study concluded that the problems experienced along the corridor should be addressed through the introduction of a number of new dual carriageway sections, including the A303 Amesbury to Berwick Down scheme.

3.1.2 Following the completion of the feasibility study in December 2014, the DfT published its Road Investment Strategy for 2015-20 (Ref 3.3) containing proposals for creating an A303/A358 dual-carriageway to the South West, including dualling of the A303 from Amesbury to Berwick Down (the proposed scheme) which would include a twin-bore tunnel at least 2.9km long through the WHS.

3.2 Selection of the proposed scheme

3.2.1 The process of options identification and route selection leading to the proposed scheme is summarised below. The process was split into the stages shown in Figure 3.1.

Figure 3.1: Options identification and selection process



Options identification

3.2.2 The process of options identification and route selection leading to the proposed scheme is summarised below. The process followed the following stages:

- Corridor identification and initial sifting of corridors (Stage 1);
- Design development of route options within preferred corridors (Stage 2);
- Route options appraisal and sifting to identify options to take forward for further appraisal (Stage 3);
- The selection of two preferred routes, which were taken to non-statutory public consultation in January/March 2017 (Stage 4);

- e) The selection of a Preferred Route which was announced by the Secretary of State in September 2017 and which forms the basis of the proposed scheme (Stage 5).

Table 3.1 Table 3.1: Development of the Preferred Route (Ref 3.4)

3.2.3 summarises the process that has led to the development of the Preferred Route and includes the main reasons for selection of chosen options and the rejection of the alternatives, taking into account the effects of the development on the environment.

Table 3.1: Development of the Preferred Route (Ref 3.4)

Options Identification Stage	Details
<p>Stage 1 - Corridor identification and initial sifting of corridors</p>	<p>A review of 60 route options was undertaken. These options were grouped into seven separate corridors:</p> <ul style="list-style-type: none"> • Corridor A – surface routes more than 1km north of the existing A303 (outside Stonehenge WHS); • Corridor B – surface routes more than 1km north of the existing A303 (at least partially within Stonehenge WHS); • Corridor C – surface routes within 1km of the existing A303 (at least partially within Stonehenge WHS); • Corridor D – partially tunnelled route options within 1km (on plan) of the existing A303 (at least partially within Stonehenge WHS); • Corridor E – surface routes more than 1km south of the existing A303 (partially within Stonehenge WHS); • Corridor F (north) – surface routes south of the existing A303 (wholly outside WHS) and north of Salisbury; • Corridor F (south) – surface routes south of the existing A303 (wholly outside WHS) and north of Salisbury, further south than Corridor F (north); and • Corridor G – surface routes south of A303 (outside Stonehenge WHS) and south of Salisbury. <p>A multi-criteria assessment using the Client Scheme Requirements, the Early Assessment and Sifting Tool (EAST) from WebTAG and National Policy Statement for National Networks (NPSNN) environmental aspects was carried out to recommend better performing corridor(s) to be taken forward for further consideration.</p> <p>The outcome of this process was a recommendation that Corridor D, Corridor F (north) and Corridor F (south) be taken forward for further consideration. A summary of the environmental reasons for the selection of these corridors is given below:</p> <p>Surface route options within the World Heritage Site (WHS) (Corridors B, C and E) would offer transport benefits and could be delivered at a lower cost than a tunnelled solution but would be considered wholly unacceptable from a cultural heritage point of view.</p> <p>A surface route close to the existing alignment would fail to reduce severance within the WHS and would cause substantial harm to the Outstanding Universal Value (OUV) of the site.</p> <p>Options involving a surface route to the north or south of the existing alignment would reduce the visual and noise impacts of the road on the Stonehenge monument itself but any such route would still fundamentally affect the character of the WHS.</p> <p>A tunnelled route through the WHS (Corridor D) would reduce severance within the WHS and improve the setting of key assets such as Stonehenge. The surface elements may cause adverse effects on the character of the WHS but it is considered that substantial harm can be</p>

Options Identification Stage	Details
	<p>avoided with appropriate design. A tunnelled route has the potential to contribute to the enhancement of the historic landscape within the WHS. Despite its high capital cost, a tunnelled route would deliver transport and economic benefits in line with the objectives for the scheme.</p> <p>Because of the location of settlements, there is limited scope to realign the A303 to the north of the WHS (Corridor A), but a route which skirts the northern boundary of the WHS has been considered. Such an option would reduce severance within the WHS, but it would also have substantial harmful impacts. On balance, potential harm to the WHS may outweigh the benefits associated with the removal of the A303 through the WHS.</p> <p>Corridor F surface route options to the south of the WHS would remove the A303 from the WHS in its entirety. This would bring benefits by reducing severance and improving the setting of key assets, including the Stonehenge monument. These benefits would need to be balanced against potential adverse environmental effects of constructing a longer route within a high quality, unspoilt landscape, leading to increased loss of habitats.</p> <p>To varying degrees, depending on the alignment, surface route options to the south of the WHS would also offer a less direct route for through traffic and would therefore offer reduced transport benefits. More traffic would also be left on local roads, giving rise to adverse impacts on local villages.</p> <p>A surface route to the south of Salisbury was also considered (Corridor G). However, the length of such an option would lead to substantially increased habitat loss and severance compared to other corridors. This option, whilst offering improved access to Salisbury would fail to reduce journey times for users of the A303 and would not, therefore, meet the objectives for the scheme.</p>
<p>Stage 2 - Design development of route options within preferred corridors</p>	<p>Design Fix B involved developing route options within the corridors identified from Design Fix A and rationalising them based on impacts on the key constraints.</p> <p>A total of ten route options were developed for further appraisal, seven within Corridor D and three within Corridor F. The options within Corridor D incorporated varying lengths of tunnel (2.9km or 4.5km), different locations for the tunnel portals, as well as a northern or southern bypass of Winterbourne Stoke. The three route options within Corridor F largely represented a northern, central and southern option.</p>
<p>Stage 3 - Route options appraisal and sifting to identify options to take forward for further appraisal</p>	<p>The following options were taken forward for further appraisal:</p> <ul style="list-style-type: none"> • Option D061: was a part surface/part tunnelled route of total length 12.5km which included a 2.9km tunnel through part of the Stonehenge WHS and a bypass to the north of Winterbourne Stoke. The proposed western portal was located approximately 80m south west of Normanton Gorse, and the eastern portal located approximately 80m east of The Avenue; • Option D062: was a part surface/part tunnelled route of total length 12.6km which included a 2.9km tunnel through part of the Stonehenge WHS and a bypass to the south of Winterbourne Stoke. The proposed western portal was located approximately 80m south west of Normanton Gorse, and the eastern portal was located approximately 80m east of The Avenue; • Option F010: the route leaves the A303 in the west and ran between Winterbourne Stoke and Berwick St. James. The route then continued east, keeping south of the WHS boundary but north of Upper Woodford. The route then ran south of the Boscombe Down Airfield before connecting back to the existing A303 dual carriageway east of Amesbury.
<p>Stage 4 - Recommended</p>	<p>Following on from Design Fix C, and further appraisal and assessment, the two route alignments within Corridor D, namely D061 and D062 were</p>

Options Identification Stage	Details
Route Options for Consultation	<p>identified as the preferred route options for consultation on the basis that they performed better against Client Scheme Requirements (CSR) and the relevant national and local policy objectives than F010.</p> <p>Description of Option D061 and D062 are provided below:</p> <ul style="list-style-type: none"> Route Option D061 (Published as 'Option 1N' for consultation): 2.9km length tunnel with route running north of Winterbourne Stoke, the eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse; Route Option D062 (Published as 'Option 1S' for consultation) – 2.9km length tunnel with route running south of Winterbourne Stoke, the eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse.
Development of Modified Routes	<p>In response to the findings of archaeological surveys and feedback received during the non-statutory consultation held between January and March 2017 (Ref 3.5), seven modifications of Options 1N and 1S were developed for further appraisal and assessment. These were 1Na, 1Nb, 1Nc, 1Nd, 1Sa, 1Sb and 1Sc.</p>
Stage 5 - Identification of the Preferred Route	<p>All modified routes were subject to an assessment that screened the options against key considerations raised from the public consultation, and the associated key engineering and environmental assessment topics, as well as the results of further geophysical surveys, to identify the better performing route options. The outcome of this review was that Option 1Na, 1Nd and 1Sa performed better than the other options and were therefore shortlisted for more detailed appraisal.</p> <p>Based on the detailed appraisal of the modified route options following the public consultation, Option 1Nd was identified as the recommended Preferred Route.</p> <p>The preferred Route was the route which received greater public support, and performed better from a heritage, landscape and biodiversity perspective, and provides greater potential for impacts to be mitigated. It also performed better in the engineering assessment as it was a slightly shorter route. The option was modified further, and the route through the western part of the WHS altered, to take into account consultation responses. The western portal was moved closer to the existing A303 to mitigate impacts on archaeology, the winter solstice alignment and the RSPB reserve at Normanton Down. This option forms the basis of the proposed scheme.</p>

3.2.4 Full details of the options identification and selection process, along with the development of the Preferred Route can be found in the Scheme Assessment Report (Ref 3.4) available at:

www.highways.gov.uk/A303Stonehenge/consultation.

3.3 Development of the proposed scheme

3.3.1 The Secretary of State announced the Preferred Route on 12th September 2017 and it is this route which forms the basis for the proposed scheme considered within this PEI Report. Design development is ongoing, and is being informed by an iterative EIA process, consultation and evolving knowledge of the environment that would be affected by the proposed scheme.

3.3.2 The local design refinement options which have been considered within the development of the proposed scheme will be reported in the ES. The development of the proposed scheme design is being undertaken in accordance

with the criteria for ‘good design’, outlined in the NPSNN (Ref 3.7). Five options which remain under consideration are addressed in section 3.4 below. The main reasons for the selection of chosen options and the rejection of the alternative, taking into account the consultation feedback and the effects of the development on the environment, will be reported in accordance with the requirements of the EIA regulations in the ES.

3.4 Appraisal of options presented for consultation

3.4.1 The description of the proposed scheme presented at 2.2 includes five scheme elements for which options are included (see summary in Table 2.1) and for which stakeholder views are sought within the consultation. The below tables provide a summary of any environmental differences between the options. Where an environmental topic is not listed in the tables, but is covered in the PEI Report, the differences between the options are minor or negligible in the context of that topic.

3.4.2 Table 3.2 reviews the two options presented for the southern parapet of the River Till Viaduct :

Table 3.2: River Till Viaduct Options

	(a) Open southern parapet	(b) Southern parapet with vertical barrier
Landscape / Visual	Retaining an open parapet would reduce the scale of the River Till Viaduct in views from Public Rights of Way and Winterbourne Stoke, to the south of the viaduct, in comparison to the vertical screen. However, as views of vehicles would remain with an open parapet, it is not the preferred option from a landscape and visual perspective.	An opaque barrier may screen vehicles from Public Rights of Way and Winterbourne Stoke, to the south of the viaduct, which is why it is the preferred option in terms of landscape and visual effects. Ongoing visual assessment work will determine the extent of screening provided by the vertical barrier.
Ecology	Retaining an open parapet would be expected to be slightly beneficial compared to the alternative in terms of reducing shading to the River Till (SSSI and SAC) beneath the viaduct.	An opaque barrier would be expected to be slightly worse than the alternative as it could slightly increase shading to the River Till (SSSI and SAC) beneath the viaduct.
Noise	Retaining an open parapet would allow vehicle noise to propagate south from the bridge. Ongoing noise assessment work will determine how effective a noise barrier is in reducing noise at receptors to the south of the bridge.	A barrier, if appropriately designed, could help reduce vehicle noise propagating south from the bridge. Ongoing noise assessment work will determine how effective a noise barrier is in reducing noise at receptors to the south of the bridge.
Water Environment	The point on shading made in respect of ecology above is also relevant in the context of the River Till and the Water Framework Directive Assessment. This option may therefore be slightly beneficial in relation to the water environment.	The point on shading made in respect of ecology above is also relevant in the context of the River Till and the Water Framework Directive Assessment. This option is likely to be slightly worse than the open parapet option in relation to the water environment.

3.4.3 While inclusion of the vertical barrier would likely reduce the scale of noise and visual impacts, it is unlikely to result in a change in significant effects. For the purpose of the PEI Report, the option without the vertical barrier has been assessed.

3.4.4 Table 3.3 reviews the two options presented for location of the green bridge at or near the existing A60 alignment:

Table 3.3: Green Bridge Options

	(a) At A360 alignment	(b) 150m east of A360 alignment
Landscape / Visual	<p>This is the more preferable option from a landscape and visual perspective as it retains the linear form to the western edge of the World Heritage Site and pattern of the A360 alignment.</p> <p>However, there is no marked difference in the assessment conclusions between this option and the 150m east option, as the functionality of the green bridges remains in both options, and no landscape and visual receptors are adversely affected.</p>	<p>This option slightly deviates from the existing north to south linear pattern of the A360 and the overall linear form to the western edge of the World Heritage Site.</p> <p>However, there is no marked difference in the assessment conclusions as the functionality of the green bridge remains in either option, and no landscape and visual receptors are adversely affected.</p>
Cultural Heritage	<p>In terms of cultural heritage, this is the slightly more preferable option. The location would maintain the connectivity between the monument groups, would limit landtake and therefore removal of archaeological remains within the WHS (including damage to the scheduled boundary bank (NHLE 1010837) It would also maintain the historic route along the A360 on the WHS boundary. No difference in overall assessment conclusions.</p>	<p>In terms of cultural heritage, this is the slightly less preferable option. Although the revised location would maintain the connectivity between the monument groups, it would increase landtake within the WHS for its construction and also the removal of archaeological remains situated within its construction footprint. There would also be a direct physical impact on the scheduled boundary bank (NHLE 1010837). The historic route along the western boundary of the WHS would also be altered and diverted. It would not materially enhance the connectivity between the monument groups above and beyond that of Option A, hence little additional benefit to OUV. No difference in overall assessment conclusions.</p>

3.4.5 The option with the Green Bridge 150m further east has the potential for additional significant effects with regard to cultural heritage. For the purpose of the PEI Report, the option at the A360 alignment has been assessed.

3.4.6 Table 3.4 reviews the two options presented for the approach to the western portal:

Table 3.4: Western Portal Approach Options

	(a) Vertical Retaining Walls	(b) Grass Slopes
Landscape / Visual	Slightly less preferable option in terms of landscape and visual, as this provides a hard engineered landscape from any viewpoints close to the cutting and from the new road.	Slightly more preferable option in terms of landscape and visual, as this provides a more natural landscape from any viewpoints close to the cutting and from the new road.
Ecology	Slightly less preferable option in terms of ecology as this provides less opportunity for grassland habitat creation. The reduced landtake associated with this option is slightly beneficial but the adjacent habitat is arable and of relatively low value as habitat	Slightly more preferable option in terms of ecology as this provides an opportunity for grassland habitat creation on a greater area of the cutting slope.
Cultural Heritage	Preferred over the grass slopes option in terms of OUV as minimises landtake and visibility of portal, traffic, signage and buildings in views from key monument groups in WHS, and avoids scheduled monument (Bronze Age land boundary earthwork). Signage and buildings also assumed to be less visible.	Less preferable over the retaining wall option in terms of OUV impact, due to increased landtake with impact on scheduled monument (Bronze Age land boundary earthwork), likely greater visibility of portal, traffic, signage and buildings in views from key monument groups in WHS, notably Winterbourne Stoke Crossroads barrow group.
People and communities	The reduced landtake associated with this option is slightly beneficial as it minimises the loss of arable land.	The increased landtake associated with this option is slightly worse than the alternative as there would be a slightly greater loss of arable land from adjacent areas
Water Environment	This option would be less preferable if piling or foundations are more extensive or deeper and the impacts on groundwater flows greater than for the alternative. The landtake associated with the option may be slightly better than the alternative in relation to the lesser volume of chalk aquifer removed.	This option would be more preferable if the piling or foundations are less extensive or deep and so reduce any impact on groundwater flows. The landtake associated with the option may be slightly worse than the alternative in relation to the greater volume of chalk aquifer removed.
Materials	This option is likely to be slightly more preferable in terms of materials as it would lead to slightly less excavation than the alternative	This option is likely to be slightly less preferable in terms of materials as it would lead to slightly more excavation than the alternative

3.4.7 The option with grass slopes has the potential for additional significant effects with regard to cultural heritage. For the purpose of the PEI Report, the proposed option with the vertical retaining walls for the lower two thirds has been assessed.

3.4.8 Table 3.5 reviews the two options presented for the western portal:

Table 3.5: Western Portal Canopy Options

	(a) Full canopy with buildings external to canopy	(b) Canopy with ventilation slots with some buildings under canopy
Landscape / Visual	This is the preferable option in terms of landscape and visual as it retains the surface landform above the tunnel and therefore the existing landscape pattern and coherency. The buildings at the portal would be screened by their position below the surface level.	This is a less preferable option in terms of landscape and visual as the ventilation slots would alter the surface landform and land use above the tunnel, thereby reducing the landscape coherency and pattern, compared to the full canopy option.
Cultural Heritage	More preferable option because provides a more natural landscape in views from Normanton Down Barrows and Longbarrow.	Less preferable option because less natural landscape with fenced ventilation slots in views from Normanton Down Barrows, Lake Barrows and Longbarrow

3.4.9 While the option with ventilation slots would have greater landscape and cultural heritage impacts than the full canopy option, this is unlikely to result in a difference in significant effects between the two options. For the purpose of the PEI Report, the proposed option with the full canopy has been assessed.

3.4.10 Table 3.6 reviews the two options presented for the Countess Junction:

Table 3.6: Countess Junction Options

	(a) A303 flyover comprising two bridges with central embankment	(b) A303 flyover comprising a single viaduct (without a central embankment)
Landscape / Visual	This is a more preferable option in terms of landscape and visual as it enables landscaping adjacent to the flyover. The landscaping aids in visually screening the flyover as well as reflecting the vegetated character of this part of Amesbury, and improves the overall aesthetic quality of the scheme.	This is the less preferable option in terms of landscape and visual as it results in an expansive area of hard surfacing below the viaduct, which is not considered to provide the aesthetic quality of the central embankment option and the open form of the single viaduct results in a greater visibility of this part of the proposed scheme.
Ecology	More preferable option in terms of ecology as it provides scope for replacement for loss of existing planting and better shelter to aid crossing of the scheme by bats	Less preferable option in terms of ecology for crossing by bats due to open structure
Cultural Heritage	More preferable option in terms of cultural heritage because green central embankment provides more 'natural' setting for the listed Countess Farm buildings.	Less preferable option in terms of cultural heritage because single viaduct creates a more intrusive 'engineered' setting for the listed Countess Farm buildings.
Noise	More preferable option to minimise the propagation of traffic noise across the junction	Less preferable option as allows traffic noise from the roundabout and A345 to propagate across the junction

	(a) A303 flyover comprising two bridges with central embankment	(b) A303 flyover comprising a single viaduct (without a central embankment)
Water Environment	Slightly more preferable in terms of the water environment if bridge piling or foundations are less extensive or go less deep and so reduce any impact on groundwater flows. Less preferable option if the embankment leads to an increase in flood risk by blocking or changing floodwater's overland flow routes.	Slightly less preferable in terms of the water environment if bridge piling or foundations is more extensive or go deeper than the alternative option and impact more on groundwater flows. More preferable option as an open viaduct would minimise any changes to flood risk by having less blocking of overland flow routes
Materials	More preferable option in relation to materials as the creation of the embankment enables more excavated materials to be reused within the proposed scheme which assists with balancing the scheme's overall earthworks	Less preferable option in relation to materials as there is a reduced requirement for fill material and this may adversely affect the earthworks balance of the scheme, giving an increased surplus of excavated materials

3.4.11 While the single viaduct option would likely increase the scale of environmental impacts, it is unlikely to result in a change in significant effects. For the purpose of the PEI Report, the option with the two bridges and central embankment has been assessed.

4 Environmental Assessment Methodology

4.1 General approach

The National Policy Statement - National Networks (NPSNN)

4.1.1 The NPSNN sets out the need for and the Government's policies to deliver Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. The NPSNN is used by the Secretary of State as the primary basis for making decisions on DCO applications for NSIPs.

4.1.2 Given the proposed scheme is a road network NSIP, the EIA approach adopted is in accordance with the NPSNN. In particular, the EIA adheres to all of the methodology requirements cited within NPSNN Section 5: Generic Impacts. Mitigation measures will be developed in accordance with the mitigation requirements also set out in Section 5 of the NPSNN.

The Design Manual for Roads and Bridges

4.1.3 Guidance published by the Government for the preparation of environmental assessments of proposed road schemes is contained in the Design Manual for Roads and Bridges (DMRB) Volume 11 (Ref 4.1). This sets out both the general process and the methods for assessing individual environmental topics. This PEI Report adheres to Interim Advice Note (IAN) 125/15 Environmental Assessment Update (Ref 4.2), which provides a new structure of DMRB Volume 11.

4.1.4 DMRB Volume 11 advises on the environmental topics to be included in an EIA, and the methods to be used in the assessment for each of those topics. The topics identified in Section 5 to 14 of this PEI Report are those required by DMRB and by the EIA Regulations.

4.1.5 The EIA being undertaken adheres to the most up-to-date, relevant guidance contained in DMRB and Highways England IANs. The methodologies used for the preliminary assessments for individual topics in this PEI Report are based on those provided in the EIA Scoping Report, having regard to the current stage of the assessment. Should any revisions to IANs or DMRB be issued between the PEI Report and reporting of the EIA in the ES, they will be adopted where appropriate, provided that it is reasonable to do so within the programme and governance for the project. Any changes in environmental legislation, such as the technical requirements under the EIA Regulations, will be accommodated within the ES as relevant.

Other studies

Heritage Impact Assessment

4.1.6 A Heritage Impact Assessment (HIA) will be prepared in parallel with the EIA. HIA is recommended by the International Council on Monuments and Sites (ICOMOS) for development which affects cultural World Heritage properties, in order to evaluate effectively the potential impact of development upon the Outstanding Universal Value (OUV), integrity and authenticity of the WHS, and to inform the proposed scheme design and mitigation. The HIA will be undertaken alongside the EIA and will focus on the impact of the proposed scheme on the OUV of the Stonehenge part of the WHS and the attributes that convey the OUV.

Habitats Regulations Assessment

- 4.1.7 A Habitat Regulations Assessment (HRA) Screening will be undertaken for each Special Area of Conservation (SAC) and Special Protection Area (SPA) which could be affected. Where there is a likely significant effect this will determine any requirement for an Appropriate Assessment. The HRA Screening and any subsequent assessments will define any requirement for mitigation that is necessary to ensure there is no adverse effect on the integrity of these sites, alone or in combination with other plans and projects. Any required mitigation would then be incorporated into the proposed scheme. Details of these assessments will be included within the ES and the full reports will accompany the application for development consent.

Water Framework Directive Assessment

- 4.1.8 A Water Framework Directive (WFD) Assessment will be undertaken and a WFD compliance assessment report produced alongside the ES. This report will consider the extent to which the proposed scheme could impact on the current and future target WFD status of the water bodies (the River Avon, the River Till and the Upper Hampshire Avon groundwater body). Where potential adverse effects are identified, an assessment of these will inform what mitigation measures need to be incorporated into the design and construction methods of the proposed scheme to remove or minimise the effect. The results will be presented in the ES.

4.2 Study area and site boundary

- 4.2.1 The study area assessed for the PEI Report for each environmental topic is described in the relevant topic chapter (chapters 5 to 14). The study area is based on the draft DCO application boundary presented in the EIA Scoping Report dated October 2017. This draft DCO application boundary (hereafter referred to as the proposed site boundary) was based on the land anticipated to be potentially required temporarily and/or permanently for the construction, operation and maintenance of the proposed scheme at the time of preparation of the EIA Scoping Report.
- 4.2.2 Since completing the PEI Report, the design of the proposed scheme has continued to be developed and the proposed site boundary has been reviewed and refined as appropriate to reflect the latest scheme requirements at the time of consultation (February 2018).
- 4.2.3 Both scheme boundaries are shown on Figure 2.1, which illustrates that the site boundary assessed in the PEI Report is generally more extensive than the updated consultation site boundary. Being more extensive, the study area used in the PEI Report assessments can be regarded as a 'worst case' and encompasses the relevant receptors for the smaller updated consultation site boundary. Similarly, the preliminary assessments contained within the PEI Report identify the likely significant environmental effects that would be applicable for the updated consultation site boundary.
- 4.2.4 The consultation site boundary includes extensions to the Scoping stage proposed site boundary to Stapleford and at Ratfyn (north of Amesbury) to allow for the provision of utilities connections required for the construction and

operation of the proposed scheme. The environmental implications of these connections are considered in separate sub-sections within each topic chapter.

- 4.2.5 The EIA and ES will be based on the final site boundary presented in the DCO application.

4.3 Existing baseline and future conditions

- 4.3.1 In order to identify the effects of the proposed scheme on the environment, it is important to understand the environment that would be affected by the proposed scheme (the ‘baseline conditions’). Understanding the baseline allows the measurement of changes that would be caused by the proposed scheme.
- 4.3.2 The baseline conditions are not necessarily the same as those that exist at the current time; they are the conditions that would exist in the absence of the proposed scheme either (a) at the time that construction is expected to start, for impacts arising from construction or, (b) at the time that the proposed scheme is expected to open to traffic, for impacts arising from the operation of the proposed scheme. Therefore, the identification of the baseline conditions involves predicting changes that are likely to happen in the intervening period, for reasons unrelated to the proposed scheme. This will entail taking current conditions and committed development into consideration and using experience and professional judgment to predict what the baseline conditions might look like prior to start of construction and operation.
- 4.3.3 This PEI Report presents baseline information representing the understanding at the time of writing. This baseline will become further developed as additional surveys are undertaken and data obtained, and will be presented in the ES.

4.4 Potential significant effects and mitigation

Defining assessment years and scenarios

- 4.4.1 The assessment of effects involves comparing a scenario with the proposed scheme against one without the proposed scheme over time. The absence and presence of a proposed scheme are referred to as the ‘Do Minimum’ and ‘Do Something’ scenarios respectively. The ‘Do Minimum’ scenario represents the future baseline with minimal interventions and without new infrastructure.
- 4.4.2 Depending on the topic, the effects in this PEI Report (and in the ES) are assessed for the ‘Do Minimum’ and ‘Do Something’ scenarios in the baseline year (assumed to be the year of opening, 2026 for the purposes of the ES) and a future assessment year (assumed to be 15 years after opening).
- 4.4.3 Demolition of the proposed scheme has been scoped out of the EIA on the basis that the road would become an integral part of national infrastructure and would not be decommissioned.

Identifying potential effects

- 4.4.4 The EIA Regulations require: “The description of the likely significant effects” of the proposed scheme on the environment, covering “the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the

development”. The PEI Report provides a preliminary view on likely significant effects, which will be refined during the ongoing EIA and design process.

Assessing significance

4.4.5 The significance of an environmental effect is typically a function of the ‘value’ or ‘sensitivity’ of the receptor and the ‘magnitude’ or ‘scale’ of the impact.

4.4.6 DMRB Volume 11, Section 2, Part 5 HA 205/08 ‘Assessment and Management of Environmental Effects’ provides advice on typical descriptors of environmental value, magnitude of change and significance of effects. Table 4.1 to Table 4.4 reproduce these descriptors and demonstrate how the significance of effect category can be derived. Assessments against these criteria will be made on the basis of professional judgement.

Table 4.1: Environmental value (or sensitivity) and typical descriptors

Value	Typical Descriptors
Very high	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 4.2: Magnitude of change and typical descriptors

Magnitude of Change	Typical Descriptors
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Low or medium importance and rarity, local scale.
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No Change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

4.4.7 Table 4.3 demonstrates how combining the environmental value of the resource or receptor with the magnitude of change produces a significance of effect category.

Table 4.3: Significance of effects matrix

Magnitude of Change	Value/Sensitivity of Receptor				
	Very High	High	Medium	Low	Negligible
Major	Very Large	Large/ Very Large	Moderate /Large	Moderate	Slight
Moderate	Large/ Very Large	Moderate/ Large	Moderate	Slight	Neutral
Minor	Moderate/ Large	Moderate	Slight	Neutral	Neutral
Negligible	Slight	Slight	Neutral	Neutral	Neutral
No Change	Neutral	Neutral	Neutral	Neutral	Neutral

4.4.8 The DMRB recognises “the approach to assigning significance of effect relies on reasoned argument, professional judgement and taking on board the advice and views of appropriate organisations. For some disciplines, predicted effects may be compared with quantitative thresholds and scales in determining significance. Assigning each effect to one of the five significance categories enables different topic issues to be placed upon the same scale, in order to assist the decision-making process at whatever stage the project is at within that process”.

4.4.9 Table 4.4 illustrates how the DMRB describes the significance of effect categories. In arriving at the significance of effect, the assessor will also consider whether they are direct, indirect, secondary, cumulative, short, medium or long-term, permanent or temporary, positive or negative.

Table 4.4: Descriptors of the significance of effect categories

Significance Category	Typical Descriptors of Effect
Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change (e.g. loss or severe damage to key characteristics) in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

- 4.4.10 Effects determined to be slight or neutral are not deemed to be significant, and as such will not be reported in detail in the ES and will not require specific mitigation. The exception to this is where the combination of multiple slight effects has the potential to lead to a significant (i.e. moderate or above) cumulative effect.
- 4.4.11 Not all of the environmental topics will use the above criteria or approach. For example, some topics do not use a matrix based approach but instead use numerical values to identify impacts (e.g. Noise and vibration) and some topics do not have agreed methods of assessment or scales of measurement for either value or sensitivity (e.g. Geology and soils). Therefore, each environmental topic specialist will use the information provided above, their topic specific guidance as well as their professional judgement to assess the significance of effects. However, irrespective of the criteria or approach that a topic requires, the descriptors of significance listed in Table 4.4 will be used.
- 4.4.12 Further topic-specific details of the methodology for determining significance are presented in chapters 6.1 to 6.10 of the EIA Scoping report. (see <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010025/TR010025-000032-Scoping%20Report.pdf>).

Mitigation measures, enhancements and residual effects

- 4.4.13 The EIA will take into account any design measures that have been incorporated into the proposed scheme design (embedded mitigation measures), as well as any standard construction management activities that the proposed scheme will implement through the CEMP and in accordance with NPSNN.
- 4.4.14 Highways England is committed to including mitigation measures as necessary to address potentially significant adverse environmental effects identified during the EIA process as far as reasonably practicable. Mitigation of potentially significant adverse environmental effects (including, where appropriate, any proposed monitoring arrangements) will be an iterative part of the proposed scheme development following the hierarchy below:
- a) Avoidance – incorporate measures to avoid the effect, for example, alternative design options or modifying the proposed scheme programme to avoid environmentally sensitive periods.
 - b) Reduction – incorporate measures to lessen the effect, for example, fencing off sensitive areas during construction and implementing a Construction Environmental Management Plan (CEMP) to reduce the potential impacts from construction activities.
 - c) Compensation/Remediation – where it is not possible to avoid or reduce a significant effect then offsetting measures should be considered, for example the provision of replacement of habitat to replace that lost to the proposed scheme or remediation such as the clean-up of contaminated soils.

- d) Enhancement – where possible enhancement measures will be incorporated into the proposed scheme. Enhancement measures are considered to be over and above any avoidance, mitigation and compensation measures required to remove the adverse impacts of the proposed scheme.

4.4.15 With regard to the protection of internationally designated or inscribed sites, Highways England has been and will continue to liaise with the relevant stakeholders to ensure that the proposed scheme includes the requisite measures to:

- a) ensure that the Outstanding Universal Value of the WHS is maintained ; and
- b) ensure that the integrity of the River Avon Special Area of Conservation (SAC) and the Salisbury Plain SAC and Special Protection Area (SPA) is not adversely affected.

4.4.16 Within this PEI Report, the individual technical chapters identify the possible mitigation required to mitigate any potential significant adverse effects which have been identified and incorporated in the scheme design to date. Effects that remain after mitigation are referred to as residual effects. The assessment of the significance of the residual effects after mitigation and/or enhancement is the key outcome of the EIA and will be reported in the ES.

Construction and operational effects

4.4.17 The EIA considers impacts during the construction and operation of the proposed scheme. The construction phase assessment addresses both the temporary activities involved in building the scheme and the subsequent permanent presence of the scheme once constructed; where relevant, these temporary and permanent effects are described separately below. The operational assessment considers the situation when the scheme is being used by traffic.

Assessment of cumulative effects

4.4.18 Cumulative effects are the result of multiple impacts on environmental receptors or resources. There are principally two types of cumulative impacts:

- a) The combined action of a number of different projects, cumulatively with the project being assessed, on a single resource/receptor (cumulative) ; and
- b) The combined action of a number of different environmental topic specific impacts upon a single resource/receptor (in combination).

4.4.19 Further details on the scope of the cumulative effects assessment is provided in Section 15.

4.5 Major events

Background

4.5.1 The 2017 EIA Regulations introduced a requirement to consider major accidents and disasters. The general scope of the requisite assessment covers:

- a) Vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project (subsequently referred to as major events); and
- b) Any consequential significant environmental effects from those major events.

Methodology

4.5.2 The assessment will:

- a) Apply professional judgement in consultation with Highways England to develop project specific definitions of major events;
- b) Identify any major events that are relevant to and can affect the proposed scheme;
- c) Where major events are identified, describe the expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to the project;
- d) Report the conclusions of this assessment within the individual environmental topics; and
- e) Clearly describe any assumed mitigation measures and details of the preparedness for and proposed response to such emergencies, to provide an evidence base to support the conclusions and demonstrate that likely effects have been mitigated / managed to an acceptable level.

4.5.3 The potential receptors of effects resulting from major events and any consequences for receptors will be reported in the relevant ES topic chapter as required.

4.5.4 The methodology adopted for the assessment is described in the EIA Scoping report which is available at the link given in Chapter 1.

Preliminary assessment

4.5.5 The preliminary assessment undertaken for the PEI Report is that there are unlikely to be any significant effects associated with major events.

4.6 Human health

Scope of assessment

4.6.1 There is no consolidated methodology or accepted good practice for this topic, however the NPSNN (paragraph 4.81) defines how significance of effects are to be determined and the scope of the assessment is covered by existing Highways England guidance. The assessment to be undertaken as part of the EIA will address health in the first instance by utilising individual guidance for air quality, noise and vibration, road drainage & the water environment and people and community effects. To enable overall health conclusions to be drawn, a qualitative assessment of information collated via the topic assessments will then be undertaken and presented within the cumulative effects section of the ES. Potential health effects associated with specific issues will also be reported within the relevant ES topic chapters.

Preliminary assessment

- 4.6.2 The preliminary assessment undertaken for the PEI Report is that there are unlikely to be any significant issues associated with the proposed scheme with regard to human health.

5 Air Quality

5.1 Introduction

- 5.1.1 This chapter identifies and proposes measures to address the potential impacts and effects of the proposed scheme on air quality, during construction and operation.
- 5.1.2 The assessment has been prepared in accordance with the general principles of DMRB, Volume 11, Section 3, Part 1 'Air Quality' (HA207/07) (Ref 5.6) and associated IANs (Ref 5.7 – 5.10).
- 5.1.3 The Scoping Report determined that a 'detailed' level of assessment is required with regard to air quality and this level of assessment will be undertaken for the EIA and reported within the ES that will be submitted with the DCO application.
- 5.1.4 For this PEI Report a preliminary assessment has been undertaken using the DMRB Screening tool to inform upon the effects of the proposed scheme.
- 5.1.5 The objectives of the assessment are to:
- a) identify relevant receptors to represent locations where people are likely to be present, based on potential impacts of air quality on human health and nationally or internationally designated ecological sites;
 - b) estimate pollutant concentrations at these sensitive receptors so as to assess the local operational air quality effects for the proposed scheme, focussing on key road traffic pollutants - NO₂ and PM₁₀ for human health, NO_x and nitrogen deposition for ecological sites;
 - c) compare baseline modelling predictions and baseline air quality monitoring data against relevant air quality objectives so as to ensure confidence in and provide verification of the model results;
 - d) consider the rate of improvement in air quality over time as cleaner road vehicles enter the national vehicle fleet;
 - e) determine the magnitude of change (impact) in pollutant concentrations as a result of the operation of the proposed scheme; and
 - f) subsequently determine the significance of the effects on air quality due to the operation of the proposed scheme.
- 5.1.6 Preliminary information on compliance with EU Limit values and effects during the construction phase is also presented.
- 5.1.7 Greenhouse gas emission calculations will be undertaken as part of the EIA Assessment that will be reported in the ES.

5.2 Stakeholder engagement

- 5.2.1 Initial consultation on air quality has been undertaken with Wiltshire Council. The following air quality matters have been discussed:

- a) construction compounds and the use of generators;
- b) construction phase diversion routes;
- c) construction phase HGV movements with reference to movement of spoil and tunnel arisings;
- d) construction phase mitigation;
- e) the air quality assessment study area and proximity with air quality management areas (AQMAs);
- f) monitoring data;
- g) data sources for background concentrations;
- h) pollutants considered within the air quality assessment;
- i) assessment of future air quality and assumed improvements – particularly in reference to long term trends;
- j) consideration of summer periods within the assessment;
- k) use of detailed modelling techniques, particularly to enable consideration of summer periods;
- l) tunnel portals and proximity to sensitive receptors; and
- m) Highways England air quality guidance.

5.3 Assessment assumptions and limitations

- 5.3.1 The detailed air quality assessment in the EIA and ES will be based on detailed traffic modelling data which is currently being prepared. In this PEI Report, we have described potential increases/decreases in pollutant concentrations based on traffic flows estimated for the options selection stage.
- 5.3.2 Monitoring data have been obtained from local authorities and previous scheme-specific studies. The local operational air quality assessment uses the latest Defra local air quality management tools and guidance and Highways England tools and guidance that was available at the time the assessment was undertaken, with the predictions having been checked against the most recently available local air quality monitoring data.
- 5.3.3 Within this PEI Report the operational air quality assessment is focussed on the immediate area along and around the proposed scheme. The study area for the ES will be defined when detailed traffic modelling data is available.
- 5.3.4 At this stage, details in relation to construction vehicles, the construction schedule, associated activities and detailed plant equipment are not yet available, therefore only a qualitative discussion of potential construction air quality impacts associated with these sources is provided in this chapter.
- 5.3.5 An assessment of the construction impacts will be undertaken as part of the EIA and reported in the ES that will be submitted with the DCO application.

5.4 Study area

- 5.4.1 The assessment of construction phase traffic effects (typically Heavy Goods Vehicles (HGV) assessment and traffic management assessment) and operational phase traffic effects (local operational assessment) uses a study area of 200m around roads likely to be affected by the proposed scheme. This is due to the effect of pollutants from road traffic reducing with distance from the point of release, and beyond 200m these are likely to have reduced to a concentration equivalent to background concentrations (Ref 5.6).
- 5.4.2 Individual sensitive receptors (within or outside AQMAs) are studied in the local operational assessment at distances of up to 200m. The air quality study area for the construction phase HGV and traffic management assessments and the local operational assessment consider the proposed scheme, and those routes where the proposed scheme is predicted to have an impact. Affected roads have been identified by comparing estimated traffic data with the proposed scheme (Do Something) and without the proposed scheme (Do Minimum) against the local air quality screening criteria presented in DMRB, which are as follows:
- road alignment will change by 5m or more; or
 - annual average daily traffic (AADT) flows will change by 1,000 or more; or
 - heavy duty vehicles (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
 - daily average speeds will change by 10km/hr or more; or
 - peak hour speed will change by 20km/hr or more.
- 5.4.3 These criteria are used to identify whether significant changes in air quality might occur. If a criterion is not met or exceeded, then a significant change in air quality is not anticipated. However, if a criterion is met, this does not automatically mean a significant effect is anticipated, but that further evaluation is required to understand the potential for significant effects.
- 5.4.4 For this PEI Report, the air quality assessment has considered those areas where a change in traffic meeting the criteria identified above occurs in the immediate area along and around the proposed scheme. This includes the scheme route, and following main routes: the A303 immediately to the east and west of the proposed scheme, the bypassed A303 (e.g. Winterbourne Stoke), the A36 towards Warminster, the A36 towards Salisbury and the A338 towards Salisbury. Additionally, other A-road routes north and south of the A303 including the: A360, A345 and A3028 have been assessed. Smaller potentially affected routes have also been assessed including: Packway, the Rolleston Corner and Chitterne Road (B390), Stockton, B3083 and minor roads south of the A303, between the A360 and the A345.
- 5.4.5 Additional links are included in the local operational air quality model where the additional emissions from these areas or links are required to describe pollutant concentrations at sensitive receptor locations along affected roads. This has been carried out with regard to sensitive receptors along affected routes and adjacent to the proposed scheme.

5.5 Baseline conditions

5.5.1 Baseline air quality data and sensitivity receptor data for the study area have been gathered from the following sources:

- a) boundaries of AQMAs (Ref 5.4);
- b) Local Authority monitoring data (Ref 5.16, 5.17 and 5.15);
- c) Highways England monitoring data (Ref 5.11);
- d) Defra Pollution Climate Mapping (PCM) Model GIS data for the latest available year (Ref 5.5);
- e) Defra air pollution background concentration maps (Ref 5.3);
- f) locations of human health receptors (residential properties, schools, hospitals and elderly care homes) from Ordnance Survey (OS) base mapping (Ref 5.14); and
- g) boundaries of relevant designated ecological sites (Ref 5.13).

5.5.2 There are no AQMAs within the PEI Report study area; the nearest AQMAs are within Salisbury, approximately 6.2 miles (10km) south of Amesbury (Ref 5.4).

5.5.3 Information on areas exceeding EU limit value thresholds ($40\mu\text{g}/\text{m}^3$ for annual mean NO_2) is available from Defra's PCM Model (Ref 5.5). This model provides 'road contributed' concentrations of pollutants, including annual mean NO_2 . Based on 2017 roadside NO_2 concentrations modelled by the Defra PCM model, no links exceeding $40\mu\text{g}/\text{m}^3$ are present within the PEI Report study area.

5.5.4 Estimates of background pollutant concentrations in the UK are available for 0.6 mile (1km) grid squares throughout the UK up to the year 2030, based on baseline data available for 2013. The projected 2015 background concentrations for NO_2 and PM_{10} for the grid squares through which the proposed scheme corridor would pass are all below the relevant air quality objectives. Background NO_2 concentrations range from $6.7\mu\text{g}/\text{m}^3$ to $11.0\mu\text{g}/\text{m}^3$ whilst background PM_{10} concentrations range from $12.7\mu\text{g}/\text{m}^3$ to $16.8\mu\text{g}/\text{m}^3$.

5.5.5 A six month NO_2 diffusion tube survey was undertaken at locations in close proximity to the A303 Stonehenge between December 2015 and June 2016. The findings of this survey at locations considered within this assessment are presented in Table 5.1.

Table 5.1: Highways England Diffusion Tube Monitoring Results ($\mu\text{g}/\text{m}^3$)

Site ID	OS Grid Ref		Site Name	Site Type	2015 Annual mean NO_2 concentration ($\mu\text{g}/\text{m}^3$) ^{a, b}
	X	Y			
AMES_001	415365	142157	Countess Rd	Roadside	17.5
AMES_002	416665	143663	Bulford High St	Roadside	16.4
AMES_003	417800	143035	A3028 Double Hedges	Roadside	8.4
AMES_004	418596	143452	Bulford Barracks	Roadside	15.0

Site ID	OS Grid Ref		Site Name	Site Type	2015 Annual mean NO ₂ concentration (µg/m ³) ^{a, b}
	X	Y			
AMES_005	418217	142290	A303 Jnc Allington Track	Roadside	18.5
AMES_006	416625	141621	Maple Way	Roadside	11.7
AMES_007	415976	142114	Ratfyn Road	Kerbside	11.5
AMES_008	415768	141602	Cold Harbour	Roadside	9.5
AMES_009	415285	141308	Church Lane	Kerbside	8.2
AMES_010	411797	141854	A303 Longbarrow	Roadside	18.7
AMES_011	412007	142368	Stonehenge	Roadside	8.9
AMES_012	409966	141347	A303/A360	Roadside	19.5
AMES_013	407625	141021	Brook Close	Kerbside	9.3
AMES_014	407661	140685	Church Street	Kerbside	6.9
AMES_015	407126	139279	Berwick St. James (1)	Roadside	6.3
AMES_016	407188	139548	Berwick St. James (2)	Roadside	7.2
AMES_017	406876	140830	A303 Parsonage Down	Roadside	20.1
AMES_018	401189	138335	A36	Roadside	21.4
AMES_019	400950	138400	Deptford	Roadside	13.4
AMES_020	399997	138534	Fisherton De La Mere	Roadside	9.9
AMES_021	400775	137712	Wylie High Street	Kerbside	8.3
AMES_022	400916	137307	Dinton Road	Roadside	6.0
AMES_023	400410	137617	Dyer Lane	Kerbside	8.0

^a Bias-adjustment factor of 0.85 was applied to the diffusion tubes beginning 'AMES' based on the results of triplicate co-location studies undertaken at the Charlton Mackrell and Bournemouth Porchester School AURN sites.

^b Seasonal adjustment factor of 0.91 were applied to the diffusion tubes beginning 'AMES' based on the average ratio of the monitoring period mean and the 2015 annual mean at the Bournemouth, Charlton Mackrell, Reading New Town and Southampton Centre AURN sites.

- 5.5.6 The monitored concentrations shown in Table 5.1 suggest that existing annual mean NO₂ concentrations at kerbside and roadside locations in the air quality study area and adjacent to the A303 are well below the annual mean Air Quality Strategy (AQS) objective (40µg/m³). This survey includes sites within the main proposed scheme extent (the tunnel area), near Countess Roundabout and within the Winterbourne Stoke bypass areas.
- 5.5.7 Continuous air quality monitoring and passive diffusion tube monitoring is ongoing at specific sites within the area administered by Wiltshire Council. None of these sites are located within the air quality study area for the PEI Report.
- 5.5.8 Considering the relevant road traffic pollutants and comparing these against AQS objectives, the following is concluded:
- national assessments have demonstrated that there is no risk of carbon monoxide, 1,3-butadiene, benzene, lead and sulphur dioxide concentrations exceeding the relevant UK AQS objectives due to emissions from traffic anywhere in the UK. These pollutants have not been considered further as

they are very unlikely to be present at levels which would represent potential significant impacts due to the proposed scheme;

- b) for particulate matter (PM₁₀), local authorities within the air quality study area have not identified a risk of exceedances for PM₁₀; and
- c) for the hourly mean NO₂ UK AQS objective, local authorities within the air quality study area have not identified a risk of exceedance, so the hourly mean for this pollutant is not considered as part of the air quality assessment in terms of having potential for significant impacts due to the proposed scheme.

5.5.9 On this basis, changes to the annual average NO₂ concentrations represent the focus of the air quality assessment for public exposure (i.e. residential properties) whilst predicted changes to the concentrations of PM₁₀ are also reported.

5.5.10 Designated ecological sites in the air quality study area within Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Ramsar sites, and which contain features which are sensitive to air pollutants, are summarised in Table 5.2. Site relevant critical loads, maximum nitrogen deposition rates and maximum NO_x concentrations within these designated sites are also presented, which indicate that baseline critical loads for nitrogen deposition may be exceeded at designated sites in the PEI Report air quality study area but that the critical level for NO_x for the protection of vegetation (30µg/m³) is unlikely to be exceeded at all sites, except for the River Avon System SSSI and Stockton Wood and Down SSSI (Ref 5.1).

Table 5.2: Designated Ecological Sites within Air Quality Study Area Containing Features which are Sensitive to Air Pollutants

Designated site	Relevant nitrogen critical load class	Critical load (kg N/ha/yr) ^a	Max. nitrogen deposition (kg N/ha/yr) ^b	Max. NO _x concentration (µg/m ³)
Salisbury Plain SSSI / SPA / SAC	Sub-Atlantic semi-dry calcareous grassland	15	21.42	11.86
River Avon System SSSI / SAC	Broadleaved deciduous woodland ^c	10	35.56	20.76
	Rich fens	15	21.70	20.76
River Till SSSI	Site specific	Site specific	12.18	9.27
Steeple Langford Down SSSI	Sub-Atlantic semi-dry calcareous grassland	15	19.74	8.87
Parsonage Down SSSI	Sub-Atlantic semi-dry calcareous grassland	15	19.46	9.07
Yarnbury Castle SSSI	Sub-Atlantic semi-dry calcareous grassland	15	19.18	8.42
Stockton Wood and Down SSSI	Broadleaved deciduous woodland	10	30.80	8.66
	Sub-Atlantic semi-dry calcareous grassland	15	19.32	8.66

Relevant nitrogen critical load class, critical load, max. nitrogen deposition rate and max. NO_x concentration data taken from Air Pollution Information System website (<http://www.apis.ac.uk/>) (Ref 5.1).

^a Taken from 'Indicative values within nutrient nitrogen critical load ranges for use in air pollution impact assessments' (<http://www.apis.ac.uk/indicative-critical-load-values>)

^b These data are the most recent available from the APIS website and are a 3-year mean for the period 2013-15.

^c forms a small part of the overall SSSI.

5.6 Potential impacts

5.6.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out below. Prior to implementation of the mitigation, the proposed scheme has the potential to affect local air quality (positively or negatively), both during construction and once in operation, in the following ways:

- a) there could be increased emissions of dust during construction of the proposed scheme from dust-raising activities on site;
- b) there could be emissions associated with non-road mobile machinery (NRMM) undertaking construction works;
- c) air quality could be affected by changes in traffic flows during construction, as a result of temporary traffic management measures and/or additional vehicles travelling to and from the construction site transporting materials, plant and labour;
- d) once operational, by changes in vehicle activity (flows, speeds and composition) as a result of the proposed scheme; and
- e) by any changes in the distances between sources of emissions and air quality sensitive receptors - the proposed scheme tunnelled extent would enclose a section of the A303. This would improve air quality along the tunnelled section of the A303 but would result in emissions from tunnel operations at exit portals, although the nearest sensitive receptors, such as residential properties, to the portals are a significant distance from the portals at a minimum of 400m. Therefore air quality effects at these receptors are not expected to be significant. Air quality within the tunnels will be considered as part of the scheme design process.

5.6.2 There could be adverse effects during the construction of the proposed scheme in relation to construction dust and NRMM and vehicle emissions. However, any impacts on human health related to air quality would be temporary (i.e. during the period of the construction works only) and could be suitably minimised by the application of industry standard mitigation measures. Designated ecological sites and the lichen community found on the Stones at the Stonehenge monument which may be particularly sensitive to such dust (Ref 5.2) are also potential sensitive receptors. However, due to the construction mitigation measures that would be utilised significant effects are not expected. Additionally, in the case of the Stones, the distance between them and anticipated work areas would also reduce the likelihood of significant effects. These potential affects will be considered further within the ES.

5.7 Design, mitigation and enhancement measures

Construction

- 5.7.1 During the construction of the proposed scheme changes in air quality might occur due to dust emissions from construction activity, emissions from site plant equipment and HGVs and also from changes in traffic flows along the proposed scheme and wider road network with traffic management in place.
- 5.7.2 A Construction Environmental Management Plan (CEMP) will be prepared for the construction phase. The CEMP will include a range of industry standard practice construction phase dust mitigation measures required in all works undertaken where adverse effects on sensitive receptors might occur.
- 5.7.3 The types of activities that could generate dust during the construction phase include:
- a) movement of vehicles;
 - b) enabling works (e.g. verge clearance);
 - c) earthworks and tunnelling;
 - d) minor demolition (e.g. concrete bases and footings);
 - e) excavation and installation of drains and communication ducts;
 - f) construction of retaining walls etc.;
 - g) surfacing works;
 - h) central reserve works;
 - i) installation of verge furniture and planting vegetation; and
 - j) stock piling/ storage.
- 5.7.4 The above activities would be mitigated using standard mitigation measures such as those within Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction (Ref 5.12), for example:
- a) Develop and implement a series of dust management measures and monitoring measures (e.g. visual inspections);
 - b) Fully enclose site or specific operations where there is a high risk of dust production and the site is active for an extensive period;
 - c) All construction plant would use fuel equivalent to ultra-low sulphur diesel (ULSD) where possible;
 - d) Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; and

- e) Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site) where reasonably practicable.

5.7.5 Where standard mitigation measures may not be sufficient to minimise emissions of dust alone, additional mitigation measures would be proposed as required.

Operation

5.7.6 The proposed scheme minimises operational impacts by:

- a) Choosing a route that bypasses Winterbourne Stoke and takes the related vehicle emissions north; and
- b) Reducing congestion and its consequential air quality effects.

5.8 Assessment of effects

5.8.1 The effects have been assessed following consideration of the potential impacts outlined in section 5.6 and the mitigation measures in section 5.7.

Construction phase dust assessment

5.8.2 There is a risk of temporary adverse impacts from dust emissions to occur at sensitive receptors located close to the proposed scheme during the construction works. The location with the greatest numbers of receptors within 200m of the proposed construction works is around the Countess Roundabout where site specific mitigation measures, in addition to standard mitigation measures, may be required to avoid significant temporary effects on air quality. These measures will be set out in the CEMP for the proposed scheme.

5.8.3 Adoption of such measures would minimise the risk of significant adverse dust effects and statutory nuisance issues during the construction.

Construction phase HGV assessment

5.8.4 As noted previously, the criterion for an affected route in relation to construction HGV traffic is a change of more than 200 HGVs per day. Where HGV movements are below this threshold, significant changes in air quality are not considered likely. Detailed information on likely HGV movements is not currently available. However, due to the nature of the proposed scheme large amounts of materials will be required and transportation for these materials will be required. It is noted that tunnel arisings will be generated and that whilst it is proposed that these will be placed within the proposed site boundary, there is a possibility that tunnel arisings may sometimes need to be disposed of off-site. Therefore, there is a risk that the transportation of construction materials or waste materials causes deterioration in air quality along transport routes. A particular concern would be if tunnel arisings were transported to sites along routes within AQMAs or other locations with sensitive receptors close to these routes.

5.8.5 Further work will be undertaken to characterise air quality impacts from this source during the EIA if construction phase estimated HGV numbers are above the DMRB criteria for an extended period (i.e. more than six months).

Construction phase traffic management assessment

- 5.8.6 The proposed scheme would require works to the existing road network e.g. Countess Roundabout, Longbarrow Junction and Rollestone Corner. Traffic management would be in place to minimise traffic re-routing throughout the construction phase. However, it is not currently known to what extent traffic re-routing may take place during this period. As such, further air quality work may be required and reported in the ES to support the DCO application depending upon traffic re-routing estimates.

Local operational air quality assessment

- 5.8.7 The anticipated concentrations and changes in annual mean NO₂ and PM₁₀ along with the number of days' exceedance of the 24-hour PM₁₀ objective are discussed in this section.
- 5.8.8 All the locations that have been considered within the PEI Report air quality study area are predicted to meet relevant air quality objectives for all of the above pollutants. This is because air quality is already good in the immediate area around the proposed scheme and because further improvements in air quality are expected by the opening year of the proposed scheme due to improvements in background concentrations and reductions in emissions from vehicles as cleaner vehicles enter the fleet.
- 5.8.9 The proposed scheme bypasses Winterbourne Stoke and this will result in notable reductions in traffic along the bypassed section of the A303, which to the west of the Longbarrow Junction would be de-trunked and retained for local access to Winterbourne Stoke. This is expected to result in an improvement in air quality for those sensitive receptors along the de-trunked A303. Air quality is not expected to deteriorate at sensitive receptors in the northernmost portion of Winterbourne Stoke due to the distance that the new alignment is set back from Winterbourne Stoke.
- 5.8.10 Along the proposed scheme route to the east of Winterbourne Stoke there is a revised junction proposed at Longbarrow Junction. The closest sensitive receptor for public exposure is Hill Farm. This sensitive receptor is located over 200 m away and so is not expected to be adversely affected by this new junction, but may experience some improvement in air quality due to the alignment of the A303 moving further from Hill Farm.
- 5.8.11 The section of the proposed scheme that runs through the WHS within a tunnel would experience an improvement in air quality. There are a small number of sensitive residential receptors in this section of the scheme route (e.g. Stonehenge Cottages). These would experience an improvement in air quality.
- 5.8.12 The eastern and western tunnel portals are expected to be located approximately 400m and 1.6km from any sensitive residential receptors respectively. At these distances pollutants are expected to have dispersed without causing any notable changes in air quality.
- 5.8.13 At the eastern end of the proposed scheme route at Countess Roundabout a flyover would be constructed. This would allow additional traffic to flow through the junction along the A303 and this may cause some reduction in air quality, but this may be offset in part by the associated reduction in traffic flows using the

roundabout and the existing A303 routes leaving and joining the roundabout. The height of the flyover may also result in improved dispersion and reduce the overall increase in pollution from the additional traffic predicted to use the A303. Overall this is not predicted to result in any exceedances of health based air quality objectives around Countess Roundabout.

- 5.8.14 The A345 north of Countess Roundabout is expected to have some reduction in traffic flows and therefore have some improvement in air quality. Whilst south of the Countess Roundabout there would be some traffic increases and so a reduction in air quality is predicted, albeit not resulting in an exceedance of any air quality objectives.
- 5.8.15 Based on the estimated traffic flows available during the assessment period, traffic flows are expected to increase along the A303 immediately to the east and west of the proposed scheme, due to the reductions in delay that the scheme is anticipated to deliver and so increases in pollutant concentrations may occur, but these are not expected to be significant.
- 5.8.16 The A36 towards Warminster is expected to experience increases in traffic flow this may cause a reduction in air quality, albeit not to concentrations above air quality objectives. Other routes expected to experience an increase in flows which may cause a reduction in air quality, albeit not to concentrations above air quality objectives, include:
- a) A36 towards Warminster;
 - b) A360;
 - c) Minor routes through Stockton and adjacent villages; and
 - d) B3083 through Berwick St James and into Shrewton.
- 5.8.17 Similarly, along the A36 towards Salisbury increases in traffic are expected and so a deterioration in air quality, however not to the extent that air quality objectives will be breached along this route. Additionally, the Salisbury AQMA is not expected to be significantly affected by the proposed scheme as the changes in traffic considered closest to the AQMA (5.5km from the AQMA) were small and only a very limited change in air quality was predicted.
- 5.8.18 Traffic flows are expected to reduce, and therefore air quality improvements are expected, along the following routes:
- a) A338 towards Salisbury;
 - b) A3028 north of the A303 and east of the A345;
 - c) Packway, the Rollestone Corner and Chitterne Road (B390); and
 - d) Minor roads south of the A303, between the A360 and the A345.

Ecosystems assessment

- 5.8.19 Traffic flows along roads close to the following designated ecosystem sites are expected to reduce and therefore reductions in oxides of nitrogen and nitrogen deposition are expected at these sites:
- a) River Avon System (SSSI, SAC) (e.g. along the A36 and adjacent to minor roads south of the A303, between the A360 and the A345);
 - b) Camp Down SSSI;
 - c) Lower Woodford Water Meadows SSSI;
 - d) Salisbury Plain (SSSI, SAC, SPA) (e.g. along the B390 and B3086); and
 - e) River Till (SSSI, SAC) (e.g. along the B3086).
- 5.8.20 Traffic flows along roads close to the following designated ecosystem sites are expected to increase and therefore increases in oxides of nitrogen and nitrogen deposition are expected at these sites:
- a) River Avon System (SSSI, SAC) (e.g. along the A303 at the east end of the proposed scheme and to the west of the proposed scheme, and along the A36);
 - b) Yarnbury Castle SSSI;
 - c) Parsonage Down (SSSI, SAC);
 - d) River Till (SSSI, SAC) (e.g. around the Rollestone Corner); and
 - e) Salisbury Plain (SSSI, SAC, SPA) (e.g. along the A303 to the east of the proposed scheme).
- 5.8.21 As the above shows there are some designated ecosystems within 200m of more than one affected road within the PEI Report air quality study area. For these sites there may be an increase in concentrations of oxides of nitrogen and nitrogen deposition in some parts of the site, and decreases in other parts of the site. Those designated ecosystems with increases in concentrations of NO_x and rates of nitrogen deposition will be subject to further air quality assessment and biodiversity assessment, as required, in the EIA. Significant air quality effects on these sites are not considered to be likely based on the calculations undertaken using the estimated traffic flows for the scheme.

Operational impacts – local air quality compliance risk assessment

- 5.8.22 The results of the local air quality operational assessment have been used to determine compliance risks with the EU Air Quality Directive, following guidance set out within IAN 175/13.
- 5.8.23 A comparison between the outcome of the local air quality operational assessment and those links reported by Defra to the European Commission has found that there are no areas anticipated to be non-compliant with the limit value within the air quality study area for the proposed scheme in the opening year of 2026.

5.8.24 This indicates that there is no risk of non-compliance with the EU Air Quality Directive for the proposed scheme and thus an AQAP is not expected to be required. The compliance risk assessment will be updated as part of the ES.

Summary of preliminary assessment

5.8.25 All the locations that have been considered within the PEI Report air quality study area are predicted to meet relevant air quality objectives for all of the above pollutants and changes in air quality as a result of the scheme are not expected to change this situation.

5.8.26 Therefore, on the basis of the guidance presented in IAN 174/13, the proposed scheme is not likely to result in any significant adverse effects that would require additional essential mitigation to be employed to make the proposed scheme acceptable for air quality.

5.8.27 Preliminary construction assessment:

- With the implementation of the above mitigation measures, no likely significant effects are anticipated.

5.8.28 Preliminary operational assessment:

- No likely significant effects are anticipated.
- Air quality is likely to be improved through Winterbourne Stoke once the proposed scheme is in use.

5.8.29 Additionally, with Highways England's commitment to include requisite mitigation measures, the integrity of SACs and SPAs would not be adversely affected, i.e. there would be no overall significant air quality effects.

5.9 Corridors for utility connections

5.9.1 The construction of additional power connections is anticipated to be a potential source of dust and additional vehicle trip emissions for sensitive receptors. These potential effects will be considered in the ES. At this stage likely significant effects are not expected from these additional construction works. The additional power connections would not have any operational air quality effects.

6 Cultural Heritage

6.1 Introduction

- 6.1.1 This chapter addresses the likely significant effects of the proposed scheme on cultural heritage. The chapter considers the known heritage baseline, alongside a consideration of changes ('impacts') on heritage assets that may occur due to the construction and operation of the proposed scheme and the resultant potential effects.
- 6.1.2 Cultural heritage includes archaeological remains, built heritage and the historic landscape. This chapter considers the historic evolution of the landscape and the potential effects to the settings of heritage assets. The likely change to the 'present day' landscape and views and effects to the landscape character areas is addressed within Chapter 7, Landscape and Visual Effects. The latter includes changes to the landscape character, views and effects within the WHS.
- 6.1.3 This chapter is supported by Figures 6.1-6.12. A full discussion of the legislative framework and assessment methodology for the full EIA is provided in Chapter 6.2 of the EIA Scoping Report.
- 6.1.4 A separate Heritage Impact Assessment (HIA) is being prepared in parallel with the EIA. HIA is recommended by ICOMOS for development which affects cultural World Heritage properties, in order to evaluate effectively the potential impact of development upon the OUV, integrity and authenticity of the WHS, and to inform the proposed scheme design and mitigation. The HIA will focus on the impact of the proposed scheme on the OUV of the Stonehenge part of the WHS and the attributes that convey the OUV. The HIA will be reported and summarised in the ES and the full HIA Report will be published as a standalone technical appendix to the ES. The EIA will consider impacts on the WHS, informed by the HIA, and will assess the significance of effects on individual or, where appropriate, groups of designated and non-designated heritage assets. The preparation of both EIA and HIA will be coordinated closely, and both reports will draw upon the same historic environment baseline.

6.2 Stakeholder engagement

- 6.2.1 Stakeholders for the proposed scheme include statutory consultees, land managers, land owners, heritage interest groups, academics and local communities. In addition to the statutory consultation process, there will be ongoing engagement with statutory and formal consultees to steer the development of the proposed scheme in terms of heritage considerations.
- 6.2.2 The Heritage Monitoring and Advisory Group (HMAG) has been convened to advise Highways England. The HMAG comprises representatives from Historic England, Wiltshire Council Archaeology Service (WCAS), English Heritage and the National Trust, and is tasked with providing heritage advice on the project. HMAG sets and monitors archaeological requirements and standards of work within the WHS, and advises on the heritage impact assessments undertaken to inform route selection and mitigation measures. For sections of the proposed scheme outside of the WHS, WCAS acts as lead curator on behalf of the Local Planning Authority.

- 6.2.3 HMAG is augmented by a Scientific Committee of additional specialists and experts, set up in response to UNESCO/ICOMOS recommendations from both its 2015 and 2017 advisory missions on the project. Its membership comprises recognised, leading, independent experts who can provide additional advice throughout the development of the project.
- 6.2.4 The UNESCO World Heritage Centre (WHC) and the International Council on Monuments and Sites (ICOMOS International, a global non-governmental organization responsible for supporting UNESCO in the implementation of the World Heritage Convention) are also key stakeholders in relation to the impact of the proposed scheme on the Outstanding Universal Value of the World Heritage Site. The development of the proposed scheme has benefited from two UNESCO/ICOMOS Advisory Missions invited by the UK Government, in October 2015 and January 2017. A third UNESCO/ICOMOS Advisory Mission has been invited for March 2018. The timing of this third Advisory Mission will allow the advice provided to inform the development of the proposed scheme prior to the formal submission of the DCO application.

6.3 Assessment assumptions and limitations

- 6.3.1 This preliminary assessment is based on baseline and proposed scheme design information available at the time of writing this PEI Report. A full assessment is being undertaken as part of the EIA and will be reported in the ES that will be submitted with the DCO submission.
- 6.3.2 Parts of the proposed scheme were subject to investigation as part of the 2004 Published Scheme, including geophysical surveys and trial trenching. Review of these indicates that additional surveys and/or re-survey will be required in certain areas to:
- a) Ensure comprehensive coverage of the proposed scheme; and
 - b) Overcome limitations in the historic surveys that arise from technical advances, evolving best practice and minimum standards, thus ensuring a robust baseline assessment.
- 6.3.3 The surveys will comprise site walk-overs, geophysical survey, surface artefact collection, trial trenching and test pitting at locations agreed with HMAG.
- 6.3.4 The results of these further archaeological evaluations will be incorporated into the EIA and ES.

6.4 Study area

- 6.4.1 The study area for identification of cultural heritage assets that would be affected by the proposed scheme extends 500m from the proposed site boundary. A flexible approach will be taken to the identification of high-value assets on which there may be an impact upon setting, up to 2km beyond these limits.
- 6.4.2 The study area includes sections of the current A303 and A360 which will be de-trunked and/or decommissioned or downgraded as part of the proposed scheme, both within and outside the WHS.

6.5 Baseline

- 6.5.1 The proposed scheme passes through the Stonehenge, Avebury and Associated Sites World Heritage Site ('the WHS'). The WHS is inscribed for its Outstanding Universal Value (OUV) and is of international importance as well as a designated heritage asset under UK planning policy. The OUV of the WHS derives from the unique concentration of Neolithic and Bronze Age ceremonial and funerary monuments, many of them grouped together on prominent ridgelines and with strong visual links between themselves and with the unique stone circle at Stonehenge. The monuments themselves and their associated remains, the relationships between monument groups, between monuments and the topography, and between certain monuments and the skies and astronomy, are all attributes of the OUV of the WHS derived from the adopted Statement of OUV, as identified in the 2015 WHS Management Plan (Ref 7.8).
- 6.5.2 As clearly set out in the 2015 WHS Management Plan (Ref 7.8), the existing A303 adversely impacts the OUV, integrity and authenticity of the WHS, severing relationships between key groups of monuments and presenting a significant barrier to landscape connectivity. The sight and sound of traffic on the existing A303 is a major detrimental impact on the experience of Stonehenge in particular and the wider WHS.
- 6.5.3 The historic landscape character of the WHS is dominated by the prominent groups of ceremonial and funerary monuments, many of which survive as substantial earthworks. These survive within a generally open landscape characterised by its rolling landform, large fields bounded by fences, modern plantations, and long-distance views in which archaeological monuments, clumps of trees and plantations and roads are prominent. This open landscape contrasts with the more enclosed character of the Avon valley on the eastern fringes of the WHS. The 2015 WHS Management Plan (Ref 7.8) identifies a series of sub landscape types.
- 6.5.4 The WHS also contains monuments of other periods that are designated as of national importance and, beyond the WHS, the study area also contains heritage assets – archaeology, built heritage and historic landscapes – dating from prehistory through to the 20th century. As well as the Neolithic and Bronze Age monuments, both within and outside the WHS, Iron Age and Roman sites are also present, including the hillforts of Yarnbury Camp and Vespasian's Camp and contemporary occupation areas. The modern settlements and the surrounding rural landscape have their origins in the medieval period, while Amesbury Abbey Park was originally a monastic house which later developed into a country house and park. The built heritage spans the medieval and post-medieval eras, while 20th-century heritage is also represented, most obviously by military bases and their associated infrastructure.
- 6.5.5 The following paragraphs provide an outline of the cultural heritage resource in the vicinity of the proposed scheme; a more detailed and fully-referenced narrative will be presented within the ES.
- 6.5.6 The description runs from west to east along the main proposed scheme carriageway, before discussing heritage assets elsewhere within the study area. Site ID numbers prefixed by 'NHLE' refer to the National Heritage List for England entries and are designated heritage assets; numbers prefixed by 'MWI'

are non-designated heritage assets included on the Wiltshire and Swindon Historic Environment Record (WSHER). Some recently discovered heritage assets not yet included in either record are identified individually in the text. Sites discussed in the text are shown on Figures 6.1 to Figure 6.12.

Winterbourne Stoke Bypass

- 6.5.7 The Iron Age hillfort at Yarnbury Camp (NHLE 1005689) stands immediately to the north-west of the western limit of the proposed scheme, situated on the summit of a prominent hill, a local high point in the landscape. Some 500m to the north the scheduled Parsonage Down Camp earthwork enclosure and its associated field system (NHLE 1009646) covers an extensive area and is also considered to be of Iron Age or Roman date. Between these two sites is a scheduled Bronze Age round barrow (NHLE 1005614), while another scheduled barrow stands in isolation to the south of the A303 on Steeple Langford Cow Down (NHLE 1004725). The existence of these barrows and enclosures, along with other, non-designated examples set within ancient field systems, reflects a former prehistoric landscape that extended across much of the study area.
- 6.5.8 South of the proposed scheme on a former turnpike road now extant only as a green lane, a scheduled guidepost (NHLE 1005621) dating to 1750 is one of several such markers or milestones near to the proposed scheme, all belonging to the turnpike era.
- 6.5.9 Moving eastwards towards Parsonage Down, the proposed scheme crosses an area of Iron Age or Roman settlement activity identified by geophysical survey (e.g. MWI74870; MWI74872). An Early and Middle Iron Age to Roman period enclosed settlement (MWI6943, MWI6959) lies to the immediate south of the proposed new carriageway alignment.
- 6.5.10 An extensive field system on Parsonage Down known from aerial photography is likely to date to the later prehistoric (Middle Bronze Age - Iron Age) and Roman periods (MWI7095). These fields appear to overlie an older funerary and ceremonial landscape, evidenced by a group of potential barrows identified from aerial photographs (MWI7134, MWI7160; MWI7200); an upstanding scheduled barrow (NHLE 1004741) lies 700m west of these on Parsonage Down. Multi-period settlement, from the Middle Bronze Age to the Roman period, is evidenced by a number of enclosures and linear features on High Down (MWI7098) and by a profusion of pit-like features across the eastern parts of Parsonage Down (MWI74875).
- 6.5.11 South of the proposed scheme, the village of Winterbourne Stoke is likely to be of Saxon origin. It may have been larger during the medieval period as earthworks of deserted settlement plots are in evidence within the village. The core of the village south of the existing A303 is a Conservation Area in which a number of listed buildings are present, including the Grade II* listed Manor House and the Church of St Peter (NHLE 1130971; 1130975).
- 6.5.12 To the north, at distances of between 400m and 800m from the proposed scheme, are three scheduled areas: the Winterbourne Stoke West round barrow cemetery, the Coniger enclosure (related to a later rabbit warren) and section of linear boundary earthwork (NHLE 1015019); the Winterbourne Stoke East round barrow cemetery and earthwork enclosure on Fore Down (NHLE 1015020); and

a Romano-British settlement on Winterbourne Stoke Down (NHLE 1015222), which lies within an extensive rectilinear field system (MWI7093).

- 6.5.13 The historic landscape of this section of the proposed scheme includes open downland enclosed in places for arable agriculture and the more intimate enclosed landscape of the Till valley. Prehistoric monuments are visible on high ground, with relict land divisions, field systems and lynchets relating to prehistoric, medieval and post-medieval agriculture. The Till valley floor includes earthwork traces of a water management system or water meadows (MWI6987) of likely post-medieval date.
- 6.5.14 Little archaeology is known on the flanks of the Till valley, although chalk combs to the west and east have potential to contain deposits of colluvium (hillwash sediments) that can contain or seal archaeological remains.

Longbarrow Junction

- 6.5.15 The proposed carriageway alignment crosses the existing A303 north of Oatlands Hill and meets the WHS boundary at the existing Longbarrow Roundabout. Immediately adjacent to the roundabout is the scheduled Winterbourne Stoke Crossroads barrow cemetery. Comprising some 25 individual monuments, the cemetery is arranged in two groups and aligned on the prominent Neolithic long barrow, with another cluster of barrows to the north-west. Another Bronze Age bowl barrow lies 250m south-west of the crossroads (NHLE 1011045). A scheduled enclosure and round barrow (NHLE 1011048) bisected by the A303 and a C-shaped enclosure (MWI7210) identified from aerial photography and geophysical survey, could also represent an earlier form of funerary or ceremonial monument.
- 6.5.16 The Winterbourne Stoke Crossroads barrow group has strong visual relationships with other major barrow groups that also convey the OUV of the WHS, notably the Normanton Down barrow cemetery to the east and the North Kite Enclosure and Lake Barrow cemetery (NHLE 1010863), which lie c. 1.5km south of the proposed carriageway alignment. The Neolithic long barrow has visual and topographic relationships with a number of other long barrows, including three examples within the recently-identified 'Diamond Group', which includes an upstanding scheduled long barrow on Wilsford Down (NHLE 1010830) and two ploughed down long barrows west of the Diamond wood known from recent geophysical survey and partial excavation (Wessex Archaeology 2016a and b (Ref 6.1, Ref 6.2) and Historic England 2017 (Ref 6.3)).
- 6.5.17 A later Bronze Age settlement partly excavated during the construction of the Longbarrow Roundabout in 1967 (MWI6924) may have been deliberately located in proximity to the barrow cemetery. South-east of Longbarrow Roundabout, within the WHS, several Middle Bronze Age pits also probably relate to this settlement, while geophysical survey suggests the settlement focus lay to the north-west of the roundabout. Also apparently aligned on the barrow group is a linear boundary ditch that extends for some 3km, on a south-east to north-west alignment, from the Diamond copse to the south-east across the proposed carriageway alignment to Winterbourne Stoke Down to the north-west. The boundary is an example of a 'Wessex linear ditch', a characteristic feature of the Salisbury Plain area, many of which appear to have been established in the Late

Bronze Age (c.1200-700 BC); within the WHS the boundary feature survives as a scheduled upstanding earthwork (NHLE 1010837).

- 6.5.18 Around Oatlands Hill, south-west of the proposed new Longbarrow Junction, a number of archaeological features have been identified, including a possible enclosure, two barrows and a boundary ditch (MWI7210; MWI7153; MWI7136; MWI6407/MWI12690), as well as a cluster of suspected prehistoric pits (main groups MWI6944; MWI74878) and a probable trackway (MWI7125). These features may represent a field system and settlement of Bronze Age to Roman date.
- 6.5.19 Within the WHS, the proposed carriageway alignment passes close to two bowl barrows (NHLE 1013812; 1010831) on Wilsford Down; and the Wilsford Shaft, a ploughed-out pond barrow that, on excavation, was found to contain a vertical shaft containing votive objects (NHLE 1010833).

Longbarrow to Countess

- 6.5.20 The historic landscape character in this section of the proposed scheme through the WHS includes extensive areas under arable cultivation, reflecting the enclosure of the downland for arable agriculture in the later 19th and 20th centuries, modified in more recent years by an extensive grassland reversion programme on parts of the National Trust estate providing a more sympathetic setting for many monument groups that convey attributes of the OUV of the WHS, including Stonehenge. This contrasts with arable and other current land uses, particularly south of the A303. The predominant north-west to south-east orientation of land divisions south of the A303 reflects that of the scheduled later Bronze Age land division (NHLE 1010837) and of the byways that formerly converged on Stonehenge prior to their modification following state guardianship of the Stones.
- 6.5.21 Plantations and trees are a dominant characteristic of the historic landscape, both ornamental planting thought to be associated with the Amesbury Abbey park on King Barrow Ridge and 20th century plantations such as at Durrington Down, Fargo, the Diamond, Normanton Gorse and Winterbourne Stoke Crossroads. Although in some cases these plantations screen modern intrusions such as parts of Larkhill camp in views across the WHS, others interrupt or restrict views between monument groups.
- 6.5.22 South of the tunnel section of the proposed scheme, the Normanton Down barrow cemetery, including several outliers and two long barrows, some 40 monuments in total, dominates the southerly approach to Stonehenge and defines the immediate southern horizon in views from Stonehenge and its environs. An outlier of the Normanton Down barrow cemetery, a bowl barrow known as Wilsford G1 (NHLE 1010832), now levelled by ploughing, lies immediately east of the proposed western portal location. The barrow was excavated in 1960, revealing a total of 13 burials; a further two burials were found outside the barrow during investigations in 2002, indicating a possible associated 'flat' cemetery (i.e. burials without barrow mounds).
- 6.5.23 To the north of the tunnel section of the proposed scheme, the Stonehenge Down barrow cemetery comprises nine barrows, all degraded to some extent by ploughing. Stonehenge itself (NHLE 1010140) stands 200m north of the

proposed tunnel alignment, 165m from the present A303 at its closest point. From Stonehenge, the visual and topographic relationships with the prominent barrow groups on King Barrow Ridge and Normanton Down are particularly apparent.

- 6.5.24 North of Stonehenge, the existing A303 is visible from the Cursus (NHLE 1009132) and the long barrows at the east and west ends of it; and the Cursus Barrows, the Stonehenge Avenue and the New King Barrows (NHLE 1012381). Barrows immediately adjacent to the present A303 include: NHLE 1008947; 1012420; and 1012129. Monuments to the south of the existing A303 on the southern extent of King Barrow Ridge include a barrow cemetery north of Luxenborough Plantation (NHLE 1012372), the Neolithic Coneybury Henge (NHLE 1012376) and the King Barrow (NHLE 1012375) on Coneybury Hill. Recent excavations at West Amesbury Farm identified a group of Middle Neolithic pits, on the southern end of King Barrow Ridge, close to Coneybury Hill, indicating occupation activity amongst the monumental landscape (Ref 6.3).
- 6.5.25 The proposed tunnel alignment passes beneath King Barrow Ridge and the Avenue (NHLE 1010140) before emerging east of the Avenue just to the north of the existing A303. To the north and south of the proposed eastern portal location are a number of scheduled barrows at Countess West and to either side of the Avenue (NHLE 1010331, 1012127, 1012128, 1012129, 101230, 1012131, 1014088, 1009142, 1009143, 1009144 and 1009151). The landscape in this part of the proposed scheme was formerly part of Amesbury Abbey Park, evident now in the plantations known as the Nile Clumps.
- 6.5.26 As the proposed carriageway alignment re-joins the existing A303 Amesbury Bypass it passes immediately to the north of the Iron Age hillfort known as Vespasian's Camp (NHLE 1012126). This is a large ramparted enclosure of 15 ha, which incorporates several earlier barrows within its defences. The site was in agricultural use during the medieval and post-medieval periods prior to incorporation within the Amesbury Abbey landscape park, but is now entirely within mature woodland.
- 6.5.27 Adjacent to Vespasian's Camp, south of the existing A303, archaeological excavations at Blick Mead have yielded large Mesolithic lithic assemblages, along with faunal remains and palaeoenvironmental material (MWI74449; MWI74473). Situated on a spring line, this archaeological site has been interpreted as evidence for a sustained or repeated large-scale presence over a span of almost 3000 years, from the 9th-7th millennia BC, possibly continuing into the 5th millennium BC. Mesolithic deposits are also known from the northern edge of the Avon floodplain west of Countess Farm.
- 6.5.28 Both Vespasian's Camp and Blick Mead fall within the Grade II* Amesbury Abbey Park (NHLE 1000469), which occupies all of the land immediately south of the proposed scheme for the kilometre leading up to the existing Countess Roundabout. The abbey was a Benedictine foundation of 979 AD, dissolved in 1177, with elements being incorporated into a subsequent priory. After the Dissolution, the priory manor was replaced by a new house, around which an extensive park developed, including modifications to Vespasian's Camp, and taking in land further to the north and west. The current house at the centre of the park is Grade I listed (NHLE 1131079), while several other structures are listed at Grade II*. The park is included within the Amesbury Conservation Area, which

extends into the town's built-up core to the south-east, incorporating a substantial number of listed buildings including the Grade I church (NHLE 1182066). To the west, the West Amesbury Conservation Area is focused on a cluster of listed buildings, including the Grade I listed West Amesbury House (NHLE 1318515).

- 6.5.29 At Countess Roundabout the proposed scheme meets the eastern boundary of the WHS. Immediately to the north-west of the roundabout is a cluster of Grade II listed buildings at Countess Farm, comprising the main farmhouse and a series of barns and granaries (NHLE 1131055-7; 1318487-8). To the south, within Amesbury Abbey Park, another group of listed buildings is present, including the Grade II* listed Diana's House (NHLE 1131053).
- 6.5.30 Between Longbarrow Roundabout and Stonehenge, four Grade II listed milestones are present. One stands on the A360 100m south of Longbarrow Roundabout (NHLE 1130972); two are on the A303 (NHLE 1130999; 1131085); and one is opposite Stonehenge on the former A344 (NHLE 1131086).

High Load and Diversionary Route

- 6.5.31 The high load and diversionary route for the proposed scheme would follow existing roads around the boundary of the WHS. From Longbarrow Roundabout proceeding north on the A360/B3086, the route passes to the west of the Lesser Cursus (NHLE 1010901) and the Lesser Cursus barrow cemetery (NHLE 1008952, NHLE 1010893-903), and a series of barrows (known as the Rollestone barrow cemetery) along a ridge to the north of Greenland Farm (for example, NHLE 1010886, 1010891-2, 1010904-5, 1012168-70). In the vicinity of Rollestone Corner and the junction with the Packway is the unscheduled Net Down barrow cemetery (MWI7016-18) and areas of relict prehistoric and medieval field systems. Beyond the northern boundary of the WHS, 1.2km to the north of the High Load/Diversionary Route the Neolithic causewayed enclosure of Robin's Hood's Ball (NHLE 1009593) and associated barrows, including a long barrow and a number of round barrows, is one of a small number of sites outside the WHS boundary that are mentioned in the WHS inscription, and are thus considered part of the WHS and to contribute to its OUV. A Grade II listed milestone (NHLE 1284782) is situated south of the Rollestone Corner junction on the B3086.
- 6.5.32 Eastwards from Rollestone Corner, the Packway impinges on a round barrow cemetery (NHLE 1009124). South of the Packway further monuments within the WHS include a tightly-clustered group of barrows, including a bell barrow and three disc barrows (NHLE 1012170), the Durrington Down barrow cemetery (NHLE 1008943), a long barrow in Larkhill Camp (NHLE 1012167), a barrow cemetery south of Fargo Road (NHLE 1009062) and a further barrow cemetery in Larkhill Camp (NHLE 1009068).
- 6.5.33 On the A345, heading south towards Countess Roundabout, the present road passes through the eastern part of the scheduled henge monument at Durrington Walls (NHLE 1009133) and runs adjacent to Woodhenge (NHLE 1009133).
- 6.5.34 The final element of the high load route follows the A3028 through Bulford, from the junction of the Packway and A345 to the A303. Bulford itself is a Conservation Area and contains a Grade I listed church (NHLE 1131034) and a number of Grade II listed buildings. The diversionary route follows the A345 down

to Countess Roundabout; the A345 passes through the eastern side of the extensive henge monument at Durrington Walls (NHLE 1009133); there would be no new landtake or construction activities within the scheduled area.

East of Countess Roundabout

- 6.5.35 To the east of Countess Roundabout, the study area includes land at Countess East, Ratfyn, Solstice Park and Bulford. A number of late prehistoric monuments are present here, including the scheduled Earl's Farm Down barrow cemetery (NHLE 1009560; 1009566), and the Bulford barrow cemetery, which incorporates a large number of both scheduled and non-designated assets along an east-west ridgeline between the B3028 and the minor road connecting Bulford to Amesbury (for example NHLE 1009545; 1009564; 1009602; 1009604-5; 1009931; 1009933; 1009969; 1015216). The Bulford barrow cemetery has long distance (1.5-2km) views west to barrow groups in the WHS at Countess Farm and King Barrow Ridge, and north-west towards Durrington Walls. Seven ploughed down barrows, amongst the barrow groups on New Barn Down to the north of the A303 and on Earl's Farm Down, were investigated in advance of the construction of Solstice Park.
- 6.5.36 Amesbury Countess was formerly a separate settlement, distinct from the centre of Amesbury and West Amesbury. At Countess East, previous investigations have confirmed the existence of Early to Middle Saxon settlement remains above the floodplain (MWI12036), as well as the presence of Neolithic flintwork and a stone-built Roman building of uncertain function (MWI12030).

6.6 Potential impacts

- 6.6.1 The construction and operation of the proposed scheme would result in a range of changes to the historic environment. These changes would produce potential impacts on individual heritage assets; the attributes of OUV of the WHS; and on the OUV of the WHS as a whole. These impacts may be positive, negative or a combination of both, depending on the nature and scale of the change and the asset or attribute affected.
- 6.6.2 Construction impacts are those associated with the construction of the road, including the presence of the infrastructure once constructed. Operational impacts are restricted to those resulting from the use and maintenance of the road once built. Impacts can be considered in terms of whether they are direct (as a direct consequence of the road) or indirect (such as changes in visitor footfall numbers during construction and operation, which lead to the degradation of, or improvement to, the conservation of monuments); temporary or permanent; and in terms of their duration (short term, medium term, long term). Separate impacts on the settings of individual monuments and groups of monuments would arise both due to the construction and/or operation of the proposed scheme.

Construction impacts

- 6.6.3 The permanent removal of the existing A303 road infrastructure in the tunnel section of the proposed scheme would reconnect and improve the settings of monuments within the WHS that convey the attributes of OUV, enhancing the character and form of the WHS. The tunnel section would remove the existing severance caused by the current A303 between the proposed portal locations, in

key views and sight lines including the midwinter solstice sunset alignment. The proposals would also remove the severance of the Avenue where it is crossed by the existing A303 and would remove the existing Longbarrow Roundabout from the WHS. These changes would represent substantial benefits for the WHS.

- 6.6.4 Construction of the proposed scheme may also potentially adversely impact heritage assets in a number of ways, for example:
- a) Partial or total removal of heritage assets, including archaeological remains, within the proposed carriageway alignment.
 - b) Compaction of archaeological deposits by construction traffic and structures.
 - c) Temporary and permanent effects on the settings of heritage assets, including changes to the physical surroundings of a heritage asset; changes to the appreciation of the sense of place of an asset; changes which affect the viability of a heritage asset; visual intrusion; lighting and dark skies; noise; air quality; severance; and access.

Operational impacts

- 6.6.5 Operation of the proposed scheme could also result in impacts on the setting of heritage assets. Setting impacts may commence during the construction of the proposed scheme (see above) and may continue during operation; however, the degree of impact may vary between phases.

6.7 Design, mitigation and enhancement measures

- 6.7.1 Where possible, proportionate measures to avoid or minimise direct impacts on heritage assets, have been integrated within the proposed scheme design. Measures to conserve or enhance the setting of heritage assets have also been embedded in the design. The proposed scheme design has been developed to reduce the visual intrusion of new highway sections within the WHS, placing the new western approach roads in cutting and adopting a sensitive, low-key design for the tunnel portals.
- 6.7.2 The location and design of the tunnel portals has been developed to minimise the visibility of these new structures within the WHS. The western portal has been moved 100m westwards to avoid impacting the scheduled Wilsford G1 barrow (NHLE 1010832). The proposed additional length of canopy up to 200m long would reduce the visibility of the portal in views from monument groups such as the Winterbourne Stoke Crossroads barrow cemetery.
- 6.7.3 The eastern portal location would be concealed in views from the Avenue and King Barrow Ridge. Re-use of the existing dual carriageway Amesbury Bypass eastwards to Countess Roundabout would minimise impacts on the setting of the scheduled Vespasian's Camp and the Grade II* Registered Park and Garden at Amesbury Abbey.
- 6.7.4 Construction compound locations would be situated outside the WHS, avoiding designated heritage assets. The layouts of construction compounds would be designed to reduce impacts on the settings of heritage assets and to minimise visibility in views from the WHS.

- 6.7.5 Heritage-specific mitigation will be proposed to further limit impacts and to provide opportunities to enhance the historic environment as the design is developed.
- 6.7.6 The need to protect heritage assets and their settings has also been taken into account in the development of the draft Environmental Masterplan (Figure 2.4), including ecological and landscape mitigation proposals and the design of green bridges to maintain connectivity on the Winterbourne Stoke Bypass. Opportunities to enhance the historic environment will be further developed during the design process, where appropriate and feasible.
- 6.7.7 Archaeological evaluations are being designed in consultation with HMAG to confirm the presence and significance of any archaeological remains within the proposed carriageway alignment. These investigations are being undertaken to inform the results of the EIA and HIA and do not constitute mitigation for any potential impacts due to the proposed scheme. Where adverse impacts are suggested, the archaeological evaluations will inform a suitable mitigation strategy or a change in the design, comprising either retention of the archaeological remains by design, or a programme of archaeological investigation and recording proportionate to the level of impact and the value of the assets affected. Archaeological mitigation investigations would include archaeological excavations, recording, reporting, publication and dissemination to local communities, the wider general public and academics. An archaeological mitigation strategy will be designed and agreed with the HMAG within the WHS; and with Wiltshire Council Archaeological Service (WCAS) (for non-designated and designated assets) and Historic England (for designated assets) outside the WHS boundary.

6.8 Assessment of effects

- 6.8.1 The existing A303 has a major impact on the OUV of the WHS. It adversely affects the settings of many of the monuments within the WHS, including Stonehenge itself, and the interrelationships between monuments – these settings and interrelationships are attributes of the OUV of the WHS alongside other aspects such as their relationship to the skies and astronomy and their influence on architects, artists, historians, archaeologists and others. The A303 also restricts and severs access, and impacts the quality of the visitor experience, such that the vast majority of visitors are able to appreciate only part of the WHS.

Construction Impacts

- 6.8.2 The proposed scheme would bring substantial beneficial effects to the WHS and to the settings and interrelationships of key monument groups that convey the OUV of the WHS. The removal of the visual and aural intrusion of the existing A303 between Longbarrow and the eastern tunnel portal would enhance the settings of key monuments, including Stonehenge and barrows in the Stonehenge Triangle; the Normanton Down barrows; the King Barrows; the Cursus, its associated long barrows and the Cursus Barrows. The visual and physical severance of relationships between Stonehenge and the Normanton Down Group would be removed and the integrity of the midwinter solstice sunset alignment in views from Stonehenge would be restored. The proposed tunnel would also allow the Stonehenge Avenue to be reunited where it is currently severed by the existing A303.

- 6.8.3 The removal of the Longbarrow Roundabout and the placing of the western portal approach road in a deep cutting would be a beneficial change to the setting of the Neolithic long barrow and the other barrows in the Winterbourne Stoke Crossroads barrow cemetery by the removal and greening of the A303 and part of the A360 from adjacent to the monument. The visual relationships between the cemetery and the Diamond group of long barrows, round barrows and hengiform monuments would change due to the removal of traffic within these views, as would longer-distance views between the Lake barrows and the Winterbourne Stoke Crossroads barrow cemetery (see also 6.8.10 below).
- 6.8.4 In addition to the benefits to the WHS, construction of the proposed scheme, including the main carriageway, viaducts, tunnel portals, new junctions and road realignments would result in physical impacts on a small number of known archaeological features, and on the historic landscape. Complete loss is anticipated to be limited to a few known heritage assets due to construction of the main carriageway and junctions; those identified at this early stage include:
- a) Removal of a possible non-designated round barrow at Parsonage Down (MWI74873) as a result of the construction of the Winterbourne Stoke Bypass.
 - b) Removal of a non-designated possible barrow or enclosure north of Oatlands Hill (MWI7120) due to the construction of the new Longbarrow Junction.
- 6.8.5 A number of non-designated assets may be truncated (partially removed) by the construction of the proposed main carriageway and junctions; the extent of any loss of remains is unknown at this stage, but may include:
- a) Truncation of non-designated prehistoric pits at Longbarrow Crossroads (MWI6944) due to the construction of the western approach cutting within the WHS.
 - b) Truncation of non-designated prehistoric pits west of Winterbourne Stoke (MWI74872) due to the construction of the Winterbourne Stoke Bypass.
 - c) Truncation of a non-designated boundary ditch northeast of Oatlands Hill (MWI6407; MWI12690) as a result of the construction of the western approach cutting, new Longbarrow Junction and realignments of the A360 southern approach road.
 - d) Truncation of a non-designated possible settlement enclosure north west of Longbarrow Roundabout (MWI6405; MWI7125; MWI7201) due to the realignment of the A360 northern approach road.
 - e) The infilled ditches of non-designated field systems, observed on aerial photographs throughout the scheme length, likely to be of Mid- / Late Bronze Age, Iron Age, Roman or later date, both within and outside the WHS.
- 6.8.6 Associated construction activities, such as topsoil storage, spoil deposition and compound locations may also cause physical impacts on archaeological remains

due to the required preparatory works, and setting impacts for the duration of the works.

- 6.8.7 The proposed deposition of material at Parsonage Down (refer Chapter 2 The Project) would impact a number of non-designated heritage assets, depending on the extent of topsoil stripping and the nature of ground preparation required. These would include non-designated heritage assets at Cherry Lodge (MWI7134; MWI7200; MWI7160); an oval enclosure (MWI74874) and pits (MWI74875) at Parsonage Down; and features related to Roman settlement at High Down (MWI7098). The tunnel spoil deposition at Parsonage Down may also result in a temporary adverse effect on the setting of the Barrow SSW of Melsom's Field Barn (NHLE 1004741).
- 6.8.8 The erecting of construction compounds would have a temporary adverse effect on the setting of heritage assets for the duration of the works. Construction compound locations would be situated outside the WHS and would be designed to avoid or reduce impacts on heritage assets and their settings (see section 6.7 above).
- 6.8.9 Construction activities have the potential to have a temporary adverse effect on the settings of heritage assets along the route as a result of potential noise and visual intrusion. Design measures to limit these potential impacts would be further explored and incorporated in the proposed scheme design.
- 6.8.10 The construction of the proposed scheme would introduce new infrastructure and changes to the setting of heritage assets, including:
- a) The non-designated Early and Middle Iron Age to Roman settlement south of Parsonage Down (WSHER MWI6943).
 - b) The scheduled Winterbourne Stoke West round barrow cemetery, The Coniger enclosure and section of linear boundary earthwork (NHLE 1015019).
 - c) The scheduled Winterbourne Stoke East round barrow cemetery and earthwork enclosure on Fore Down (NHLE 1015020) and the Romano-British settlement on Winterbourne Stoke Down (NHLE 1015222).
 - d) The scheduled Winterbourne Stoke Crossroads barrow group;
 - e) Scheduled barrows southwest of Normanton Gorse (NHLE1013812, 1010831) and the Wilsford Shaft (NHLE 1010833); and the northernmost components of the Normanton Down Barrow Cemetery group, particularly the scheduled Sun Barrow (NHLE 1012370).
 - f) The scheduled Rollestone Barrow Cemetery, in particular those to the south-west of Rollestone Corner (for example NHLE 1010886, NHLE 1010891).
- 6.8.11 It is noted that for some assets there would be both positive and negative changes to the setting of heritage assets (for example the Winterbourne Stoke Crossroads barrow cemetery – see 6.8.3 above). The new infrastructure, for example the western tunnel approach cutting and western portal and canopy,

would be designed to minimise visibility of the new infrastructure and visual intrusion.

- 6.8.12 Construction of the Countess Roundabout flyover would alter the settings of listed buildings at Countess Farm (NHLE 1131057, 1318488, 138487). The new flyover would also be visible in longer distance views (1.5km – 2km) from the Bulford barrows outside the WHS (NHLE 1009545; 1009564; 1009602; 1009604-5; 1009931; 1009933; 1009969; 1015216).
- 6.8.13 The downgrading of the existing A303 and A360 and the modification of the junction at Rollestone Corner would alter the settings of four listed milestones (NHLE 1130972, 1130999, 1131085, 1284782). Construction of the proposed new carriageway alignment south-east of Yarnbury Camp would also alter the setting of a scheduled guidepost. All of these designated heritage assets would be retained in situ wherever possible by the design.

Operational impacts

- 6.8.14 Downgrading of the existing A303 carriageway to form a ‘green’ byway would remove the existing severance across the central part of the WHS and allow opportunities to open up the WHS landscape for increased public access using public rights of way. This would represent a substantial benefit.
- 6.8.15 The removal of moving traffic, lighting and noise over a 3km section of the A303 in the WHS would also represent a substantial benefit. The removal of the existing A303 and A360 carriageways and the existing Longbarrow Roundabout would take away the sight and sound of traffic movements from the setting of a number of assets, including:
- a) The scheduled Bronze Age enclosure and bowl barrow 100m west of Longbarrow Crossroads (NHLE1011048).
 - b) The scheduled Winterbourne Stoke Crossroads Barrow Cemetery (for example NHLE 1011047; 1011841; 1011842; 1011843; 1012368).
 - c) The scheduled and non-designated Diamond group (for example NHLE 1010830, 1010834).
 - d) The scheduled North Kite Enclosure and Lake Barrow Cemetery (NHLE 1010863).
 - e) Scheduled barrows southwest of Normanton Gorse (NHLE1013812, 1010831).
 - f) The Wilsford Shaft (NHLE 1010833).
 - g) The scheduled Normanton Down Barrow Cemetery (including, for example, NHLE 1009614, NHLE 1009617-18, NHLE 1009626, NHLE 1012370, NHLE1012369, NHLE 1008953).
 - h) The scheduled Stonehenge Barrow Cemetery (for example NHLE 1012383),

- i) The scheduled Stonehenge and the Avenue and The Avenue Barrow Cemetery (NHLE 1010140).
- j) The scheduled Coneybury Henge and Barrow (NHLE 1012375, 1012376).
- k) The scheduled New King Barrows (NHLE 1012381).

6.8.16 The placing of the road in the western part of the WHS into a cutting designed to conceal traffic movements, although introducing new infrastructure to the setting of some monuments, would reduce operational effects and have beneficial effects on views between barrow groups. The design of the cutting would ensure that the residual effect on the settings of monuments from noise intrusion due to traffic movements is minimised.

6.8.17 There would be new adverse effects on the settings of the listed buildings at Countess Farm and Diana's House, alongside the Amesbury Abbey Registered Park and Garden as a result of the operation of the proposed new flyover and grade separated junction at Countess Roundabout.

6.8.18 The high load and diversionary routes use existing local roads and adjacent heritage assets already experience noise and visual intrusions within their settings. As such the intermittent use of these routes associated with the proposed scheme is unlikely to impact heritage assets and significant effects are not anticipated.

Summary of preliminary assessment

6.8.19 Construction and operation of the proposed scheme would deliver substantial benefits to the WHS as a whole and the settings of monuments within it. The severance of visual and topographic relationships between key monument groups that convey attributes of the OUV of the WHS would be removed and connectivity greatly enhanced over a length of 3km within the tunnel section. The new tunnel portals and approach roads within the WHS would be sensitively located and designed to minimise intrusion and maximise benefits.

6.8.20 Preliminary Construction Assessment:

- Construction activities would have likely impacts on the setting of monuments within and outside the WHS and result in significant temporary adverse effects.
- Construction activities would have likely impacts on the setting of listed buildings in the vicinity of Countess Roundabout and result in significant temporary and permanent adverse effects.
- The proposed scheme would have likely impacts to non-designated archaeological assets, mostly outside the WHS, and result in significant permanent adverse effects due to the loss or truncation of archaeological remains.
- The proposed scheme would have likely significant permanent effects on the setting of listed buildings in the vicinity of Countess Roundabout. The proposed scheme would likely lead to positive changes to the setting of

monuments within the WHS, including Stonehenge, and result in significant permanent beneficial effects.

- The proposed scheme would have likely positive changes due to the removal of the severance of the Avenue and of relationships between monuments within the WHS, and result in significant permanent beneficial effects.

6.8.21 Preliminary Operational Assessment:

- Operation of the proposed scheme would have likely positive changes to the setting of monuments within the central section of the WHS due to the removal of traffic, and result in significant beneficial effects.
- Operation of the proposed scheme would have likely positive changes to public access to the WHS, using public rights of way south of the existing A303, due to the removal of severance, and result in significant beneficial effects.

6.8.22 Conclusion:

- The preliminary assessment undertaken to date indicates that significant permanent adverse effects on cultural heritage assets would be limited to the loss of a small number of non-designated archaeological remains, and the settings of listed buildings in the vicinity of Countess Roundabout.
- Further design work, following public consultation, will optimise the design to minimise direct physical impacts on archaeological remains where possible and minimise visual intrusion of new infrastructure on monuments and monument groups that contribute to the OUV of the WHS.
- Overall, the proposed scheme would maintain the OUV of the WHS.

6.9 Corridors for utility connections

6.9.1 The proposed western power connection from Stapleford would comprise an underground cable laid along existing highways and byways north across Stapleford Down to Oatlands Hill, the existing A303 and the A360. The existing byways are an integral part of the historic landscape, bounded by extensive crop mark field systems (MWI6069) and overlooked by scheduled barrows in the South Kite enclosure (NHLE 1015223, 1015224), as well as non-designated enclosures and settlement sites, such as those south of Druid's Lodge. Prehistoric boundary features are crossed by the byway in places; however, any impact on archaeological remains is likely to be minimal. The Stapleford substation is located on the River Till floodplain on which traces of water meadows are recorded (MWI6052), extension of the substation may impact surviving earthwork features.

6.9.2 The proposed eastern power connection would comprise the extension of two substations east of the River Avon. The connection would be either via an underground cable along an existing track that follows the route of the former military railway to Larkhill and Bulford (MWI2603), or crossing over the River Avon to Countess East, either underground or overhead. Countess East includes

Saxon settlement remains and careful siting of the connection would be required to avoid the known remains situated here.

- 6.9.3 Overall, the power connection proposals are limited in extent and no additional likely significant effects are identified.

7 Landscape and Visual Effects

7.1 Introduction

- 7.1.1 This chapter considers the two related topics of landscape and visual effects.
- 7.1.2 The term 'landscape' is synonymous with both rural landscapes and urban landscapes or townscapes. Landscape effects relate to the direct physical changes to the fabric or individual features of the landscape, as well as the potential indirect changes to the wider patterns of land use, land cover and the arrangement of landscape features which determine the character and the aesthetic and perceptual qualities of the landscape.
- 7.1.3 The assessment of visual effects addresses potential changes in the composition and quality of existing views as a result of the change to the landscape features, or the introduction of new elements within the view.
- 7.1.4 This chapter has been prepared in accordance with detailed Interim Advice Note (IAN) 135/10 Landscape and Visual Effects Assessment, Highways England, 2010 (Ref 7.1), but set within the context of the more recent Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3), Landscape Institute and Institute of Environmental Management and Assessment, 2013 (Ref 7.2). This is considered appropriate as IAN 135/10 refers to the GLVIA and NPSNN footnote 102 refers to GLVIA3.
- 7.1.5 As the proposed scheme crosses a WHS there are overlaps between the landscape and visual assessment and Chapter 6 Cultural Heritage. The historic evolution of the WHS landscape, the potential effects to the setting of heritage assets and the cultural heritage impacts of the proposed scheme are assessed within Chapter 6 Cultural Heritage. The likely change to the 'present day' landscape, views and effects to the published landscape character areas, including those within the WHS, are addressed within this chapter.

7.2 Stakeholder engagement

- 7.2.1 Engagement has taken place between the project team and key stakeholders. Working groups have been set up, associated with a number of the environmental disciplines, including heritage, landscape and biodiversity. These are advisory groups and allow the project team to work closely with stakeholders as the design develops.
- 7.2.2 Consultation has also involved discussions with Natural England regarding proposed viewpoint locations at Parsonage Down National Nature Reserve ('Parsonage Down') and within the Cranbourne Chase AONB, and with the National Trust for viewpoint locations along the A303.
- 7.2.3 Stakeholder engagement will continue as the proposed scheme develops and will include further meetings with Wiltshire Council, Cranbourne Chase AONB planning officers, the National Trust and Natural England, to discuss the ongoing scope of the ES Landscape and Visual Impact Assessment (LVIA) and associated landscape mitigation.

7.3 Assessment assumptions and limitations

- 7.3.1 Field work has been undertaken during 2017 summer months when the existing vegetation was in leaf and therefore the extent of inter-visibility between the proposed scheme and the study area is potentially reduced compared to winter months, when the vegetation is not in leaf. The ES LVIA field work and subsequent construction and year 1 assessments will be based on winter conditions when the existing vegetation is not in leaf, with field work undertaken in early 2018.
- 7.3.2 Access to viewpoints has been based on publicly accessible areas and private land where access had been agreed.

7.4 Study area

- 7.4.1 The landscape and visual study area has been informed by a detailed desk based review of the landform, whereby the proposed scheme will be situated within an undulating and rolling landscape that influences the extent of visibility and perception of the proposed scheme. Computer generated Zones of Theoretical Visibility (ZTVs) and supporting field work have been undertaken to supplement the desk based reviews.
- 7.4.2 As a result, landscape and visual effects are anticipated to be localised due to the pattern of ridge lines and valleys which result in varying degrees of enclosure and visibility. At this stage therefore, the landscape and visual study area extends 5km from the centreline of the proposed scheme (Figure 7.1).
- 7.4.3 The 5km study area broadly extends from Yarnbury Camp in the west; Shrewton, Larkhill, Durrington in the north, Amesbury and Bulford in the east and the River Avon and Berwick St James in the south.

7.5 Baseline conditions

Landscape Context

Topography and Watercourses

- 7.5.1 As shown by Figure 7.2, the study area consists of a complex pattern of rolling landform, resulting in a series of ridge lines, valleys and downland.
- 7.5.2 The principal watercourses are the River Till and the River Wylye in the western part of the study area and the River Avon in the eastern part. These rivers form part of the river systems around Salisbury, along with the River Nadder and River Bourne, to the south and east of the study area respectively.
- 7.5.3 At the western part of the study area, there is elevated undulating landform either side of the A303, including Berwick Down at 150m AOD and Parsonage Down, between 155m AOD and 80m AOD. The rolling landform continues to the south and south-west of the A303, before falling steeply to the River Wylye (60m AOD) and then rising to form a ridge line across the Middle Hills, between the Great Ridge (220m AOD) and Grovely Hill (144m AOD).
- 7.5.4 Winterbourne Stoke is situated in a low lying position within the River Till valley at 70m AOD, and is enclosed by elevated landform to the south of the A303.

- 7.5.5 To the north-east of Winterbourne Stoke, the landform consists of a series of narrow valleys and associated ridgelines extending from the River Till valley to Winterbourne Stoke Down. The elevated landform to the south of Winterbourne Stoke also continues eastwards to Oatlands Hill (128m AOD), to the south of the A303, before falling gradually eastwards towards Wilsford and Normanton Downs.
- 7.5.6 From the Winterbourne Stoke Group (121m AOD) the landform falls eastwards to a dry valley at Stonehenge Bottom (80m AOD). The Stones are situated across this falling landform, at approximately 103m AOD. From Stonehenge Bottom the landform rises to form a ridge line (King Barrow Ridge) between the south-east edge of Durrington, Long Barrow, Stonehenge Cottages and Coneybury Hill (114m AOD).
- 7.5.7 From this ridgeline, the landform then falls towards Amesbury and the River Avon, which meanders between the Countess Roundabout and the western edge of the settlement, at approximately 60m AOD. Across the eastern part of Amesbury, there is an elevated ridge extending between Bulford Camp and Boscombe Down Airfield (between 100m AOD and 210m AOD) with localised high points including Beacon Hill at 204m AOD.
- 7.5.8 As a result of this rolling landform, the valley systems and ridge lines, the extent of visibility across the study area is varied with enclosed views within the valleys contrasting with extensive and often panoramic views from elevated ridges.

Vegetation Patterns

- 7.5.9 Figure 7.3 shows that the arable land use within the study area results in a generally open landscape, with hedgerows dividing fields and bordering road networks. The key vegetation patterns within the study area consist generally of localised clumps of woodland, particularly across ridge lines and elevated landform. There is also substantial garden vegetation within settlement patterns and intermittently within the river valleys, particularly sinuous woodland belts adjacent to the River Till in Winterbourne Stoke and the River Avon in Amesbury.
- 7.5.10 Linear woodland belts also extend along the southern edge of Durrington, across the southern aspect of Oatlands Hill and on the eastern aspect of Winterbourne Stoke Hill.
- 7.5.11 Woodland clumps within the WHS are located around the southern edge of Larkhill and across the ridgelines at King Barrow, around Stonehenge Cottages, Fargo Plantation, the Winterbourne Stoke Group, Normanton Gorse and Wilsford Down.
- 7.5.12 Within Amesbury, principal vegetation patterns include the vegetated banks of the River Avon as well as roadside planting around Countess Roundabout, including within the WHS.

Settlement, Infrastructure and Land Use

- 7.5.13 The principal land use within the study area is agricultural, consisting overall of large scale arable fields interspersed with localised areas of livestock.

- 7.5.14 Winterbourne Stoke is a small scale nucleated settlement adjacent to the A303. The main part of the village extends in a linear form to the south of the A303, with a garage, public house and Manor Farm, in addition to a small number of residential properties adjacent to the A303.
- 7.5.15 Within the WHS, land use includes tourism, with built form and car-park at the Stonehenge Visitor Centre, situated along the western edge of the WHS, adjacent to Airman's Corner roundabout.
- 7.5.16 The western edge of the WHS is also defined by the linear road alignment of the A360, which continues northwards via the B3086 to the Packway at Rolleston Camp and southwards to Salisbury.
- 7.5.17 The Ministry of Defence (MoD) establishments of Durrington and Larkhill extend across elevated landform to the north and south of The Packway and Fargo Road. To the north of these settlements, the landform is undulating across Salisbury Plain.
- 7.5.18 West Amesbury's settlement pattern extends intermittently to the west of the River Avon, and adjacent to Stonehenge Road. Amesbury Park is situated to the north of this road and adjacent to the River Avon.
- 7.5.19 Amesbury is a predominantly residential settlement, concentrated to the south of the A303. The eastern part of Amesbury also consists of extensive large scale utilitarian built form within several business parks, which due to the scale of the buildings and their elevated position are visible from within the surrounding landscape, including from within the WHS. The northern part of Amesbury consists of a ribbon pattern of generally 2 storey semi-detached properties adjacent to the A345 and is physically separated from the remainder of the settlement by the A303.
- 7.5.20 The A303 is the main road infrastructure within the study area consisting in the main of a single lane carriageway and a series of roundabouts, which are lit.
- 7.5.21 Additional infrastructure within the study area includes overhead pylons extending across the south-east part of the WHS, between the A345, the A303 and West Amesbury.

Public Rights of Way (PRoW)

- 7.5.22 Figure 7.4 shows the PRoW across the study area.
- 7.5.23 Around Winterbourne Stoke the PRoW include WST03 (byway) between the A303 and the B3083; WST05 and WST06B (byways) within the River Till valley and WST011 (footpath) across Winterbourne Stoke Hill.
- 7.5.24 Within the WHS, PRoW AMES12 (byway) extends between Wilsford Down and Durrington, but is severed by the A303; AMES11 (byway) extends southwards from the A303 and AMES9A, AMES10, AMES37, AMES39 and DURR30 (bridleways) form connected routes between the A303, the southern edge of Durrington and the A345. There is also open access land within parts of the WHS.

- 7.5.25 Within Amesbury, PRow AMES44 (bridleway) extends between the A303 and London Road, within the northern part of Amesbury.
- 7.5.26 Parsonage Down is publicly accessible via a bridleway adjacent to its western edge and is an area of open access land.
- 7.5.27 The PRow networks are therefore localised within and around the settlement patterns with dedicated routes within the WHS and adjacent to the River Avon, at Ratfyn Barrow.
- 7.5.28 The A303 physically severs the PRow connectivity within the WHS, between the north and south parts of Winterbourne Stoke and between the WHS and Amesbury.

Tranquillity

- 7.5.29 IAN 135/10 paragraph 2.13 defines tranquillity as “the remoteness and sense of isolation, or lack of it, within the landscape, which is often determined by the presence or absence of built development and traffic.”
- 7.5.30 Additionally, the Landscape Institute’s Technical Information Note (TIN) 01/2017: Tranquillity – An Overview (Ref 7.10), states that tranquillity is a perceptual aspect of the landscape.
- 7.5.31 From the initial field work, vehicles on the A303 are visible and audible from numerous locations, including within the River Till valley and key visual locations within the WHS (New King Barrows, the Cursus and the Stones).

Published Landscape Character Assessments

- 7.5.32 Landscape character assessment is defined within GLVIA 3 as the:

“process of identifying and describing variation in the character of the landscape and using this information to assist in the managing change in the landscape. It seeks to identify and explain the unique combination of elements and features that make a landscape distinctive”.

- 7.5.33 Landscape character assessments are referred to below. These assessments have been undertaken by various organisations and at national, county and district scales. Natural England for example, has divided England into 159 distinct natural areas, with their boundaries following natural lines in the landscape rather than administrative boundaries. Natural England’s assessments are intended to inform and contribute towards policy formulation and local planning, action and development. Similarly, Local Planning Authorities use their published landscape character assessments as part of their planning policy evidence base and the assessments often provide specific guidance or recommendations on managing landscape change.
- 7.5.34 The proposed scheme is covered by the following published landscape character assessments, summarised below.

Published national landscape character assessments

- 7.5.35 The study area lies wholly within National Character Area (NCA) 132: Salisbury Plain and West Wiltshire Downs (Ref 7.5), which is characterised as:

“sparsely settled, predominantly agricultural area with a strong sense of remoteness and openness. The dominant element in the landscape – apart from the expansive sky – is the gently rolling chalk downland.”

- 7.5.36 The key characteristics of NCA 132 include:

“Woodland generally confined to valley slopes, with scattered copses and shelterbelts (usually of beech or conifer) found on the high downs, and occasional ancient oak woods on the ridgetops;

Large arable fields predominate, with generally very few hedgerows or obvious boundary features; there are often wide grass buffer strips;

Outstanding prehistoric ritual landscape, with many Scheduled Ancient Monuments and earthworks prominent in the open landscape, notably Stonehenge; and

Military tracks, airfields and structures reflecting a major land use. Visually prominent modern military housing and supporting development are found in the eastern side of the NCA.”

- 7.5.37 Statements of environmental opportunity for NCA 132 include developing network connectivity (biodiversity); protecting, conserving and sustainably managing the NCA’s landscape, including for enhancing the visitor experience to the WHS and considering the removal or extension of woodland on a case by case basis, including for shielding the WHS from inappropriate development, and extending the scope for recreational access.

- 7.5.38 The A303 is noted by the published study as a busy road and one which intrudes upon tranquillity and dark skies.

Published county landscape character assessments

- 7.5.39 At the county scale, the study area is covered by the Wiltshire Landscape Character Assessment (Ref 7.6) and is within the following Landscape Character Types (LCTs) and sub-divided Landscape Character Areas (LCAs):

a) LCT High Chalk Plain – LCA’s 3A Salisbury Plain West and LCA 3B Salisbury Plain East; and

b) LCT Chalk River Valley – LCA’s 5D Upper Avon and LCA 5E Wyllye Valley.

- 7.5.40 The key characteristics of the LCT High Chalk Plain include:

“Very large scale and open, exposed landscape;

Rolling plateau land form with panoramic views over the surrounding lowlands creating a sense of elevation;

Large regular arable fields are bounded mainly by ditches or fences with occasional hedgerows; and

Steep and incised slopes down to the surrounding river valleys.”

- 7.5.41 The A303 is noted by the published study as one of the busy transport routes within the area.
- 7.5.42 LCA 3A Salisbury Plain is the largest character area within the LCT High Chalk Plain, which is noted for its continuity and intensively farmed land use. Whilst this results in an open character, it also results in a ‘manicured’ feel. Additional attributes of LCA 3A are expansive and panoramic views; military installations and signage and a landscape of restricted public access.
- 7.5.43 LCA 3B Salisbury Plain East is noted for its vast scale and sense of isolation and exposure, as well as extensive areas of calcareous grassland recolonization within MoD ownership.
- 7.5.44 The key characteristics of the LCT Chalk River Valley include:
- “Strongly enclosed valleys with an intimate scale contrasting with the surrounding open upland landscape;*
- Level, often narrow valley floors with relatively steep sides;*
- Valley used as transport corridors with major roads and railway lines along valley sides; and*
- Rural landscape sometimes interrupted by the large volume of traffic.”*
- 7.5.45 LCA 5D Upper Avon is noted as a narrow strongly contained valley, which is wider and more level at Amesbury. The LCA is assessed by the published study as a highly rural landscape, despite the busy A303 and A345.
- 7.5.46 LCA 5E Wylve Valley is noted as an intimate landscape with a semi-enclosed character, which whilst crossed by busy transport corridors, (the A303 crosses via a viaduct) the floodplain retains a peaceful quality.
- Published district level character assessments*
- 7.5.47 As shown by Figure 7.5, at the district scale, the study area is covered by the Salisbury District Landscape Character Assessment (Ref 7.7) and is within the following LCT’s and LCA’s:
- a) LCT A: Narrow Chalk River Valley, with LCA’s A1: Till Narrow Chalk River Valley and A2: Upper Avon Narrow Chalk River Valley (relevant to the proposed River Till crossing and the Countess junction respectively)
- 7.5.48 The stated key characteristics of LCT A: Narrow Chalk Valley includes narrow river corridors, narrow valley floors and a pastoral land use. The valley corridors are also noted as transport routes, with major roads along the valley sides.
- 7.5.49 The key characteristics of LCA A1: Till Narrow Chalk River Valley includes narrow river corridors, sinuous woodland and dispersed and scattered

settlements. Winterbourne Stoke is noted as a historic village and where the busy A303 main road corridor crosses the valley and introduces a source of noise and movement.

- 7.5.50 The published evaluation of LCA A1: Till Narrow Chalk River Valley is that its condition is good and that it has a moderate to high inherent sensitivity as a result of its enclosed character, sinuous woodlands, small scale fields and the water meadows within the floodplains. The increased traffic along the A303 is noted as threatening the overall sense of tranquillity and rural nature of villages and surrounding landscape.
- 7.5.51 The key characteristics of LCA A2: Upper Avon Narrow Chalk River Valley includes strongly contained valleys cutting through the adjacent Chalk Downland and predominantly rural landscapes with a strong sense of tranquillity throughout, despite isolated visual and noise intrusion from the A345 road corridors.
- 7.5.52 The published evaluation of LCA A2: Upper Avon Narrow Chalk River Valley is that its condition is good and the overall landscape sensitivity is moderate to high. Additionally, views are generally constrained by the landform and linear woodland belts but from the higher valley sides there are open and sometimes panoramic views across the adjacent open Chalk Downland landscapes and therefore from these locations the visual sensitivity is higher.
- a) LCT B: Broad Chalk River Valley Slopes and LCA B1: Wylve Broad Chalk River Valley Slopes (the proposed scheme is not physically within these LCT and LCA)
- 7.5.53 The key characteristics of LCT B: Broad Chalk River Valley Slopes include strongly enclosing valley sides and wide, extensive valley slopes.
- 7.5.54 The key characteristics of LCA B1: Wylve Broad Chalk River Valley Slopes include steep slopes with semi-natural grassland or 'hanging' woodland.
- 7.5.55 The published study assesses the overall landscape condition of LCA B1 as moderate due to declining boundary features including hedgerows. The overall inherent landscape sensitivity is also assessed as moderate.
- a) LCT C: Broad Chalk River Valley Floor and LCA C1: Wylve Broad Chalk River Valley Floor (the proposed scheme is not physically within these LCT and LCA)
- 7.5.56 The key characteristics of LCT C: Broad Chalk River Valley Floor includes generally flat valley floors and networks of mature hedgerows.
- 7.5.57 The key characteristics of C1: Wylve Broad Chalk River Valley Floor includes enclosed flat valley floors with an intimate scale and mature trees. The landscape is also noted as being interrupted by large volumes of traffic.
- 7.5.58 The published study assesses the overall landscape condition as moderate due to the natural form of the valley, balanced with the decline of semi-natural habitats. The inherent landscape sensitivity is assessed as moderate to high.
- a) LCT D: Chalk Downland and LCA's D1: West Wiltshire Downs Chalk Downland, D2 Tilshead Chalk Downland, D3: Larkhill Chalk Downland and

D4 Boscombe Down Chalk Downland (the proposed scheme crosses D2 and D3)

- 7.5.59 The key characteristics of LCT D: Chalk Downland include large scale landform or broad rolling hills; a predominantly arable landscape with main roads cutting across it; large open skies and panoramic views, large woods and a strong sense of elevation.
- 7.5.60 The key characteristics of LCA D1: West Wiltshire Downs Chalk Downland include a large-scale landscape of broad rolling hills and undulating land separated by dry river valleys, as well as fast moving transport corridors including the A303 and A350 in cuttings and on embankments.
- 7.5.61 The published study assesses the landscape condition as moderate as a balance between the decline in landscape features resulting from intensive farming with the largely unsettled character.
- 7.5.62 With regards to LCA D1's inherent sensitivity, the A303 is noted as a fast moving corridor in cuttings and on embankments, which partially reduces the sense of isolation within the landscape and results in a moderate to high sensitivity to the southern part of the LCA D1.
- 7.5.63 The stated key characteristics of LCA D2: Tilshead Chalk Downland include:
- “Very large-scale landscape, which generally has a strong sense of openness and exposure;*
- Strong sense of elevation, with frequent panoramic views over surrounding Landscape Character Areas;*
- Strong sense of continuity throughout this gently rolling landscape; and*
- Sense of tranquillity is generally strong throughout much of the area, disturbed at times by military activities and traffic noise on the A303 road corridor to the south.”*
- 7.5.64 The published study assesses the landscape condition as good within MoD areas and moderate outside of these, due to the loss of hedgerows and field boundaries.
- 7.5.65 The tranquillity of LCA D2 is noted as disturbed by traffic noise on the A303 road corridor to the south of LCA D2 reducing the overall high sensitivity of LCA D2. The visual sensitivity is also assessed as high, due to long distance panoramic views and the strong inter-visibility with the chalk downland.
- 7.5.66 The key landscape changes include the noise and visual intrusion from vehicles on the A303.
- 7.5.67 Management strategies for LCA D2 include maintaining open views across the downland; extending opportunities for pasture, replanting hedgerows and conserving chalk grassland.
- 7.5.68 The stated key characteristics of LCA D3: Larkhill Chalk Downland include:

“Strong sense of continuity throughout this gently rolling landscape;

A largely uninhabited landscape of unenclosed rough grassland, criss-crossed by army tracks;

Numerous archaeological features visible within the landscape, including instantly recognisable landmarks, such as Stonehenge;

Strong recognisable sense of place as a result of views across this landscape towards archaeological features;

Very large-scale landscape, which generally has a strong sense of openness and exposure;

Strong sense of elevation, with frequent panoramic views over surrounding Landscape Character Areas;

The landscape is covered by a patchwork of arable farmland and calcareous grassland;

The utilitarian form, materials and layout of military camps (such as Larkhill towards the north of the area), have a strong influence on the character of this landscape;

A network of rural roads crosses the landscape, in addition to main road corridors of A303 and A345, which introduce noise and visual intrusion;

Sense of tranquillity is generally strong throughout much of the area, however, this is disrupted by military activities and traffic noise on the A303 and A345 road corridors; and

Large-scale landscape pattern delineated by low hedgerows, which are often sometimes gappy, and regular shaped mixed woodland copses and shelter belts.”

- 7.5.69 The visual character summary notes that the urban edges of Amesbury and the A303 are visual intrusions and similarly the large scale massing within Larkhill military camp are dominant landscape features.
- 7.5.70 The arable farmland outside of MoD ownership is assessed as being in moderate condition due to the notable hedgerow and field boundary loss. The overall inherent landscape sensitivity is assessed as moderate to high, reflecting the A303's disturbance to the tranquillity. The visual sensitivity is assessed as high as a result of the strong inter-visibility with chalk downland and open views to landmark features.
- 7.5.71 Key landscape changes include the noise and visual intrusion from vehicles on the A303.
- 7.5.72 The management strategies and objectives include maintaining open and dramatic views across the chalk downland towards landscape features and archaeological monuments, such as Stonehenge.

Published local level character assessments

7.5.73 The Stonehenge World Heritage Site Landscape and Planning Study identifies the following landscape character areas within the WHS, which are also reproduced in Map 9 of the WHS Stonehenge and Avebury WHS Management Plan, 2015 (Ref 7.8):

- a) Agricultural downland;
- b) Avon valley, river valley slopes;
- c) Avon valley, water meadows and floodplain;
- d) Downland ridgelines;
- e) Dry river valleys;
- f) Unimproved downland/ military training;
- g) Upper Stonehenge dry valley; and
- h) Urban areas.

7.5.74 The WHS Management Plan notes that typically, much of the WHS is an open landscape. The rolling landform, with large fields bounded by fences and long-distance views of plantations, clumps of trees, roads and upstanding archaeological features are noted as the most distinctive characteristics of the downland plateau landscape of the WHS. In contrast to the expansive downland plateau areas, the enclosed and small-scale character of the Avon valley is a notable variation in the character of the WHS. The general absence of hedgerows and buildings is also a notable characteristic.

7.5.75 The WHS Management Plan notes that the setting of the WHS is characterised by a rolling open landscape, which is particularly sensitive to development, stating that:

“At Stonehenge, with the exception of the grassland areas in and around key monuments, the landscape of the WHS is more or less wholly farmed with extensive areas of very large arable fields. There are also limited (but visually prominent) areas of woodland. Principal features of the landscape include the distinctive ridgelines with their concentrations of visible archaeological remains, including the Stones themselves, and dry valleys which cut deeply into the surrounding downland.” (WHS Management Plan paragraph 8.3.2)

7.5.76 The WHS Management Plan identifies the key characteristics of the WHS landscape as:

“An open landscape in which the sky dominates;

The undulating landform, with large fields bounded by fences and long distant views of plantations, clumps of trees, roads and upstanding archaeological features being the most distinctive characteristics of the downland plateau landscapes within the WHS;

The general absence of hedgerows and buildings is also a notable feature; and

Enclosed small scale character of the Avon Valley.”

7.5.77 The landform within the WHS (rolling with a series of ridges and valleys) is also noted as a distinctive feature, with visually prominent ridges and panoramic views from Windmill Hill and valley floors which mark the transitions between the WHS and surrounding landscape types. The modern features of the WHS landscape include intensive military use.

7.5.78 The WHS Management Plan notes that the intrusive elements within the WHS are:

“roads and traffic which dominate a number of areas and are visibly and aurally intrusive;

the A344, A303 and A360 at Stonehenge;

the traffic;

the severance between Stonehenge Avenue and Durrington Walls as a result of the A303 and A345; and

buildings at Larkhill and Boscombe Down, the latter of which is noted as being visually prominent.”

Landscape Character Summary

7.5.79 In summary, the landscape character within the study area consists of or is influenced by:

- a) large-scale, smooth, rolling chalk downland with a strongly exposed character interspersed with woodland often on ridgelines;
- b) river valleys with water meadows and sinuous woodland belts;
- c) visible archaeological features;
- d) arable, military and tourist land uses;
- e) visually and aurally dominant A303, crossing the WHS and physically severing PRoW and settlement patterns, as well as reducing the tranquillity of the landscape; and
- f) visually dominant large scale utilitarian massing within east Amesbury and MOD facilities.

Landscape designations

7.5.80 Figure 7.3 shows the landscape related designations within the 5km study area, including:

- a) Cranborne Chase Area of Outstanding Natural Beauty (AONB) – to the south-west of Winterbourne Stoke. The Cranbourne Chase AONB

Management Plan (Ref 7.8) states the special characteristics and qualities of the AONB, which include panoramic views and expansive dark skies. The A303 crosses the AONB and is noted as an exposed transport route and key viewpoints are identified within the central part of the AONB; and

- b) Special Landscape Area (SLA) – a saved policy of the former Salisbury District Council adopted Local Plan (Ref 7.9), Policies C4 and C5 (Landscape Conservation). The SLA covers the majority of the study area, except for Countess Roundabout, Amesbury, Bulford and Larkhill. The policy acknowledges the landscape is not of such high quality as the AONB, but considers it worthy of being preserved and that only development which is essential to the rural economy or desirable for the enjoyment of its amenities will be permitted, and the location, scale and nature of such development will be carefully controlled in order to conserve the character of the SLA.

7.5.81 There are also numerous Tree Preservation Orders (TPOs) within the study area, including a woodland belt south-west of Countess Roundabout, north-west of Amesbury. North of the existing A303, west of Countess Roundabout a series of trees and small groups of trees, known as 'Nile Clumps', are also covered by TPO.

7.5.82 Information regarding TPOs will be updated in further consultation with Local Planning Authorities as part of the ES LVIA baseline in combination with a full review of the relevant landscape and visual policies at national, county and district levels.

7.5.83 Heritage designations include (refer to Chapter 6: Cultural Heritage):

- a) Stonehenge, Avebury and Associated Sites WHS – which cover a large part of the study area east of the A360/B3086 and west of the A345;
- b) Amesbury Abbey, a Grade II* Registered Historic Park and Garden (RHPG) – lies to the south of the existing A303, to the south-west side of Countess Roundabout; and
- c) Conservation Areas – at Winterbourne Stoke, Berwick St James, West Amesbury, Amesbury and Bulford.

7.5.84 Ecological designations include the River Avon System Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI), River Till SSSI, and Parsonage Down, which is a National Nature Reserve (NNR) and a SSSI. Refer to Chapter 8: Biodiversity.

Visual

7.5.85 The assessment of visual effects is structured around the identification of visual receptors within the study area that have the potential for views of either the construction or operation of the proposed scheme. The identification of visual receptors is a two staged process, beginning with baseline mapping of the potential ZTV and then field work to refine and ascertain the actual inter-visibility between the proposed scheme and potential visual receptors.

ZTV Mapping

7.5.86 As noted, Figure 7.1 includes a ZTV of the proposed scheme. The ZTV was used to inform the locations for field work, as it identified the potential visibility of the proposed scheme, with locations including from within the WHS and elevated land east of Winterbourne Stoke and within Parsonage Down.

Field Work identification of Visual receptors

7.5.87 Initial representative visual receptors of the proposed scheme have been identified, as shown on Figure 7.4 and summarised in Appendix 7.A. As noted, viewpoints will continue to be reviewed and discussed with Wiltshire Council, English Heritage, Historic England, Natural England, National Trust and planning officers responsible for the Cranborne Chase & West Wiltshire Downs AONB.

7.5.88 Following analysis of the ZTVs and confirmation by site work, visual receptor groups include:

- a) Visitors to the Stonehenge Visitor Centre and the Stonehenge monument;
- b) Users of recreational facilities where the primary purpose of that recreation is enjoyment of the countryside; this includes open access land around Stonehenge and across Parsonage Down;
- c) Recreational users of the PRoW identified within the baseline;
- d) Residential properties in Winterbourne Stoke and Amesbury;
- e) Commercial and public buildings; and
- f) Users of roads.

Lighting and night time visibility

7.5.89 The CPRE on-line mapping has identified the A303 as a light source in contrast to the surrounding arable fields.

7.5.90 Night time field work has identified that the rolling landform limits the extent of views of light sources (e.g. street lighting and vehicles), particularly at lower elevations. Lighting from Shrewton, Larkhill, Durrington and Amesbury is noted for its sky glow from existing road lighting columns, including around Countess Roundabout.

7.5.91 Away from settlements, the study area is generally relatively dark, except for the influence of vehicle headlights along the existing A303, A360, reflective signs and lighting columns at Longbarrow Roundabout, Airman's Corner and Countess Roundabout.

Sensitivity of receptors

7.5.92 The LVIA methodology is outlined within the Scoping Report (Ref 7.13), with the key considerations including the assessment of the value and susceptibility of landscape and visual receptors, so as to ascertain their sensitivity to the proposed scheme.

Landscape

- 7.5.93 Overall, the study area comprises a predominantly rural landscape with distinctive elements and features that make a positive contribution to character and sense of place, including various environmental designations such as the WHS, AONB, RHPGs, Conservation Areas and the SLA.
- 7.5.94 Most of the study area is considered to be of regional or national landscape value on account of the presence of elements of national and regional importance, but with detracting features, notably the vehicles on the A303 and the presence of military training activities and road infrastructure.
- 7.5.95 Winterbourne Stoke is covered in part by a Conservation Area and contains Listed Buildings, which contribute to further localised areas of landscape value within the study area. There is also a RHPG at Amesbury Abbey, to the south-west of Countess Roundabout.
- 7.5.96 As a predominantly agricultural landscape the capacity to accommodate change without effects on its overall integrity at this stage is assessed as low and therefore the landscape character areas have a high susceptibility.
- 7.5.97 Winterbourne Stoke and Amesbury, whose townscape character is already influenced by the A303 are considered to have some capacity to accommodate change and at this stage are assessed as a medium susceptibility.
- 7.5.98 Combining the national and regional value of the landscape with the varying susceptibility results in landscape sensitivity within the study area at this stage being assessed as ranging between high and low.

Visual Receptors

- 7.5.99 Visual receptor groups assessed as having a national or regional value, a high susceptibility and a high sensitivity to the proposed scheme are:
- a) Users of recreational facilities within the study area, including:
 - i. visitors to the Stonehenge Visitor Centre;
 - ii. visitors using the pathways around the Stones; and
 - iii. visitors using open access land and permissive paths.
 - b) Recreational users of the extensive network of PRow within the study area, including:
 - i. users of byways open to all traffic;
 - ii. users of the National Cycle Network (NCN) Route 45; and
 - iii. users of other public footpaths and permissive routes.
 - c) Residential properties within the study area, including:
 - i. residents of isolated residential properties in the open countryside;

- ii. residents of villages and other small settlements, principally at Winterbourne Stoke, Berwick St James, Larkhill, Strangways and Countess; and
- iii. residents of Amesbury, on the northern periphery and across the elevated areas around the south-west periphery at West Amesbury.

7.5.100 Visual receptor groups assessed as having a national to community value, medium susceptibility and therefore a medium sensitivity to the proposed scheme include people working outdoors, motorists on tourist routes (this would include people in vehicles using the existing A303), and visitors to facilities such as pubs, hotels and schools.

7.5.101 People working indoors, motorists on other main roads and the minor local road network, and users of sports facilities are generally regarded as having a community value, low susceptibility and therefore a low sensitivity to the proposed scheme.

7.6 Potential impacts

7.6.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out in section 7.7 below. Prior to implementation of the mitigation, a summary of the potential landscape impacts (both beneficial and adverse) associated with the construction and operation of the proposed scheme is outlined below.

Construction impacts: main highway corridor and off-site works

7.6.2 Impacts within the proposed site boundary are considered, as these are the source of the direct physical and visual change to the landscape. Impacts could therefore result from the construction plant, materials and equipment that would be required to construct the proposed scheme. In addition, impacts could result from vegetation removal, soil stripping and excavation; contractor's compounds and temporary lighting; arisings storage and treatment; stockpiled soil and materials and the activity associated with redistributing excavated spoil and traffic and PRow diversions.

7.6.3 Several high sensitivity visual receptor groups including residents within Winterbourne Stoke and PRow users on the identified baseline routes including within the WHS, could experience adverse visual impacts during the construction period as a result of the above construction activities.

Operational impacts: main highway corridor

7.6.4 In operation, the impacts within the proposed site boundary are considered as these are the source of the direct physical and visual change to the landscape. Beneficial impacts, include:

- a) removing or downgrading the existing A303 within the WHS. This is likely to result in beneficial landscape impacts by removing at-grade traffic, including from within much of the WHS, which would improve tranquillity and reduce landscape severance. There are also likely to be beneficial visual impacts for people visiting the Stones and receptors across much of the wider WHS as a result of the removal of traffic from most views;

- b) additional access routes within the WHS and the landscape as a result of the NMU strategy and green bridges, compared to the severance caused by the A303. This connectivity includes for beneficial biodiversity and green infrastructure connectivity;
- c) removing the A303 through Winterbourne Stoke with a consequent reduction in traffic and associated visual and aural intrusion and resultant increased tranquillity; and
- d) increased recreational value through new NMU routes.

7.6.5 Adverse impacts could arise from:

- a) Longbarrow Junction, as a result of the introduction of the new grade-separated A303/A360 junction, including proposed earthworks for the A303 and A360 link roads. There could be adverse visual impacts on recreational users of access land in the west of the WHS and recreational users of PRow; and
- b) The River Till viaduct, as a result of the new viaduct and associated earthworks on the approaches into the Till valley from the east and west. Adverse visual impacts would be on recreational users of PRow in the Till valley and users of local roads.

7.6.6 To reduce these potential impacts, mitigation measures have been incorporated within the design, as outlined below in section 7.7.

7.7 Design, mitigation and enhancement measures

7.7.1 Primary mitigation measures are embedded within the proposed scheme, as illustrated on the draft Environmental Masterplan (see Figure 2.4). This embedded mitigation is needed to successfully integrate the proposed scheme within the existing context of an open landscape with only localised areas of woodland.

7.7.2 A landscape character approach to the design of the proposed scheme identified the following overarching principles within the various landscape character areas as demonstrated by the Masterplan:

- a) Downland
 - i. Integration of earthworks (grading out of embankments and rounding off of top of cuttings) into rolling Downland landscape;
 - ii. Landscape enhancement through the re-creation of calcareous species rich grassland which is a key characteristic of Salisbury Plain;
 - iii. Return of regraded earthworks to agriculture;
 - iv. Use of false cuttings to aid screening of traffic;
 - v. Planting strategy to respond to landscape character and management objectives of Parsonage Down; and

- vi. Enhance north/south and east/west NMU links along former A303 and though the inclusion of 'green bridges'.
- b) WHS Downland
- i. Maximising landscape enhancement opportunities resulting from the removal of surface traffic by establishment of an NMU along the former A303 corridor;
 - ii. Maximising NMU opportunities within the WHS with north /south, as well as east /west links;
 - iii. Avoid upstanding earthworks which would otherwise conflict with the inter-relationship of archaeological features;
 - iv. Use of deep retained cutting to minimise land take within WHS and reduce the view of traffic;
 - v. Use of calcareous grassland on cut slopes above retained cut to minimise visual impact;
 - vi. Minimise lighting and signage within WHS; and
 - vii. Planting strategy to respect objectives of WHS Management Plan.
- c) River Till Valley
- i. Minimise impact on valley landscape through careful selection of crossing point;
 - ii. Use of viaduct rather than bridge with earthworks;
 - iii. Viaduct height and width designed to minimise ecological impacts through loss of habitat, by reducing shading to maintain grassland beneath the structure as well as associated landscape and visual benefits by maintaining visual permeability of the valley floor; and
 - iv. Re-grading of approach embankments.
- d) River Avon Valley
- i. No landtake around the Countess Junction to avoid direct impacts on adjacent environmental designations;
 - ii. No lighting on elevated sections;
 - iii. Appropriate landscape/townscape response to the roundabout providing NMU connectivity north/south;
 - iv. Retention of existing highway planting, supplemented by new trees where possible; and
 - v. Scheme tie-in before the River Avon.

7.7.3 Specific embedded landscape and visual mitigation therefore includes:

- a) Removing part of the existing A303 carriageway from within the WHS via tunnelling, as well as setting the road in a 6.5m to 8.5m deep cutting through the western part of the WHS to provide landscape and visual benefits, including that of the visitor experience, by removing the existing vehicles, improving the tranquillity and night sky and removing the severance between PRow within the WHS caused by the existing road. This is considered to respond positively to Natural England's Statements of Environmental Opportunity for NCA 132 by enhancing the visitor experience to the WHS;
- b) Sitting the A303 in cutting through the grade-separated Longbarrow Junction and lowering the proposed A360 roundabouts into shallow cutting and the reintroduction of native hedgerows and trees adjacent to the new road. Additionally, the proposed scheme would avoid new street lighting columns within the layout to benefit local visual receptors by reducing the potential adverse visual impacts of vehicles, lighting and highways structures;
- c) Reducing landscape and visual impacts of cut and fill earthworks by grading out terrain to more naturally flowing contours where possible to respect existing rolling landform and to allow land to be returned to existing use where possible;
- d) Providing new public access (NMU routes) within the proposed scheme, including a proposed bridleway across Berwick Down, between PRow SLAN 3 and Winterbourne Stoke; an NMU route between Winterbourne Stoke and the Stonehenge Visitor Centre, via the former A360 (broken out as part of the proposed scheme) and an NMU route along the former A303 within the WHS with links to Stonehenge Road. This beneficial change in the recreational opportunities within the landscape is a positive response to Natural England's Statements of Environmental Opportunity for NCA 132 by extending the scope for recreational access within the landscape;
- e) To facilitate the NMU routes 'green' bridges have been incorporated within the design with these structures being sympathetically integrated into the landscape via vegetation and mounding softening their appearance. Green bridges are proposed between Winterbourne Stoke and the new NMU route towards Parsonage Down, the realigned PRow WST06B and at Longbarrow Junction. The vegetated structure of these green bridges also provides for biodiversity opportunities and connectivity, reflecting Natural England's Statements of Environmental Opportunity for developing biodiversity network connectivity as well as the visual amenity experience of NMU users;
- f) Sections of false cutting on the approaches to the Till viaduct have been incorporated, along with new woodland and tree planting and grassland reinstatement below the viaduct to benefit visual amenity where they are appropriate and in keeping with the existing landscape character;
- g) The proposed River Till viaduct would be a twin deck structure, with a physical gap between the carriageways. This is to reduce the perceived massing of the structure from PRow within the River Till valley and to retain light to the valley floor so as to maintain the existing landscape structure.

- 7.7.4 Secondary mitigation measures for the construction phase to mitigate the impacts as far as reasonably practicable are:
- a) Ensuring a construction environmental management plan supported by an arboricultural impact assessment in line with BS 5837:2012 to retain and protect trees during construction in accordance with the recommendations made;
 - b) where screening earthworks such as false cuttings are proposed as part of the wider mitigation strategy, they would be constructed as early as is practicable to provide screening to the construction work;
 - c) siting compounds and other construction facilities sympathetically within the landscape, via a comprehensive site selection process. Additionally, temporary construction buildings, fencing and facilities could be rendered in tonal colours to reflect the landscape as well as screened in part by solid hoardings;
 - d) ensuring soil structures are protected where land would be used temporarily, such as for compounds, haul roads, re-grading areas, etc., so that when it is returned to the existing land use, it is in a suitable condition; and
 - e) the establishment of advanced planting for softening filtering views of the construction phase, as well as part of the wider visual mitigation if land is not required for other construction activities.

7.8 Assessment of effects

- 7.8.1 The effects have been assessed following consideration of the potential impacts outlined in section 7.6 and the mitigation measures in section 7.7.

Landscape effects

Construction

- 7.8.2 During construction, the proposed scheme is likely to result in significant adverse landscape effects to the landscape features directly within the construction footprint of the proposed roads, junctions and portals as a result of the loss of landscape features such as landform. There are also likely to be significant adverse landscape effects related to construction activity and compounds within the surrounding landscape as a result of the temporary change to the landscape character.
- 7.8.3 There would be significant adverse landscape effects to the published district landscape character areas D2: Tilshead Chalk Downland and D3: Larkhill Chalk Downland due to the introduction of the notable uncharacteristic construction activity and excavation across the rolling landform at Longbarrow Junction and Oatlands Hill.
- 7.8.4 Similarly, at a local level character scale there would be likely significant adverse landscape effects within the River Till valley to the north of Winterbourne Stoke, including to the east of Parsonage Down, and within Amesbury at the Countess Junction. In relation to the local published landscape character areas (LCA)

within the WHS, there would likely be significant adverse landscape effects to the river valley slopes LCA, downland ridgelines LCA and agricultural downland LCA as a result of the portal construction and associated excavation of spoil.

Operation

- 7.8.5 In operation the proposed scheme is likely to result in significant beneficial effects from tunnelling the A303 within part of the WHS and breaking out the existing road to form a NMU route. This would result in large scale improvement to the landscape character and restoration of features including species rich chalk downland.
- 7.8.6 The proposed scheme is therefore likely to result in significant beneficial effects to the district published landscape character area D3: Larkhill Chalk Downland, as well as those within the river valley slopes, downland ridgelines and agricultural downland LCAs within the WHS.
- 7.8.7 There would be significant adverse effects at a local scale within the River Till valley due to the viaduct and embankments. The removal of the A303 from within Winterbourne Stoke would result in a significant beneficial effect to the local townscape character, in combination with the improved recreational access within the local landscape.
- 7.8.8 The significant beneficial landscape effects provide a positive response to addressing the intrusive elements within the WHS, identified within the WHS Management Plan, specifically by removing the visible and aural dominance of the A303 within the landscape and the severance this existing road causes with existing access. The beneficial effects are also supported by the landscape planting strategy which introduces new species rich grassland as well as an increased recreational value to the landscape through the NMU routes.

Visual effects

Construction

- 7.8.9 During construction the proposed scheme is likely to result in temporary significant adverse effects on a number of visual receptors including:
- a) Residential properties in Winterbourne Stoke adjacent to the A303 and at Hill Farm, recreational users of PRoW within the River Till valley and across elevated landform including Winterbourne Stoke Hill and within Parsonage Down due to views of the cut and fill operations, the implementation of the viaduct and redistribution of excavated material;
 - b) Recreational users and tourists within the WHS due to the construction activity at the proposed portals and the location of the construction compounds in the proximity of the Longbarrow roundabout; and
 - c) Residential properties to the north of Countess Roundabout within Amesbury due to the construction of the new flyover, as well as recreational users of PRoW in the eastern part of the WHS between King Barrow Ridge and the A345.

Operation

- 7.8.10 The proposed scheme is likely to have significant beneficial effects as a result of the tunnelling of the A303 and deep cutting through part of the WHS and the associated removal of views of vehicles and the A303 road surface. These significant beneficial effects are therefore likely to be experienced by:
- a) Visitors to the Stones;
 - b) Visitors to a number of other notable heritage features in the WHS including Coneybury Hill, The Avenue, New King Barrows and The Cursus; and
 - c) Recreational users of the open access land within the WHS landscape.
- 7.8.11 Likely significant adverse visual effects relate to residential receptors at Hill Farm with views of Longbarrow Junction; recreational users within the River Till valley, north of Winterbourne Stoke and in elevated parts of the landscape, including Winterbourne Stoke Hill, with views along the River Till valley.

Summary

- 7.8.12 The proposed scheme would be situated in an open rolling landscape, with small towns, villages and farms within a pattern of ridgelines and valleys including the River Till valley. The land use is predominantly agricultural, with areas of residential and military properties and tourism associated with the WHS.
- 7.8.13 Published landscape character assessments have identified the key characteristics of the landscape as a large-scale landform with large open skies and distant panoramic views. The published studies have assessed the inherent landscape sensitivity of character types and areas within the study area as high or medium.
- 7.8.14 These published studies also identify that the A303 intrudes upon the tranquillity of the landscape, as it is a dominant feature which is visually and aurally intrusive. This is supported by the field work, which confirms the dominance of vehicles on the A303 and adjacent to the Stones especially within views from publicly accessible locations within the WHS. Also dominant within views are the large scale industrial built form within the eastern part of Amesbury, including from within the eastern part of the WHS.
- 7.8.15 The baseline review and field work have also identified that there are a number of PRoW within the study area and that the A303 physically severs the PRoW networks within the WHS, as well as at Winterbourne Stoke and Amesbury.
- 7.8.16 The design integrates the proposed scheme within the existing context of an open landscape with only localised areas of woodland. A landscape character approach to the design of the proposed scheme has identified overarching landscape and visual principles, including:
- a) tunnelling part of the A303;
 - b) integrating earthworks into a rolling landscape;
 - c) false cuttings to screen vehicles;

- d) re-creation of calcareous species rich grassland;
- e) establishing NMU routes along the former A303 corridor, within the WHS and between the WHS and Winterbourne Stoke and Amesbury;
- f) minimising lighting and signage within WHS; and
- g) a twin deck viaduct across the River Till to aid in reducing the overall mass of the structure and retain light to the valley, so as to retain the existing landscape structure and visual permeability of the valley floor.

Summary of preliminary assessment

7.8.17 Preliminary Construction Assessment:

- Construction activities would have likely significant temporary **adverse** effects on the rural landscape, particularly the River Till valley and at Longbarrow junction.
- Construction activities would have likely significant temporary **adverse** visual effects on residents of Amesbury and Winterbourne Stoke, visitors to the WHS and users of the public rights of way (PRoW) network, in particular in the vicinity of the River Till valley.

7.8.18 Preliminary Operational Assessment:

- The proposed scheme would have likely significant permanent **adverse** effects on the landscape of the River Till valley.
- Operation of the proposed scheme would have likely significant **adverse** visual effects on users of the PRoW network in the vicinity of the River Till valley.
- The proposed scheme would have likely significant permanent **beneficial** effects on the pattern, tranquillity and connectivity of the landscape within the WHS.
- Operation of the proposed scheme would have likely significant **beneficial** effects on the townscape within Winterbourne Stoke.
- Operation of the proposed scheme would have likely significant **beneficial** visual effects on residents of Winterbourne Stoke, visitors to the WHS, and users of the PRoW network within the WHS.

7.9 Corridors for utility connections

Western Connection

- 7.9.1 The western connection extends across a valley floor at the conflux of the River Wylde and River Till, at Stapleford, (60m AOD) and then across rising landform to a ridgeline between Chain Hill (148m AOD) and Oatlands Hill (128m AOD). The existing land uses within the area of the western connection include Stapleford substation and its overground telegraph poles which extend westwards across the lower part of the valley towards the A36 and eastwards towards Stapleford;

residential properties adjacent to the A36 and B3083, agricultural fields and intermittent farm properties.

- 7.9.2 The agricultural land use results in a generally open field pattern, interspersed by blocks of woodland or field boundary strips. There is also mature vegetation within the River Till valley, adjacent to residential properties and the Stapleford substation. Stapleford is a ribbon settlement, situated adjacent to the B3083 and Over Street. There are several PRoW extending from Stapleford, including a byway between the junction of the B3083, the A36 and Chain Hill. There is another byway between Chain Hill and Oatlands Hill, which crosses Druid's Head Farm.
- 7.9.3 The majority of the western extent is within published landscape LCA D3: Larkhill Chalk Downland. The western extent is within a designated Special Landscape Area and borders the edge of the Cranborne Chase AONB, adjacent to the A36. Visually, there are localised views of the area of the western connection from residential properties and road networks within Stapleford and the PRoW extending across the valley sides and ridgelines.
- 7.9.4 The landscape and visual receptors within this western connection area are assessed as ranging between high to low sensitivity, reflecting areas of undulating valley and river landscapes, townscape areas with existing built form and utilities, and road networks and views from residential properties and PRoW users.

Underground Option

- 7.9.5 During the construction phase, the potential impacts would be associated with the excavation for the underground connections and construction of the substation extension. Likely adverse impacts could arise from vegetation removal and temporary construction activity. However, due to the localised extent of the construction, and that in part it is located on existing roads and adjacent to an existing substation, no likely significant adverse landscape and visual effects are identified for the construction phase.
- 7.9.6 During operation, with the scheme underground and the substation extension reflecting the existing land use, no likely significant adverse effects are identified.

Overground Option

- 7.9.7 During construction, adverse impacts could arise from the excavation required for the telegraph pole footings, vegetation removal, the substation extension and general construction activity. However, due to the localised extent of the construction activity, no likely significant effects are identified during the construction phase.
- 7.9.8 During operation, the above ground telegraph pole and cables would introduce a visible feature within the landscape, being located across rising landform and the ridgeline between Chain Hill and Oatlands Hill, in contrast to the existing utilities which are located in the lower parts of the valley. Whilst visible, the extent of overground utilities will remain a minor component of the wider view within the landscape and are therefore not likely to result in a significant adverse effect.

Eastern Connection

- 7.9.9 The eastern connection extends across the lower slopes of Bulford Hill, at 75m AOD, to the east of the River Avon. The area of the eastern connection is adjacent to an existing substation and consists of agricultural fields, woodland, farms, including Rattyn Farm and an access track, which also serves as a byway. There are overhead power lines and telegraph poles within the agricultural fields to the east of the access track and byway, as well as adjacent to the River Avon.
- 7.9.10 The mature vegetation bordering the existing substations, farms and access track reflects the wooded character along the western bank of the River Avon and marks a contrast with the generally open character of the wider agricultural land uses. The area of the eastern connection is within published landscape character area LCT A2: Upper Avon Narrow Chalk River Valley.
- 7.9.11 There are close range views of the of the eastern connection from PRoW across more elevated parts of Bulford Hill, residential properties along the southern edge of Durrington and the eastern edge of the WHS.
- 7.9.12 The landscape and visual receptors are assessed as ranging between high to low sensitivity, reflecting areas of the WHS, townscape areas with existing built form and road networks and views from residential properties and PRoW users.

Underground Option

- 7.9.13 During the construction phase, potential impacts would occur from the excavation for the underground connections, localised vegetation removal and substation extension. Adverse impacts could arise from vegetation removal and temporary construction activity, however due to the localised extent of the construction, in part located on existing roads and adjacent to an existing substation, no likely significant adverse landscape and visual effects are identified.
- 7.9.14 During the operation phase, the extension to the substation is considered to reflect the existing land use and visual context and in combination with the utilities being underground, no likely significant adverse landscape and visual effects are identified.

Overground Option

- 7.9.15 Similar to the underground option, there would be no likely significant adverse landscape and visual effects during the construction phase as the construction activity would be localised to an area already consisting of utilities infrastructure and pylons.
- 7.9.16 During operation, the above ground connection would be situated adjacent to roads and tracks, in proximity to existing overhead pylons and telegraph poles. In combination with the short extent of the overground connection, no likely significant effects are identified.

8 Biodiversity

8.1 Introduction

- 8.1.1 This chapter describes the baseline habitats and species present within the study area, how these habitats and species would be impacted and the measures proposed to avoid, reduce or mitigate the impacts. Opportunities to provide enhancements at both the local and landscape scale have also been included where applicable.
- 8.1.2 The preliminary assessment has been undertaken in accordance with the following policy and guidance: the National Policy Statement for National Networks (NPSNN) (Ref 1.3), the Interim Advice Note Ecology and Nature Conservation: Criteria for Impact Assessment, Highways Agency (HA 103/10) (Ref 8.1) and Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment (Ref 8.2); according to the stage of the proposed scheme development and available baseline data. Table 8.1 below identifies the sections of the NPSNN related to biodiversity and signposts the sections of the chapter which address the requirements.

Table 8.1: Summary of NPSNN requirements relating to biodiversity

NPSNN	Relevant sections / paragraphs
Decision making: consideration and assessment of receptors	
Internationally, nationally and locally designated sites	The statutory and non-statutory designated sites are described within section 8.6 and Table 8.3 and Table 8.4
Irreplaceable habitats and protected habitats	The irreplaceable habitats located within the study area are described within section 8.6. The habitats along with the description of the habitats within the study area are described within section 8.6.
Protected species assemblages and species of principal importance	The baselines are described within Table 8.5.
Ecosystems	The impact of the proposed scheme on ecosystems is detailed within section 8.6.

8.2 Stakeholder engagement

- 8.2.1 Consultation with key stakeholders was carried out during a period of public consultation in early 2017, prior to determination of the preferred route for the proposed scheme. Further consultation in relation to biodiversity was carried out with environmental stakeholders in early autumn 2017 and will continue during the work toward the Environmental Statement (ES).
- 8.2.2 Stakeholders that have been contacted are listed below, together with a brief summary of discussion topics:
- a) Wiltshire Council: an Environment Working Group was held, including an initial meeting held with the county ecologist and Environment Agency to discuss the proposed scheme programme and future involvement; also consultation on the draft Environmental Masterplan.

- b) Environment Agency: consultation has been made in relation to the River Till and River Avon, including biological data collected by the Environment Agency, the potential impacts of construction and the potential effects on biodiversity arising from the proposed scheme.
- c) Natural England: several meetings and other discussions have been held about the proposed scheme programme and potential opportunities for biodiversity mitigation and enhancement that could be incorporated into the design; the possible impacts on the SAC from the River Till viaduct; protected species licensing; future public access provision at Parsonage Down NNR; potential synergy between habitat creation within the proposed scheme and a wider ecological network project initiated by Natural England, and discussion of the draft Environmental Masterplan.
- d) National Trust: consultation has been made on the draft Environmental Masterplan. National Trust has been involved in the regular solutions meetings for design development and presentation of the draft EMP.
- e) Ministry of Defence (MOD): consultation has been undertaken about potential use of chalk spoil in habitat creation.
- f) Royal Society for the Protection of Birds (RSPB): an introductory meeting was held to discuss the proposed scheme programme and potential opportunities for biodiversity mitigation and enhancement measures that could be incorporated into the design. In a site visit RSPB showed examples of habitat creation on chalk, and there has been discussion of the issue of disturbance of stone curlews.
- g) Great Bustard Group: a charity working to re-introduce the great bustard (*Otis tarda tarda*) to the UK and promote its interests throughout its range. A discussion and site visit were held regarding the great bustard re-introduction programme, data provision and potential for disturbance.
- h) Wiltshire Chalk Grassland Group: a working group led by Natural England, with participants including National Trust, Plantlife, Butterfly Conservation, Wiltshire Wildlife Trust, Wiltshire Council, RSPB, and local naturalists and land managers. A session was held to discuss the proposed scheme and biodiversity objectives, design considerations and an ecological network of interconnected habitats that will allow movement of species of chalk grassland between sites.

8.3 Assessment assumptions and limitations

- 8.3.1 This is a preliminary description of the ecological receptors within the study area and the likely ecological impacts arising from the proposed scheme, as assessed at the time of writing. The PEI Report draws on ecological surveys undertaken between 2016 and 2017. However, most reports are still in production, or are currently under review at the time of preparation of this report. Baseline data from the ecological survey reports outlined as 'under review' have been utilised within this report. Table 8.2 outlines the status of the reports. The ecological surveys will be updated where necessary as the proposed scheme and EIA develops.
- 8.3.2 The chapter group's impacts associated with construction and those associated with the permanent structure of the scheme together. The operational impacts

described are those arising from traffic on the completed scheme and indirect impacts such as changes in public usage.

- 8.3.3 Existing and forthcoming surveys will inform the ongoing development of the draft Environmental Masterplan. This draft masterplan is provided in Figure 2.4 and includes the proposed scheme, along with targeted mitigation that has been incorporated into the design. This is an ongoing iterative process, with environmental specialists actively involved in its development; using the mitigation hierarchy to avoid impacts, incorporate mitigation for those that cannot be avoided, and to incorporate opportunities for enhancement at the earliest possible stage.

8.4 Study area

- 8.4.1 To define the total extent of the study area for ecological assessment, the proposed scheme was reviewed in order to identify the spatial scale at which ecological features could be affected. The study area has been defined by determining a Zone of Influence (Zol), encompassing the likely significant ecological effects of the proposed scheme, including those which would occur by habitat loss or degradation and those which will occur through disturbance, such as noise and human activity.
- 8.4.2 The Zol differs for different ecological features and the impacts considered. For designated sites the Zol varied dependent on the reasons for designation. Statutory designated sites including Special Area of Conservation (SAC), Special Protected Area (SPA), Ramsar site, Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR) were considered up to 2km from the proposed scheme. This study area was extended to 30km for all statutory designated sites where bats were a qualifying feature of its designation, in accordance with current DMRB guidance (Ref 8.6). In addition any SSSIs were considered where their impact zones, as defined by Natural England, extended into the proposed site boundary. Sites designated at a local level (Local Nature Reserves (LNR)), non-statutory designated sites (County Wildlife Sites (CWS)), ancient woodlands and RSPB reserves were considered up to 500m from the proposed site boundary.
- 8.4.3 Table 8.2 in Section 8.5 below outlines the study area for each species and habitat survey undertaken. This has taken into account the ecology of the species or habitat, the impacts that potentially arise from highway schemes, as outlined in the Design Manual for Roads and Bridges, Volume 11, Section 3, Part 4, Highways Agency (Ref. 8.6) and the proposed scheme at its current stage of development. The Zols will be reviewed and if necessary revised during the work towards the ES.

8.5 Field surveys

- 8.5.1 In order to determine baseline conditions within the study area, habitat and protected species surveys outlined in Table 8.2 were undertaken. The scope of these surveys was determined through desk study (including consideration of the habitats present within the proposed scheme's Zol and data received from the local records centre, refer to the Scoping report (Ref 7.13) for further information on the desk study), consultation and an initial walkover survey. Table 8.2 outlines the status of the technical reports at the time of preparing this report in December 2017.

Table 8.2: Ecological field surveys

Ecological Survey	Study Area	Baseline Report Status
Phase 1 Habitat	A survey of all habitats within 125m of the centreline of the 2016 route options was undertaken between January and July 2017. This survey will be updated to include habitats within 200m of the proposed draft site boundary.	Under review
Other Terrestrial Vegetation	Including national vegetation classification (NVC) surveys in semi-natural habitats, scarce arable flora surveys and hedgerow surveys (Hedgerow Regulations Survey) carried out in June and July 2017. The areas surveyed were selected based on the initial habitat survey and desk study information. The coverage will be updated as necessary during or after updates to the habitat survey. Lichen surveys were undertaken between October and December 2017 on the Stonehenge stones, Parsonage down and Bulford camp.	In production
River Habitat Survey (RHS)	Surveys were undertaken in August 2016 and May 2017 along six 500m reaches within the River Avon and the River Till, extending approximately 1km upstream and 2km downstream from the current A303 crossing of the River Avon and approximately 0.5km upstream and 2.5km downstream from the proposed River Till crossing.	Under review
Aquatic Macrophytes	Surveys were undertaken in August 2016 and May 2017 along six 500m reaches within the River Avon and the River Till, extending approximately 1km upstream and 2km downstream from the current A303 crossing of the River Avon and approximately 0.5km upstream and 2.5km downstream from the proposed River Till crossing.	Under review
Desmoulin's whorl snail (<i>Vertigo moulinsiana</i>)	Surveys were undertaken between October and December 2016 along a 2km stretch of the River Till upstream of Winterbourne Stoke and 1.5km upstream and 6km downstream of Amesbury on the River Avon. The survey focussed on areas of suitable habitat on river margins and associated floodplains.	Under review
Aquatic invertebrate	Surveys were undertaken in October 2016 and May 2017 along six 500m reaches within the River Avon and the River Till, extending approximately 1km upstream and 2km downstream from the current A303 crossing of the River Avon and approximately 0.5km upstream and 2.5km downstream from the proposed River Till crossing.	Under review
White clawed crayfish (<i>Austropotamobius pallipes</i>)	Surveys were undertaken in August 2017 along six 500m reaches within the River Avon and the River Till, extending approximately 1km upstream and 2km downstream from the current A303 crossing of the River Avon and approximately 0.5km upstream and 2.5km downstream from the proposed River Till crossing.	In production
Terrestrial invertebrates	Surveys focused on marsh fritillary butterfly and general terrestrial invertebrates were undertaken in June and July 2017 in a sample of suitable habitats within approximately 1km of the proposed scheme.	In production

Ecological Survey	Study Area	Baseline Report Status
Fish	Surveys were undertaken in October 2016 and May 2017 along six 500m reaches within the River Avon and the River Till, extending approximately 1km upstream and 2km downstream from the current A303 crossing of the River Avon and approximately 0.5km upstream and 2.5km downstream from the proposed River Till crossing.	Under review
Great crested newt (<i>Triturus cristatus</i>)	All water bodies were assessed within 500m of the Phase 1 survey area between June 2016 and June 2017. A desk study is currently being undertaken to determine if further ponds within 500m of the proposed site boundary require surveys.	Under review
Reptiles	Reptile survey was carried out to provide a baseline for a version of the proposed scheme prepared in 2004. The study area focused on the existing A303 (verges and cuttings), the proposed River Till crossing point and hedgerows. It identified the habitats that supported three common reptiles species in the study area. Review of current habitat suitability for reptiles will be used to extrapolate the likely presence of reptiles within the proposed site boundary.	Previous surveys used
Breeding bird	The study area provided coverage of the 2016 route options. In total seven transect routes were walked between April and July 2017. These transects were chosen to cover the greatest diversity of habitats suitable for breeding birds.	Under review
Quail (<i>Coturnix coturnix</i>)	The study area covered the 2016 route options. Three transect routes were identified for their suitability to support quail and were surveyed between May and July 2016. The extent of the study area is deemed suitable to provide an assessment of quail within the proposed site boundary.	Under review
Barn owl (<i>Tyto alba</i>)	Data on nesting barn owls have been provided by a local expert within 2km of the proposed scheme and are considered to provide a suitable baseline.	In production
Stone curlew (<i>Burhinus oedicephalus</i>)	RSPB carry out detailed annual monitoring of stone curlew breeding in an area that encompasses the proposed scheme. To avoid duplication of effort and potential disturbance, RSPB supplied data from annual monitoring in 2017 and previous years. Information on breeding locations and road mortalities within 5km of the consulted route options was provided by the RSPB.	Under review
Bat surveys	Surveys included bat activity (transect and static monitoring surveys), bat roost assessments, crossing point surveys and trapping and radio-tracking surveys. The study area and survey dates are currently unknown at the time of writing this report.	In production
Hazel dormouse (<i>Muscardinus avellanarius</i>)	Nest tubes and boxes were deployed within historically surveyed sites, as well as additional sites. Surveys of these boxes were carried between September 2016 and September 2017. This study area covers all habitats with suitability for hazel dormouse within the proposed site boundary.	Under review
Water vole (<i>Arvicola amphibius</i>)	Surveys were undertaken in the 2016/2017 survey season and focussed on the River Till and River Avon extending approximately 1.5km upstream and 2.5km downstream on the River Till and 2.5km upstream and 6km downstream on the River Avon from the proposed scheme. The study area covered all habitats with suitability for water vole within the proposed site boundary.	In production

Ecological Survey	Study Area	Baseline Report Status
Otter (Lutra lutra)	Surveys were undertaken in the 2016/2017 survey season and focussed on the River Till and River Avon extending approximately 1.5km upstream and 2.5km downstream on the River Till and 2.5km upstream and 6km downstream on the River Avon from the proposed scheme. The study area covered all habitats with suitability for otter within the proposed site boundary.	In production
Badger (Meles meles)	All accessible habitats within 125m of the 2016 route options were surveyed for badgers in 2017. This study area is currently being updated to include all habitats within 100m of the proposed site boundary.	Under review

8.6 Biodiversity receptors

8.6.1 This section describes the baseline conditions of biodiversity receptors associated with the proposed scheme. It includes the preliminary identification of possible impacts and effects on these receptors, and the potential necessary mitigation and enhancement measures. Noise and vibration due to tunnel boring operations are not considered a realistic impact pathway for nature conservation interests at this site and this impact pathway is therefore not discussed further.

Statutory designated sites

8.6.2 This sub-section identifies the potential impacts on statutory sites designated for nature conservation (biodiversity) interests; the sites are listed in Table 8.3 and illustrated in Figures 8.1 and 8.2. It considers each of the internationally designated sites, the potential for impacts from the proposed scheme and then considers the appropriate design, mitigation and enhancement measures. All the internationally designated sites also have one or more national designations and so to avoid duplication, all the impacts on the nationally designated sites within internationally designated sites are considered concurrently with the international sites in the text.

8.6.3 A total of three statutory designated sites, where bats form a qualifying feature of their designation, are located within the 30km study area. These, relative to the proposed site boundary are: Chilmark quarries SAC, located approximately 10.5km away; Mottisfont bats SAC, approximately 17km away, and Mells valley SAC, approximately 29km away. Recent guidelines from the Bat Conservation Trust (BCT) 2016 (Ref 8.11) recommend that statutory sites designated for bats should only be considered up to a maximum of 10km from the proposed development boundary. In light of these guidelines, it is reasonable to conclude that significant effects on sites more than 10km away are unlikely and that these sites could be scoped out of further consideration. However it is still proposed to consider the impact of the proposed scheme on these sites within the ES once updated bat baseline data is available. The impacts on these sites will not be assessed further within this PEI report.

Table 8.3: Statutory designated sites of nature conservation value within the study area

Designated Sites	Proximity to the proposed scheme	Summary of reason for designation
Statutory Designated Sites		
River Avon SAC	Crossed by the proposed site boundary	Annex I Habitats (primary reason): The presence of “ <i>water courses of plain to montane levels with the Ranunculon fluitantis and Callitricho-Batrachion vegetation</i> ”. The Avon in southern England is a large, lowland river system that includes tributaries running through both chalk and clay. Five aquatic <i>Ranunculus</i> species occur in the river system including stream water-crowfoot (<i>Ranunculus penicillatus</i> ssp. <i>pseudofluitans</i>), river water-crowfoot (<i>R. fluitans</i>) and pond water-crowfoot (<i>R. peltatus</i>). Annex II Species (primary reason): The Avon is also designated for a range of aquatic fauna including Desmoulin’s whorl snail, sea lamprey (<i>Petromyzon marinus</i>), brook lamprey (<i>Lampetra planeri</i>), Atlantic salmon (<i>Salmo salar</i>) and bullhead (<i>Cottus gobio</i>).
Salisbury Plain SAC	Located partially within the proposed site boundary near Bulford camp in the eastern part of the proposed scheme and adjacent to the proposed scheme boundary at two locations: (i) at the Diversion Route to the north of the proposed scheme and (ii) at Parsonage Down near the western end of the proposed scheme.	Annex I Habitats (primary reason): The presence of “Juniperus communis formations on heaths or calcareous grasslands” and “Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)” The juniper within Salisbury Plain is juxtaposed with semi-natural dry grassland and chalk heath. It is believed to be the largest surviving semi-natural dry grassland within the EU and is therefore the most important site for this habitat in the UK. Annex II Species (primary reason): The Salisbury Plain is designated for the marsh fritillary butterfly (<i>Eurodryas aurinia</i>), which occurs on chalk grassland.
Salisbury Plain SPA	Located adjacent to the proposed site boundary along the Diversion Route to the north of the proposed scheme.	The SPA supports at least 10% of the British breeding population and 1% of Britain’s wintering hen harrier’s (<i>Circus cyaneus</i>) population. Salisbury Plain SPA also supports 20% of the British populations of quail and individual number of other raptors.
River Avon System SSSI	Crossed by the proposed site boundary	A rich and varied chalk stream of national and international importance for its wildlife communities (wholly within the River Avon SAC). The site supports the internationally rare or threatened species (<i>Ranunculus</i> vegetation, sea lamprey, brook lamprey, bullhead, Atlantic salmon and Desmoulin’s whorl snail). The system also support a variety of invertebrates, breeding and wintering birds, diverse fish fauna, water vole, water shrew (<i>Neomys fodiens</i>) and otter.

Designated Sites	Proximity to the proposed scheme	Summary of reason for designation
River Till SSSI	Crossed by the proposed site boundary	The SSSI is located wholly within the River Avon SAC. A winterbourne chalk stream containing the internationally important habitat “floating vegetation of water crowfoot <i>Ranunculus</i> of plain and submountainous rivers”, with an associated area of reed canary grass (<i>Phalaris arundinacea</i>) swamp. The river is noted for the fish community typical of a winterbourne chalk stream, including brown trout (<i>Salmo trutta</i>), grayling (<i>Thymallus thymallus</i>) and bullhead. The internationally important snail species Desmoulin’s whorl snail was recorded in the middle reaches. The SSSI supports water vole and otter.
Parsonage Down SSSI/ NNR	Located adjacent to the proposed site boundary.	An area of important chalk downland with species-rich calcareous grassland. The site supports species rich grassland with a variety of vascular plants which have a restricted distribution within Britain, such as early gentian (<i>Gentianella anglica</i>), bastard toadflax (<i>Thesium humifusum</i>) and others. The site supports invertebrates of interest including rare spiders and typical downland butterflies. The SSSI is located wholly within Parsonage Down NNR.
Parsonage Down NNR (not SSSI)	Located partially within the proposed site boundary	The part of the NNR outside the SSSI is working farmland which supports management within the SSSI.
Salisbury Plain SSSI	Located partially within the proposed site boundary near Bulford camp to the far east of the proposed scheme and adjacent to the proposed site boundary along the Diversion Route to the north of the proposed scheme.	This site is wholly within the Salisbury Plain SAC. In addition to the features for which the SAC is designated (see above) the site is also noted for scarce plants, a range of butterflies of chalk grassland, other rare and nationally scarce invertebrates and important assemblages of breeding birds.
Yarnbury Castle SSSI	Located approximately 65m outside of the proposed site boundary.	The site supports a rich chalk grassland flora which includes several plants of nationally restricted distribution. Marsh fritillary and small heath (<i>Coenonympha pamphilus</i>) butterflies have been recorded.
Steeple Langford Down SSSI	Located approximately 700m from the proposed site boundary	An area of exceptionally herb-rich chalk grassland supporting several plant species that have a restricted distribution in Britain.

River Avon SAC

8.6.4 Two sections of the River Avon SAC are crossed by the proposed scheme: the River Avon System SSSI east of Amesbury and the River Till SSSI north of Winterbourne Stoke. Both rivers are individually notified as SSSI. There are different anticipated impacts on the two rivers, these are discussed below.

Potential impacts (Construction)

- 8.6.5 There are no anticipated direct impacts on the River Avon System SSSI or River Till SSSI sections of the SAC, as there would be no direct habitat loss associated with the proposed works.
- 8.6.6 There is potential for indirect impacts on the River Avon SAC during construction, because of the potential for runoff of soil or other material, leading to siltation downstream. The potential risk to the River Avon from pollution during construction is anticipated to be less than at the River Till, because the crossing of the River Avon involves surfacing work and maintenance works on the existing bridge rather than a new crossing, although there are likely to be works on existing embankments near the bridge. The River Till will be crossed by a new viaduct, which will involve construction of the viaduct itself, extensive embankments approaching the viaduct and a temporary haul road across the valley.
- 8.6.7 During construction there would be a need to create a temporary crossing of the River Till valley for the movement of construction plant. To minimise adverse impacts this crossing would be across a temporary bridge raised above the valley floor with supports located outside of the river (at least 8m from the banks) and outside the designated area of the SAC.
- 8.6.8 The proposed viaduct over the River Till SSSI has the potential to result in indirect impacts on the SAC, due to the permanent shading associated with the River Till viaduct. If not mitigated, the shading would be expected to result in an area of reduced terrestrial and aquatic vegetation coverage within the SSSI and adjacent river valley. If bare ground persisted under the bridge it would be susceptible to erosion, leading to potential siltation downstream and hence indirect impacts on aquatic vegetation within the SAC/ SSSI downstream and on spawning sites for fish. The erosion would be expected to continue as long as there was soil or other fine substrate that could be eroded.
- 8.6.9 The degree of shading would depend on the detailed design of the viaduct, specifically the width and the height of the viaduct and its orientation. A study has been undertaken to investigate the effects of shading by bridges on vegetation beneath them, by surveying a range of sites in southern England. The results from this study have been used to inform the design of the viaduct, to minimise the likely shading on the River Till section of the SAC and allow sufficient light beneath the viaduct to maintain vegetation. The design is a twin-deck viaduct approximately 10m high with a gap between the decks. A single-deck bridge would have to be much higher to allow enough light all the way beneath it and would be expected to have greater visual impacts for residents of Winterbourne Stoke.
- 8.6.10 No direct impacts are anticipated on the Annex II species of fish that are a primary reason for the SAC designation, as there would be no construction works within the SAC at either the River Avon or the River Till. Works on the River Avon would not be expected to have indirect impacts on fish from increased noise and vibration, because no new crossing would be created. The River Till viaduct will require construction of supports for the viaduct. Short-term disturbance during construction of the supports is not likely to affect spawning of salmon and brown trout because the winterbourne section of the River Till is likely to be dry at the usual autumn spawning period for salmon and brown trout. Noise and vibration

from construction (e.g. from piling) would have the potential to affect behaviour of fish in the immediate vicinity, if it occurred when there was flow in the winterbourne and fish were present, but the works would be at least 8m from the River Till, outside the SSSI/SAC and the method of construction to be used would minimise the noise and vibration.

- 8.6.11 No direct or indirect impacts are anticipated on Desmoulin's whorl snail, an Annex II species of the SAC designation. This is because no construction works are anticipated within suitable habitat adjacent to the River Avon where Desmoulin's whorl snail has been recorded, and because Desmoulin's whorl snail is thought to be absent from the section of the River Till within the proposed site boundary.

Potential impacts (Operational)

- 8.6.12 No direct impacts are anticipated on the River Avon SAC from operation of the proposed scheme. There is potential for indirect impacts associated with pollution from incidents such as traffic collisions, but the provision of mitigation from the drainage design will be better with the proposed scheme than for the existing road.

Design, mitigation and enhancement measures

- 8.6.13 As described above, a twin-deck viaduct would mitigate the impacts of shading. The potential for indirect impacts such as increased pollution runoff during construction works surrounding the bridge spanning the River Avon and River Till would be avoided through pollution prevention measures, which will be set out in the Construction Environmental Management Plan (CEMP). The CEMP will include sensitive working practices for working near watercourses.
- 8.6.14 The inclusion of an infiltration drainage system would control potential increases in siltation and pollution from the proposed scheme into the River Till and River Avon sections of the River Avon SAC.
- 8.6.15 The requirement for further mitigation measures will be assessed within the ES, including measures to re-instate habitats in the River Till valley (outside the SSSI/SAC) following construction. This will include any requirements for ongoing monitoring of vegetation during both the construction and operation phases.
- 8.6.16 With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC would not be adversely affected.

Salisbury Plain SAC

Potential impacts (Construction)

- 8.6.17 No direct impacts on the Salisbury Plain SAC are anticipated as no land within the site is required for construction of the proposed scheme and hence there is not likely to be any habitat loss.
- 8.6.18 Part of the SAC within Salisbury Plain SSSI is directly adjacent to the proposed site boundary on both sides of the A303 near Bulford Camp, but works in this location would be within the highway boundary.
- 8.6.19 The construction activities located within and adjacent to the Parsonage Down SSSI / NNR may result in an increase in dust deposition. This would have the

potential for temporary, localised impacts on plant growth in the calcareous habitats that are the primary reason for the designation of the site.

- 8.6.20 There would also be the potential for localised emissions during construction work around junctions along the diversion route or during the closure of minor roads east of the River Avon. It is not anticipated that those localised construction works would be likely to affect sensitive vegetation within the Salisbury Plain SSSI/SAC.

Potential impacts (Operational)

- 8.6.21 The realignment of the A303 would take the road closer to the Salisbury Plain SAC at the location of Parsonage Down SSSI. This would have the potential to result in localised increases in NO_x deposition on the SSSI/SAC, which would have the potential to change vegetation by encouraging growth of tall grasses at the expense of other plant species, as with agricultural fertilisers. This will be assessed in the ES taking into account air quality modelling and the design of the proposed scheme.

Design, mitigation and enhancement measures

- 8.6.22 A CEMP will be drafted to reduce impacts on Biodiversity receptors. This will include implementation of good working practices to avoid accidental pollution incidents and air quality mitigation measures as appropriate.
- 8.6.23 The creation of chalk grassland between Parsonage Down SSSI and the scheme is expected to provide connectivity for species to access the new habitats of the scheme as well as provide a buffer zone between the A303 and the SSSI. This conversion to chalk grassland will remove an existing area from agricultural nitrogen fertilisation and prevent runoff or leaching into the SSSI. This would contribute to offsetting any potential increase in atmospheric nitrogen deposition resulting from Scheme NO_x emissions. The habitats to be created within the proposed scheme are anticipated to improve connectivity in an east-west direction for species of chalk habitats, by providing 'stepping stones' of suitable habitat between the SSSI and other areas. This has the potential to aid dispersal and connectivity of habitats and meta-populations of species at a landscape scale.
- 8.6.24 The provision of butterfly banks planted with larval food plants will be included within the detailed design, in the form of chalk cuttings or bunds. Areas of new calcareous grassland will also be included. This would result in beneficial impacts on the chalk downland butterflies, which are an interest feature of Parsonage Down SSSI. It would also facilitate the spread of plant species of chalk grassland, helping to connect areas of habitat in an ecological network from west to east. North to south connectivity would be aided by crossings of the proposed scheme by green bridges. This would be in addition to the proposed A303 new 'green' byway (route open for use by non-motorised users) on the line of the former A303 at the tunnel.
- 8.6.25 The requirement for further mitigation measures will be assessed within the ES, following the confirmation of the proposed scheme design; this will include the requirement for further monitoring surveys. This will be taken into account in the developing draft Environmental Masterplan.

- 8.6.26 With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC would not be adversely affected.

Salisbury Plain SPA

- 8.6.27 The SPA is primarily designated due to the population of breeding stone curlew supported. It is considered likely that the breeding population of stone curlew present within suitable surrounding areas such as Normanton Downs RSPB Reserve mixes with the breeding population within Salisbury Plain SPA. As such, the population within the study area is considered to support the breeding population within the SPA and has been included below. The SPA is also designated for its overwintering population of hen harrier, although information provided in desk study indicates that the area regularly used by hen harrier is distant from the proposed scheme and the population will not be expected to be affected. RSPB advised that surveys of wintering hen harrier could be scoped out of the EIA accordingly and we will seek to agree this with Natural England.

Potential impacts (Construction)

- 8.6.28 There would be no direct impacts such as habitat loss from the Salisbury Plain SPA.
- 8.6.29 Construction activities from construction work on the diversion route are not expected to disturb known sites of breeding stone curlew in the SPA.
- 8.6.30 Stone curlews breeding outside the SPA in proximity to the scheme at Normanton Downs RSPB reserve and within other locations known to historically support breeding stone curlew would have the potential to be disturbed by increased vehicular movements and human disturbance during construction. Disturbance impacts would have the potential to cause stress, which may result in a reduction in their resilience and breeding success. In extreme cases disturbance impacts may result in the abandonment of breeding plots.

Potential impacts (Operational)

- 8.6.31 No direct impacts are anticipated on the SPA during the operational phase. On occasions when traffic is diverted away from the tunnel on to the diversion route, which runs along the southern edge of the SPA along the Packway, the increased levels of traffic may result in increased levels of light spill from vehicle movements. However this is unlikely to impact the designating features of the SPA as the site is bordered by a large swathe of scrub that shields the SPA from traffic.
- 8.6.32 The provision of the Stonehenge tunnel would facilitate future access by visitors and local residents into areas south of the existing A303 in the vicinity of the RSPB Normanton Down reserve and the surrounding areas which are known to support breeding stone curlew. The scheme would not provide unrestricted access to farmland south of the A303 and public access is expected to continue to be on the existing byways. If there is an increase in use of the byways, this may result in greater long-term disturbance on breeding stone curlew and an indirect adverse permanent effect on nesting success locally.

Design, mitigation and enhancement measures

- 8.6.33 An Outline CEMP will be drafted to reduce impacts on Biodiversity receptors. This will include implementation of good working practices and restriction of

activities to avoid disturbance impacts and mitigation measures, such as visual barriers. In order to avoid disturbance impacts on stone curlew during construction, it may be necessary to deter stone curlew from known nesting plots in proximity to the proposed scheme prior to the commencement of works. This may involve vegetation manipulation.

- 8.6.34 Mitigation measures to minimise future disturbance of stone curlew during operation may include the provision of fencing to deter visitors from accessing potential stone curlew breeding areas.
- 8.6.35 Should further mitigation such as creation or improvement of suitable breeding areas for stone curlew and landscape scale habitat creation be required, this will be assessed and included within the ES.
- 8.6.36 At this stage the proposed scheme may result in adverse effects on the breeding population of stone curlew from indirect disturbance during the operational phase. However, Highways England's is committed to including requisite mitigation measures which would ensure that the integrity of the SPA would not be significantly adversely affected by the scheme.

River Avon System SSSI

Potential impacts (Construction and Operational)

- 8.6.37 The potential impacts on the River Avon System SSSI have been described in the section on the River Avon SAC above. The reasons for designation as a SSSI are broadly the same as those for designation as a SAC. No additional impacts are considered here. In summary, no direct impacts are anticipated as the existing bridge would be retained and potential indirect impacts from drainage or runoff would be avoided or mitigated.

Design, mitigation and enhancement measures

- 8.6.38 As described above for the River Avon SAC, the mitigation for indirect impacts for the River Avon System SSSI would be incorporated into the drainage design and the CEMP.

River Till SSSI

Potential impacts (Construction and Operational)

- 8.6.39 The potential impacts on the River Till SSSI have been described in the section on the River Avon SAC. The reasons for designation of this winterbourne tributary as a SSSI are broadly the same as those for designation as a SAC. No additional impacts are considered here. In summary, potential impacts could arise from the construction of a new viaduct across the River Till and from shading but both would be mitigated.

Design, mitigation and enhancement measures

- 8.6.40 As described above for the River Avon SAC, the mitigation for direct and indirect impacts on the River Till SSSI has been incorporated into the design of the viaduct, the drainage design and the mitigation measures during the construction period which will be detailed in the Outline CEMP. Measures for habitat re-instatement and monitoring will also be assessed within the ES.

Parsonage Down SSSI / NNR

Potential impacts (Construction)

- 8.6.41 No direct impacts on Parsonage Down SSSI are anticipated as no land take is required in the SSSI.
- 8.6.42 Parsonage Down NNR is partially located within the proposed site boundary. The land that will be affected is outside the SAC and SSSI and is arable and agriculturally improved grassland, which supports management of the SSSI. Landtake from this area would be for landscape integration and it would be restored to new chalk habitats after construction.
- 8.6.43 Potential indirect impacts on the SSSI during construction are increased levels of dust deposition on vegetation.

Potential impacts (Operational)

- 8.6.44 Potential indirect impacts include increased levels of NO_x deposition due to the close proximity of the scheme and possible changes in vegetation.

Design, mitigation and enhancement measures

- 8.6.45 A CEMP will be drafted to mitigate any adverse impacts from dust. This CEMP will include sensitive working practices. In addition, the requirement for further mitigation measures will be assessed within the ES. The inclusion of an infiltration drainage system would ensure that no runoff from the scheme enters Parsonage Down SSSI / NNR occurs. Air quality mitigation measures will be included as appropriate.
- 8.6.46 The creation and enhancement of calcareous grassland and a range of other habitats is proposed as part of the scheme on part of the NNR outside the SSSI, improving the extent and diversity of habitat and better public access. Other local habitat creation is anticipated to increase connectivity along the scheme. This is anticipated to aid the spread of species from chalk grassland within Parsonage Down SSSI/ NNR.
- 8.6.47 The temporary adverse effects of landtake in the non-SSSI farmland of the NNR are not likely to be significant. The extent and types of habitat creation will be described in the ES.

Yarnbury Castle SSSI

- 8.6.48 No direct impacts are anticipated as no land take is required from this designation. It is 65m west of the proposed site boundary, near an existing section of the A303 dual carriageway, so during construction indirect impacts such as increased dust deposition are unlikely. The potential for increased levels NO_x deposition from traffic onto vegetation are not currently anticipated to have any significant effect on the SSSI and mitigation is not expected to be required, but this will be considered further within the ES.

Steeple Langford Down SSSI

- 8.6.49 No direct or indirect impacts on Steeple Langford Down SSSI are anticipated during either the construction or operational phases, as the site is located approximately 700m from the proposed scheme. No mitigation is expected to be required.

Non-statutory designated sites

- 8.6.50 There are fifteen non-statutory designated sites within 500m of the proposed site boundary (Figure 8.3).
- 8.6.51 Table 8.4 outlines these sites including their location in relation to the proposed scheme and a summary of their reasons for designation. This sub-section identifies the potential impacts on these sites and then considers the design, mitigation and enhancement measures which may be required.

Table 8.4: Non-statutory designated sites within the study area

Designated Sites	Proximity to the proposed site boundary	Summary of reason for designation
Non-Statutory Designated Sites and Nature Reserves of County or Local Importance		
Countess Cutting CWS	Located entirely within the proposed site boundary	Early-succession chalk grassland on a steep south-facing road cutting bank.
Woodhenge Verge CWS	Located entirely within the proposed site boundary	An area of amenity grassland, designated for its calcareous grassland
Parsonage Down CWS	Partly located within the proposed site boundary	Part of the NNR which is outside (but immediately adjacent to) the SSSI boundary. This land at Cherry Lodge consists of arable and improved grass leys which support the farming that maintains the adjacent SSSI.
Luxenborough Banks CWS	Partly located within the proposed site boundary	Two small areas of remnant chalk grassland surrounded by arable reversion.
Countess Farm Swamp CWS	Partly located within the proposed site boundary	An area of derelict water meadow adjacent to the Salisbury Avon, with tall-herb, rank grassland, reed bed, poor fen and willow scrub.
Little Down CWS	Located adjacent to the proposed site boundary.	An area of habitat designated for its calcareous grassland
Yarnbury Down CWS	Located adjacent to the proposed site boundary.	An area of habitat designated for its calcareous grassland
Stonehenge Down CWS	Located approximately 65m from the proposed site boundary.	An area of level calcareous grassland
Boscombe Down Railway Line CWS	Located approximately 120m from the proposed scheme boundary	Two small areas of calcareous grassland
Normanton Down RSPB Reserve	Located approximately 225m from the proposed site boundary	Former arable conversion to chalk grassland being managed to encourage breeding stone curlews and other birds such as lapwing and corn bunting.
Deptford Bank CWS	Located approximately 300m from the proposed site boundary	A steep south- and west-facing bank with unimproved chalk grassland and large areas of dense scrub
Vinies Farm Meadow CWS	Located approximately 310m from the proposed site boundary	A small wet meadow by the river Avon.
Cow Down CWS	Located approximately 420m from the proposed site boundary	A forked coombe with unimproved calcareous grassland

Designated Sites	Proximity to the proposed site boundary	Summary of reason for designation
Wilsford Manor Meadow CWS	Located approximately 430m from the proposed site boundary	Species-rich fen meadow.
Durrington Meadows CWS	Located approximately 500m from the proposed scheme boundary	A group of derelict water meadows surrounded by old Willow pollards with a typical range of grassland and wetland habitats.

Potential impacts (Construction)

- 8.6.52 Direct impacts are envisaged to be permanent and temporary habitat loss of five county designated CWS. This includes Countess Cutting CWS, Woodhenge Verge CWS, Countess Swamp CWS, Parsonage Down CWS and Luxenborough Banks CWS (Table 8.4). Parsonage Down CWS is referred to in the section on Parsonage Down NNR, as it is located wholly within the NNR but outside the SSSI.
- 8.6.53 Breeding Stone curlews within Normanton Down RSPB reserve could be indirectly impacted during the construction phase, due to increased levels of human activities that may disturb breeding birds.
- 8.6.54 There is potential for indirect effects on the ecological integrity of a further eleven CWS during the construction phase from increased disturbance and air pollution levels, depending on their proximity to the proposed scheme (see Table 8.4).

Potential impacts (Operational)

- 8.6.55 Stone curlews are readily disturbed by increased human recreational activity, especially dog walkers. The improved connectivity for the public over the proposed tunnel has the indirect potential for disturbance to stone curlew specifically the known historical breeding and roosting sites at Normanton Downs RSPB reserve. If there is increased human disturbance due to increased visitors, this would be likely to have an indirect adverse impact on stone curlew breeding locally.

Design, mitigation and enhancement measures

- 8.6.56 Mitigation measures to minimise future disturbance of stone curlew outside the SPA during operation of the scheme could include various measures such as deterring visitors from accessing stone curlew breeding areas south of the scheme and the creation or improvement of suitable breeding areas.
- 8.6.57 Mitigation measures for landtake from CWS will include the creation of new semi-natural habitat to suitably replace habitat areas which would be permanently lost during the construction activities. The creation and enhancement of calcareous grassland is proposed within the design of the proposed scheme. It is anticipated that this would increase connectivity through provision of stepping stones between areas of existing calcareous grassland within the proposed site boundary and it is expected that there will be net gain of semi-natural habitats on chalk.
- 8.6.58 A CEMP will be drafted to reduce impacts on Biodiversity receptors during construction. This will include implementation of good working practices and

restriction of activities to avoid disturbance impacts and mitigation measures such as visual barriers and prevention of pollution.

Habitats

- 8.6.59 A total of 32 habitat types were recorded within the Phase 1 habitat survey across the 2016 and 2017 study area. With arable fields being the most dominant in terms of area, followed by improved grassland and chalk grassland from arable reversion, plus some broadleaved and mixed plantation woodland.
- 8.6.60 The main habitats associated with the proposed scheme are summarised below. An update survey is currently being undertaken to provide baseline information for the proposed site boundary, the results of which will inform the ES.

Baseline conditions

- 8.6.61 No ancient woodlands were identified within the 2 km study area. A single confirmed veteran beech (*Fagus sylvatica*) tree was identified to the north of New Kings Barrow and two (unconfirmed) veteran oak trees (*Quercus* spp.) were identified to the north-east of Countess Roundabout. All three trees are located outside of the proposed site boundary, although the two veteran oak trees are located within 10m of the proposed site boundary.
- 8.6.62 A total of five Habitats of Principal Importance (HPI) were identified within the study area, these were areas of wet woodland, lowland calcareous grassland, reed beds, lowland meadows and rivers. All of these were identified as occurring within the proposed site boundary.
- 8.6.63 The study area is dominated by large arable fields and improved grassland largely dominated by perennial rye grass (*Lolium perenne*) and clover (*Trifolium* spp.) on calcareous soil. The Phase 1 habitat survey recorded recently created calcareous grassland to the south of Normanton Gorse, created by seeding on former arable land or improved grassland.
- 8.6.64 A largely fragmented network of hedgerows and scattered woodland is present within the study area. These woodlands are few in number and available information indicates they lack the principal habitat features of ancient woodlands or priority habitats. Additional woodland is located along the river valleys of the River Avon, especially at Amesbury Abbey adjacent to the proposed scheme, where areas are dominated by wet woodland species such as willow (*Salix* spp.) and alder (*Alnus glutinosa*).
- 8.6.65 The study area contains a diversity of riverside habitats, including marshy grassland, scrub and woodland. The River Avon, a chalk river characterised by its aquatic vegetation is located at the east end of the proposed scheme. The River Till is a typical winterbourne stream, flowing from north to south through the proposed scheme. It flows in winter and spring, but typically dries during summer and is flanked by adjacent floodplain pasture, part of which was formerly managed as seasonally inundated water meadow.
- 8.6.66 The botanical surveys (NVC / scarce arable flora / hedgerow) surveys will update the Phase 1 Habitat survey, provide additional detail on the composition of species and allow valuation of receptors for the ecological assessment in the ES.

Potential impacts (Construction)

- 8.6.67 None of the veteran trees are expected to be directly impacted by the proposed scheme.
- 8.6.68 Direct impacts associated with the construction phase are envisaged to be permanent and temporary habitat loss of predominantly arable fields, with loss of smaller areas of grassland and scrub, roadside trees and short lengths of hedgerow.
- 8.6.69 The siting of temporary land requirements for construction, such as haul roads, site compounds and storage areas for the anticipated large amounts of spoil associated with the tunnelling activities, are currently being developed and will be located so as to avoid adverse impacts or damage to likely important habitats as far as is reasonably practicable.
- 8.6.70 There is an increased risk of habitat degradation resulting from siltation or pollution incidents during the construction phase, but measures to control pollution will be included within the CEMP.
- 8.6.71 The conversion of parts of the existing A303 into a 'green' byway with calcareous grassland and other habitat creation within the scheme is likely to result in the net gains of this habitat following the completion of construction. This is likely to benefit a range of species by reducing severance effects associated with the existing A303 and by providing additional grassland on chalk to provide new habitats for invertebrates and other species.

Potential impacts (Operational)

- 8.6.72 The operational impacts will include any impacts from road-run off and how any pollutants or sediments in the run-off might impact adjacent habitats through infiltration into soils or through flowing into watercourses.

Mitigation and enhancement measures

- 8.6.73 The CEMP will include measures to avoid impacts on the veteran and other trees located in proximity of the proposed site boundary, such as fencing off tree root protection zones.
- 8.6.74 Where land take is required as part of the construction activities mitigation measures are being designed to avoid net loss of semi-natural habitat within the proposed scheme as a whole. The draft Environmental Masterplan shows the habitats to be created as part of the scheme. It is anticipated that there would be net gain.
- 8.6.75 Where the proposed scheme leads to the loss of hedgerows or trees appropriate new planting would be provided as mitigation. The planting would comprise appropriate native shrub species of local provenance. The planting would also be designed to contribute to the mitigation of visual impacts and impacts on landscape character. Within the World Heritage Site the priority is for an open landscape and there is expected to be little or no planting of trees or shrubs.
- 8.6.76 The drainage design will incorporate better provision for control of pollution than existing conditions.

8.6.77 At this stage, it is considered unlikely that there will be any significant effects on habitats as no irreplaceable habitats would be lost and loss of semi-natural habitat would be replaced.

Protected species assemblages and species of principal importance

8.6.78 The following relevant protected species assemblages and species of principal importance (within Table 8.5) have been identified as present, or potentially present within the study area.

Table 8.5: Summary of receptors including their baseline status, potential impacts and design, mitigation & enhancement measures in relation to the proposed scheme

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Lichen species assemblage	Lichen species are known to occur on the Stonehenge stones. Preliminary results indicate these have had no significant change from those present in 2003. Further lichen surveys are being carried out in other suitable habitats within the ZoI of the proposed site boundary at Parsonage Down and Beacon Hill.	No direct impacts are anticipated on lichen species assemblages on the Stonehenge stones. Indirect impacts associated with dust deposition during construction have the potential to lead to changes in the assemblage.	There may be indirect impacts of changes in NO _x deposition, with some areas having increases in NO _x deposition from traffic. Diversion of traffic into the tunnel is anticipated to have a positive indirect impact of decreasing the levels of air pollution in proximity to the stones.	The CEMP will include measures to control dust during construction. As lichens are especially sensitive to changes in air quality, they are being considered as markers for potential impacts of air quality change. The diversion of traffic into the tunnel is likely to enhance the air quality conditions surrounding the lichen assemblages on the Stonehenge stones. The requirement for mitigation measures within other areas of the proposed scheme will be assessed within the ES. At this stage, it is considered unlikely that there would be any significant indirect effects associated with increased NO _x on the lichen species assemblages, as species present are mainly tolerant of NO _x .	No

¹ The measures are currently considered likely to be included within the DCO application for the proposed scheme, subject to further design and assessment work.

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Plant species and assemblages	<p>Arable field margins within the study area and proposed site boundary are likely to support scarce arable flora.</p> <p>Baseline data from botanical surveys will be used to evaluate the plant species and assemblages surveys.</p>	<p>Direct impacts on scarce arable flora are anticipated from temporary and permanent land take of arable field margins. Some loss of semi-natural habitat on farmland is proposed, plus loss of vegetation from some chalk cuttings on the A303.</p> <p>A detailed assessment of the impacts on scarce arable flora and other plants will be undertaken within the ES.</p>	<p>Indirect impacts may result from increased public access causing increased trampling on chalk grassland.</p> <p>A detailed assessment of the impacts on scarce arable flora and other plants will be undertaken within the ES.</p>	<p>Mitigation for scarce arable flora may include topsoil reuse in agricultural reinstatement.</p> <p>The creation of new habitat within the proposed scheme design is anticipated to increase suitable habitat for flora on chalk soils.</p> <p>At this stage, it is considered unlikely that there would be any significant effects on notable plant species and assemblages.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
<p>Aquatic macrophyte species assemblages</p>	<p>All reaches surveyed within the River Avon study area support a range of plant species associated with the River Avon SAC designated feature. Water-crowfoot (<i>Ranunculus spp.</i>), water-starwort (<i>Callitriche spp.</i>) and common watercress (<i>Rorippa nasturtium-aquaticum</i>) were recorded in all reaches, with water parsnip (<i>Berula erecta</i>) being recorded at the majority of sites.</p> <p>Water-crowfoot species were recorded within four of the six reaches surveyed within the River Till study area with pond water-crowfoot more widespread than stream water-crowfoot. Other species associated with this vegetation type were sparse although common watercress was recorded in two reaches and water parsnip was recorded in two reaches.</p>	<p>No construction activities are anticipated within the channel of the River Avon. As such no direct impacts on macrophytes within the River Avon are anticipated.</p> <p>There is potential for indirect impacts of increased siltation from water runoff during construction, which could adversely affect growth of macrophytes downstream of the River Till viaduct and potentially also at the River Avon (see River Avon SAC, section 8.6).</p>	<p>No additional outfall locations are expected to be required at the River Avon or River Till</p> <p>There is potential for indirect permanent loss of macrophytes or change in composition due to shading by the viaduct. The height, width and design will determine the degree of shading.</p> <p>The further assessment of potential impacts will be considered within the ES, following completion of the proposed scheme drainage design (see River Avon SAC, section 8.6).</p>	<p>The inclusion of an infiltration drainage system is anticipated to prevent any additional runoff or pollution into the River Till or River Avon and is anticipated to show some improvement compared to existing conditions.</p> <p>A shading study has been undertaken and the results have informed the preferred design of the twin-deck viaduct in order to minimise the degree of shading on the River Avon SAC and so retain the vegetation.</p> <p>At this stage, it is considered unlikely that there would be any significant effects on aquatic macrophyte species assemblages as the provision of a twin deck viaduct would minimise shading on the River Till.</p>	<p>No</p>

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Desmoulin's whorl snail	Desmoulin's whorl snail was recorded within five areas adjacent to the River Avon between West Amesbury and Normanton with the closest location approximately 4.6km downstream of the proposed site boundary. Desmoulin's whorl snail was not recorded within the River Till, and is considered to be absent from the River Till study area.	No construction works are anticipated to be required in suitable habitat adjacent to the River Avon, as such no direct impacts are assumed likely. Increased siltation and pollution resulting from water runoff from the proposed scheme could adversely affect Desmoulin's whole snail that are present along the banks of the River Avon. Desmoulin's whorl snail is not considered to be present within the River Till study area, as such, no impacts are considered likely to arise from the construction or operational phase.	Desmoulin's whorl snail is not considered to be present within the River Till study area, as such, no impacts are considered likely to arise from the construction or operational phase.	The CEMP will include pollution prevention measures during construction. The inclusion of an infiltration drainage system is anticipated to prevent any additional runoff into the River Till or River Avon. At this stage, it is considered unlikely that there would be any significant effects on Desmoulin's whorl snail.	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
<p>Aquatic invertebrates</p>	<p>All reaches of the River Avon study area showed high macroinvertebrate richness and communities sensitive to changes in flow and fine sediment load. The greatest macroinvertebrate conservation value was shown furthest downstream, attributed to high taxon richness. This reach also showed the highest water quality, sensitivity to changes in flow and the least sedimentation. Two priority macroinvertebrate species were recorded, a shrimp species, <i>Niphargus aquilex</i> and a riffle beetle species, <i>Riolus subviolaceus</i>. Macroinvertebrate taxon richness within the River Till study area increased downstream, but all reaches supported communities that were sensitive to changes in flow and fine sediment load. The furthest downstream reach surveyed showed the highest sensitivity to changes in flow and the least sedimentation. The mayfly <i>Paraleptophlebia weneri</i>, classified as a Red Data Book (RDB) (Rare) species and the mollusc <i>Anisus spirorbis</i> (a species of principal importance) were recorded within the River Till.</p>	<p>No construction works are anticipated to be required in the River Avon, as such no direct impacts are assumed likely. Increased siltation and pollution resulting from water runoff from the proposed scheme could adversely affect aquatic invertebrates present within the River Avon and River Till, this may result in the temporary reduction of invertebrate abundance and diversity.</p>	<p>No direct or indirect impacts on aquatic invertebrates are expected at the River Avon as no additional outfall locations are expected to be required and road drainage volumes are not expected to increase compared to existing conditions. Shading from the River Till viaduct may result in habitat fragmentation for some species if the growth of aquatic plants is reduced (see River Avon SAC, section 8.6).</p>	<p>The CEMP will include pollution prevention measures during construction. The inclusion of an infiltration drainage system is anticipated to prevent any additional runoff into the River Till or River Avon to provide similar or better quality drainage compared to existing conditions. A shading study has been undertaken and the results have informed the preferred design of the twin-deck viaduct in order to minimise the degree of shading on the River Avon SAC. At this stage, it is considered unlikely that there would be any significant effects on aquatic invertebrates as the provision of a twin-deck viaduct would minimise shading of the River Till.</p>	<p>No</p>

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
White clawed crayfish	No white clawed crayfish were found within the study area and are considered to be absent, due to poor dispersal rates and the direct and indirect impacts of non-native signal crayfish.	White clawed crayfish are considered to be absent from the study area, no impacts are likely.	White clawed crayfish are considered to be absent from the study area, so no impacts are likely.	None required	No
Terrestrial invertebrates	Awaiting baseline data for terrestrial invertebrate surveys to evaluate the species and assemblages.	There is potential for direct impact due to loss of semi-natural habitat. Most land take is expected from arable areas, where the species present are expected to be widespread and unlikely to include species of principal importance.	An assessment of potential impacts will be considered within the ES, following receipt of the baseline data from terrestrial invertebrate surveys and completion of detailed Scheme design.	The provision of habitats suitable for terrestrial invertebrates is expected to provide 'stepping stones' between suitable habitats. The inclusion of green bridges in the proposed scheme design is expected to aid movement of invertebrates. It is not possible to predict a significant effect at this stage. Further mitigation measures may be required depending on the results of the baseline and the confirmation of the proposed scheme design.	Assessment ongoing – to be reported in the ES.

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Fish species	<p>Eleven different fish species were recorded within the River Avon study area including brown trout (a species of principal importance) and bullhead (a qualifying feature of the River Avon SAC), European eel (<i>Anguilla anguilla</i>) (a protected species) and brook lamprey (a qualifying feature of the River Avon SAC). Fish species richness within the River Avon was greatest downstream. Fish biomass and density were higher further upstream due to the occurrence of brown trout (<i>Salmo trutta</i>) (assumed to have been stocked). Four different fish species were recorded within the River Till study area including brown trout bullhead and European eel and 3-spined stickleback (<i>Gasterosteus aculeatus</i>). Fish species richness within the River Till was low in all survey reaches. The overall density and biomass was very low compared to the River Avon. No adult lamprey or larvae were recorded in any of the survey reaches despite the occurrence of both potentially optimal and sub-optimal habitat.</p>	<p>No direct impacts on fish within the River Avon are anticipated.</p> <p>No construction works are anticipated within the River Till channel. No direct impacts on fish within the River Till are anticipated.</p> <p>Indirect impacts could arise from pollution incidents and siltation from runoff during the construction phase. If this occurred it would potentially have impacts on fish spawning sites downstream of works.</p> <p>Increased levels of noise and vibration levels associated with the construction of supports for the River Till viaduct has the potential for short-term disturbance of fish in the immediate vicinity, but only if it occurred when there was flow in the winterbourne.</p> <p>There would be no impact on fish when the winterbourne is dry.</p> <p>Without the mitigation in the design, shading and hence bare ground would potentially lead to erosion and potential siltation downstream and hence indirect impacts on spawning sites for fish.</p>	<p>No direct or indirect impacts on fish are expected at the River Avon as the drainage design is expected to reduce the risk of pollution compared to existing conditions.</p>	<p>An Outline CEMP will be drafted in order to mitigate any potential impacts on fish by preventing pollution, avoiding works in the channel and measures to minimise noise and vibration during construction of the viaduct.</p> <p>The inclusion of an infiltration drainage system is anticipated to prevent any additional runoff into the River Till or River Avon.</p> <p>At this stage, it is considered unlikely that there would be any significant effects as the temporary indirect impacts can be avoided through suitable construction methods.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Great crested newt	A total of 13 water bodies located within the study area were assessed for their potential to support great crested newt. Of these a single water body in the River Till valley approximately 200m north of the proposed site boundary was found to support a small breeding population of great crested newt	<p>The proposed scheme would not result in the loss of any water bodies known to support great crested newt. The potential temporary loss of habitat approximately 200m from the breeding pond is unlikely to have an effect on the population as it is considered to be on the edge of the likely core terrestrial habitat.</p> <p>Construction activities located within 250m of the breeding pond may result in the killing, injury and disturbance of individual great crested newt during the terrestrial phase of their lifecycle.</p>	There is an abundance of suitable habitat in the form of semi-natural broadleaved woodland and a water body complex known to support great crested newt to the north of the breeding water body, likely to be the core area for the population. The viaduct will not be likely to be a barrier to dispersal of individual great crested newt to the south.	<p>Potential mitigation measures would include suitable working methods to be outlined within a CEMP.</p> <p>Mitigation measures will depend on the extent of the construction area of the proposed scheme and timing of works. This will be assessed within the ES including any requirement for a European Protected Species (EPS) licence.</p> <p>At this stage, it is considered unlikely that there would be any significant effects as no breeding sites would be lost and the temporary impacts can be avoided through suitable construction methods that will form part of the CEMP.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Reptiles	<p>Reptiles were identified along the survey corridor comprising populations of slow-worm (<i>Anguis fragilis</i>), viviparous lizard (<i>Zootoca vivipara</i>) and grass snake (<i>Natrix helvetica</i>). All populations were assessed as small. All of the species had patchy distributions mirroring the availability of suitable habitat. Slow-worm and viviparous lizard were principally recorded in the east of the proposed scheme, directly west of Countess Roundabout along the existing road verges and cuttings. Grass snakes were restricted to habitat either side of the River Till.</p> <p>Low densities of reptiles are assumed to still be present in all the suitable semi-natural habitats within the proposed site boundary, with reptile populations continuing to occur along the A303 verges / cuttings in comparable numbers and within the River Till corridor.</p>	<p>There is potential for direct impact due to loss of semi-natural habitat, the extent of which is currently unknown. The proposed scheme, and in particular the vegetation clearance and stockpiling of materials, has the potential to harm individual reptiles.</p> <p>The proposed scheme could also result in the direct loss and / or fragmentation of habitat. This can be particularly detrimental in marginal areas where suitable habitat is often limited.</p>	<p>The Till viaduct is unlikely to affect reptile species that occur in the area and is not expected to be a barrier to movement. The creation of new grassland and a 'green' byway coupled with the removal of the A303 is likely to have a positive impact. Suitable habitat is often the limiting factor in arable landscapes; it is often restricted in both abundance and distribution. The creation of high quality habitat, on the scale proposed, is likely to connect existing reptile populations and provide opportunities for expansion.</p>	<p>The habitat lost would be mitigated by the habitat creation that would be included as part of the draft Environmental Masterplan.</p> <p>Where suitable habitat exists immediately adjacent to an affected area, the preferred mitigation would be habitat dissuasion, encouraging reptiles to disperse to unaffected areas. This will be described within the CEMP and</p> <p>Where no or insufficient suitable habitat is located adjacent to the works, it is expected that reptiles would be translocated to an ex situ receptor site following published guidance.</p> <p>On this basis, it is considered unlikely that there would be any significant effects. Furthermore, temporary indirect impacts can be avoided through suitable construction methods that will form part of the CEMP.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Breeding birds	<p>A total of 29 notable bird species have been recorded as breeding or probably breeding within the study area. Of these, barn owl, hobby, kingfisher (<i>Alcedo atthis</i>), red kite (<i>Milvus milvus</i>) and stone curlew are listed on Schedule 1 of the Wildlife and Countryside Act (barn owl, stone curlew and quail are assessed separately). Hobby, stone curlew and quail are qualifying species of the Salisbury Plain SPA. Kingfishers were recorded along the River Till, although nesting burrows were not recorded in surveyed sections of the River Till or Avon.</p> <p>The study area supports a particularly high number of breeding corn bunting (<i>Emberiza calandra</i>), skylark (<i>Alauda arvensis</i>), and yellowhammer (<i>Emberiza citrinella</i>) territories.</p>	<p>Clearance of vegetation associated with the proposed scheme has the potential to damage or disturb nesting birds, particularly within the breeding bird season.</p> <p>Direct impacts associated with the loss of hedgerows and arable field margins may reduce the available foraging habitat and suitable nesting habitat where these are crossed by the proposed scheme.</p> <p>Disturbance impacts associated with the construction activities has the potential to cause stress resulting in a reduction in their resilience and breeding success. This is likely to impact few species, as many species become easily habituated to increased noise and vibration levels, but some are especially sensitive to disturbance.</p> <p>The River Till crossing is not expected to directly affect any kingfisher nesting burrows.</p>	<p>The anticipated increase of vehicular speeds has the potential to result in an increase in the risk of vehicular collisions and increased mortality in areas where the road is not tunnelled</p>	<p>Indirect impacts associated with disturbance activities can be mitigated by measures within the CEMP which will include sensitive working practices such as seasonal restrictions on vegetation clearance.</p> <p>The creation of the A303 'green' byway and associated habitat would also provide foraging habitat and potentially nesting habitat. The proposed scheme is likely to result in a net gain of habitat suitable for a range of farmland birds once operational.</p> <p>At this stage, it is considered unlikely that there would be any significant effects.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Barn owl	<p>Barn owls are known to be breeding throughout the study area. A total of six nest boxes were noted to be occupied during the 2016 nest box survey. None of the nest boxes are located within the proposed site boundary.</p> <p>An additional breeding pair was recorded during the breeding bird transects within the proximity of Berwick St James outside of the proposed site boundary.</p>	<p>The direct habitat loss may result in the reduction or degradation of suitable hunting areas where parts of existing vegetated field boundaries and soft estate are lost or severed within a barn owl's home range. No known nest sites are expected to be lost or disturbed during the construction phase. The aerial tree climbing surveys will update this report.</p> <p>Night time working may deter barn owls from hunting in certain areas.</p>	<p>Barn owls are vulnerable to mortality by road traffic (Ref 8.7), there is potential for an increased risk of barn owl and vehicle collision particularly where the road is at grade or on embankment.</p> <p>The proposed scheme has the potential to result in an increase in suitable hunting areas where the existing A303 is anticipated to be converted to a 'green' byway as this will be safe from vehicle traffic.</p>	<p>A CEMP will be drafted, this will include sensitive working practices to reduce any disturbance impacts. Habitat lost would be mitigated for through habitat creation that will be included as part of the draft Environmental Masterplan.</p> <p>Likely mitigation measures would include construction of cuttings or mounds to increase the flight height and therefore minimise the risk of barn owl mortality by collision with traffic.</p> <p>Planting design would take movement of barn owls into account and aim to direct them away from the carriageway.</p> <p>Additional enhancement measures could include the provision of owl boxes in suitable locations away from the A303.</p> <p>It is not possible to predict a significant effect at this stage. This will be fully assessed within the ES.</p>	<p>Assessment ongoing – to be reported in the ES.</p>

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Stone curlew	<p>Data obtained from the RSPB and the breeding bird survey, identified that stone curlew are consistently breeding within Normanton Downs RSPB reserve and in other suitable habitat within the study area.</p> <p>It is considered likely that the breeding population of stone curlew present in Normanton Downs RSPB Reserve mixes with the breeding population within Salisbury Plain SPA and as such the population within the study area is considered to support the breeding population within the SPA.</p> <p>Normanton Downs has been recorded to support a large post-breeding aggregation of stone curlew, with a peak count of 105 birds being recorded within September 2017 (RSPB data). The birds were recorded to be moving between suitable habitat to the north and south of the proposed site boundary.</p>	<p>Temporary habitat loss may result in the loss of suitable breeding and foraging habitat, which has the potential to reduce the breeding success of the local population.</p> <p>Stone curlews are considered to be particularly vulnerable to human disturbance as they nest on the ground in open areas. Increased construction activities (specifically increased human activities within and adjacent to suitable breeding habitat) have the potential to disturb breeding birds. Frequent or prolonged disturbance may result in birds leaving their nests for long periods of time resulting in unviable broods or increased losses to predation, potentially reducing recruitment to the population.</p>	<p>The diversion of the A303 into a tunnel is expected to encourage movement of people from Stonehenge onto Public Rights of Way across the wider WHS and beyond. This has the potential for long-term increased levels of human disturbance, which may result in the permanent reduction of the breeding success of stone curlew in the vicinity of popular areas.</p>	<p>A CEMP will be drafted. This will include sensitive working practices, use of visual screening and potential restriction of seasonal activities.</p> <p>In order to avoid disturbance impacts from construction activities, it may be necessary to deter stone curlew from plots close to the proposed scheme through vegetation manipulation. Should this be necessary an alternative plot would be required. It is likely that monitoring of areas with new plots would be required in order to determine effectiveness.</p> <p>Mitigation measures may include visitor management (See Salisbury Plain SPA in section 8.6).</p> <p>At this stage the proposed scheme may result in adverse effects on the breeding population of stone curlew from indirect disturbance during the operational phase.</p>	Yes

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Quail	Although quail was not recorded during the 2016 and 2017 surveys the grassland and arable habitats are considered suitable for this species. The population size of the migratory species varies markedly from year to year and is considered likely that the species breeds within study area occasionally.	At this point in time no adverse impacts on quail are anticipated.	At this point in time no adverse impacts on quail are anticipated.	At this stage, it is considered unlikely that the proposed scheme would have a significant effect on quail populations. Mitigation measures are therefore not anticipated to be needed.	No
Great bustard	A known great bustard release site is located within the study area and monitoring by the Great Bustard Group indicates breeding.	Construction activity may cause disturbance.	The anticipated increase of vehicular speeds has the potential to result in an increase in the risk of vehicular collisions and increased mortality in areas where the road is not tunnelled. It is anticipated that there will be an overall increase in foraging habitat and connectivity where the existing A303 is anticipated to be converted to 'green' byway and in other areas of habitat created as part of the proposed scheme.	The requirement for mitigation measures will be assessed within the ES, following the confirmation of the proposed scheme design. Mitigation measures may include visual barriers for construction sites.	Assessment ongoing – to be reported in the ES.

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Bats	Surveys have been completed, though analysis and reporting are still in preparation. A detailed assessment of the impacts on bats will be undertaken within the ES.	<p>Vegetation clearance activities associated with the proposed scheme have the potential to result in the direct loss of bats roosts and potential roosting features.</p> <p>The proposed scheme could result in the direct loss of habitat between established important bat foraging, commuting, and roosting habitat. The severance of these connective habitats may result in a barrier effect which could result in a reduction in foraging success and thus breeding success.</p> <p>Increased levels of noise, light and vibration associated with construction activities has the potential to result in disturbance impacts on roosting bats if adjacent to roosts.</p> <p>Night time construction working activities may result in increased lighting requirements, this may cause disruption to bats foraging and commuting within the study area.</p>	The lighting regime associated with the proposed scheme is expected to be limited to the roundabouts and approaches.	<p>Potential mitigation measures may include suitable working methods to be implemented under an EPS licence. The CEMP will include sensitive working measures including management of lighting during construction. Mitigation to reduce severance impacts will include a combination of suitable habitat creation and green bridges as detailed within the draft Environmental Masterplan.</p> <p>Further surveys will be required to determine the effectiveness of any mitigation for significant effects.</p> <p>The lighting design will avoid lighting within the WHS and minimise lighting elsewhere. Countess Roundabout is crossed by bats but lighting will be retained there for operational reasons.</p> <p>It is not possible to predict a significant effect at this stage.</p> <p>This will be fully assessed within the ES.</p>	Assessment ongoing – to be reported in the ES.

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Hazel dormouse	No evidence of hazel dormouse was identified during the field surveys and are considered to be absent from the study area.	Hazel dormouse is assumed to be absent from the study area, as such, no impacts on this species is anticipated.	Hazel dormouse is assumed to be absent from the study area, as such, no impacts on this species is anticipated.	None required	No
Water vole	On completion of the water vole surveys, a detailed assessment of the impacts on water vole will be undertaken within the ES. Recent records were returned from the records centre for the study area. This included records within the River Avon, adjacent to the proposed site boundary and within the wider area of the River Till.	No direct impacts are anticipated as no construction works will occur on the River Avon as the river crossing will be on an existing bridge. The proposed construction activities associated with the River Till viaduct will be restricted to the River Till floodplain. Any potential works within 50m of the River Till banks are not expected to involve construction in the river. Other indirect effects include disturbance during the construction of the River Till viaduct.	The shading impacts associated with the crossing structures over the River Till may reduce the habitat suitability for water vole through reduction of vegetation (which provides cover and a food source) if presence is confirmed in the winterbourne section of the River Till.	A pre-construction survey for water vole would be undertaken along the River Till ahead of any construction activities if considered necessary, to confirm any burrow locations. A CEMP will be drafted in order to mitigate any potential construction impacts on water vole if present. A shading study has been undertaken and the results have informed the preferred design of the twin deck viaduct in order to minimise the impact of shading on the River Avon SAC. At this stage, it is considered unlikely that there would be any significant effects in either the construction or operational phases as there would be no direct habitat loss and disturbance would be avoided. This will be fully assessed within the ES on confirmation of the baseline.	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Otter	<p>On completion of the otter surveys, a detailed assessment of the impacts on otters will be undertaken within the ES.</p> <p>Recent records were returned from the records centre for the River Avon and River Till including road mortalities on the current A303 near the River Avon. It is considered likely that otter uses the River Avon and River Till as corridors for commuting and potentially hunting and will therefore be passing through the proposed site boundary at potentially two locations.</p>	<p>No construction works will occur in the River Avon as the river crossing will be on an existing bridge. As such no direct impacts such as habitat loss are anticipated.</p> <p>The habitats surrounding the River Till are not considered suitable to support otter holts or resting places, so construction activities associated with the River Till viaduct are unlikely to result in disturbance, damage or destruction of otters within their resting places.</p> <p>It is likely that otters are using the River Till for commuting purposes. As such, construction activities, particularly if night time works are likely, may disturb otters commuting along the River Till.</p>	<p>Once the viaduct across the River Till is in place, it will not result in any severance impacts, as otters will be able to move freely underneath the viaduct.</p> <p>There is potential for an increased risk in otter road mortality along sections of the A303 near the River Avon. The inclusion of a concrete central reservation within these sections will prevent crossing of the carriageway, but may not stop attempts.</p>	<p>A pre-construction survey for otter would be undertaken along the River Till ahead of any construction activities to confirm continued absence of resting features, if considered necessary.</p> <p>A CEMP will be drafted with sensitive working practices to mitigate any impacts from disturbance.</p> <p>It may be necessary at construction and operational stage to include fencing or safe crossing features to prevent otters accessing sections of roads in proximity to the River Avon where previous road casualties have been recorded.</p> <p>As part of the developing drainage design the potential for otter to cross via existing or new culverts near the River Avon will be assessed.</p> <p>At this stage, it is considered unlikely that there would be any significant effects.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
Badger	<p>A total of 85 badger setts were identified within 125m from the proposed site boundary, of which, one main, two subsidiary, and 18 outlying badger setts were located either within the proposed site boundary or within 20m of the proposed site boundary. Following the update of the survey boundary, this number is likely to change. Further badger surveys will be undertaken where necessary to update the baseline.</p>	<p>An unconfirmed number of outlying setts are likely to be lost or significantly disturbed. It is currently unknown whether the main badger sett located within the proposed site boundary will be lost.</p> <p>Night time working practices have the potential to disturb or deter badgers from foraging within certain areas, although badgers tend to become habituated to these impacts in a relatively short period of time.</p> <p>It is anticipated that there will be an overall increase in foraging habitat from the new habitats created in the scheme.</p>	<p>There is potential for an increased risk in badger road mortality along above-ground sections of the A303. This is likely to be exacerbated by the inclusion of a concrete central reservation within these sections.</p> <p>The proposed scheme has the potential to result in fragmentation of clan territories associated with the new sections of the A303 where the scheme is not tunnelled and reduce it at the section where the scheme is in tunnel.</p>	<p>A pre-construction survey for badger would be undertaken within the proposed site boundary ahead of any construction activities if considered necessary to update the baseline.</p> <p>A CEMP will be drafted; this will include sensitive working practices. Any badger sett closures would be undertaken under an appropriate licence. Depending on the classification of the setts to be lost, the provision of artificial setts may be necessary. The provision of crossing structures, suitable for badgers, especially the green bridges detailed within the draft Environmental Masterplan, would mitigate for the potential road mortalities and would reduce any impacts of severance of territories.</p> <p>At this stage, it is considered unlikely that there would be any significant effects.</p>	No
Other species of principal importance	<p>The desk study identified records of following species of principal importance: Hedgehog (<i>Erinaceus europaeus</i>), brown hare (<i>Lepus europaeus</i>), harvest mouse (<i>Micromys minutus</i>) and polecat (<i>Mustela putorius</i>).</p> <p>Hedgehog records are located throughout the study area, with the</p>	<p>Direct impacts on hedgehog, brown hare, harvest mouse and polecat have the potential to occur through loss and / or fragmentation of suitable habitat during the construction of the proposed scheme.</p> <p>Other indirect impacts may include disturbance during the construction works.</p>	<p>During the operational phase of the proposed scheme, there is potential for an increased risk in species mortality from vehicle collision along sections of the A303 that will not be diverted into the tunnel.</p> <p>The conversion of the existing A303 to the 'green' byway coupled</p>	<p>The proposed green bridges and habitat creation detailed within the draft Environmental Masterplan would link up existing habitats within the wider landscape improving connectivity and it is expected that there would be a net gain in semi-natural habitats.</p> <p>At this stage, it is considered unlikely that there would be any significant effects.</p>	No

Receptor	Baseline	Potential Impacts (Construction)	Potential Impacts (Operation)	Design, Mitigation & Enhancement Measures and Potential Effects ¹	Likely significant effect following mitigation?
	<p>majority of records around Amesbury. Hedgehog is likely to be present within the proposed site boundary.</p> <p>Brown hare is known to be particularly abundant on Salisbury Plains and chalk downs, records are located throughout the study area including two road mortalities on the A303. Brown hare is likely to be present within the proposed site boundary.</p> <p>One record of harvest mouse is located at Countess farm to the east of the proposed scheme.</p> <p>Seven records of polecat are located within the study area including two road mortalities, there is potential for the presence of harvest mouse and polecat within the proposed site boundary.</p>		<p>with the tunnel may reduce existing severance.</p>		

Ecosystems

8.6.79 An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. Based on the current design, it is unlikely the proposed scheme would result in any biophysical changes that would have significant impacts on the ecosystem structure and function (the ecosystem's ability to support the characteristic habitat and species populations, or, integrity). This will be fully assessed within the ES on completion of the final detailed design and the updated baseline reports.

8.7 Biodiversity enhancement measures and opportunities

- 8.7.1 Further biodiversity enhancement opportunities have arisen from essential mitigation activities associated with landscaping, materials management and drainage activities. Enhancement measures include creation of additional chalk grassland habitats on new embankments, new cuttings and on the proposed green bridges and the 'green' byway.
- 8.7.2 There are considerable opportunities for habitat creation within the proposed scheme. The slopes of cuttings and embankments offer opportunities for mosaics of habitats, including sparsely vegetated chalk slopes with food plants for butterflies and areas for other wildflower grassland and scrub. There is scope for planting of new woodland and hedgerows in appropriate areas outside the World Heritage Site to help extend or connect existing woodland or hedges. This may be required as mitigation to help facilitate crossing of the proposed scheme by bats, but also to extend existing habitats.
- 8.7.3 Additional excavated material would be used to integrate embankments and the tops of cuttings into the surrounding landscape. New habitats would be created on the filled embankments. The extent of these new habitats would depend on the landform in each case and how much would be retained as habitat in the 'soft estate' of the A303 or returned to agriculture. Drainage infiltration basins offer scope for intermittently wet areas of habitat and there is the potential for creation of small wetlands as part of the draft Environmental Masterplan.
- 8.7.4 One of the aims for biodiversity enhancement is to facilitate the spread of invertebrates, such as butterflies of chalk grassland, from their core areas of habitat to other existing and new habitats. This would be achieved by using habitats created as part of the scheme. There is scope for re-connecting semi-natural habitats via the creation of a new 'green' byway extending along several kilometres of former highway, with at least part of the width of the 'green' byway converted to chalk grassland. In addition, there would be green bridges within the proposed scheme, with slopes or bunds supporting wildflower grassland and providing sheltered habitat links across the proposed scheme and into adjacent habitats along the soft estate and adjacent areas.
- 8.7.5 The creation of new habitat would assist in the realisation of the Highways England Biodiversity Plan (HEBAP) to protect and increase the biodiversity on the roads network as part of their 2017 Environment Strategy and in order to

contribute towards the Government's aims detailed within the Biodiversity 2020' strategy. Suitable management of cuttings and green bridges included within the final design would be guided by the principles of Natural England's The Mosaic Approach: Managing Habitats for Species to improve biodiversity, specifically targeting priority habitats and species (Ref 8.10).

8.7.6 The development of the final design (inclusive of mitigation and enhancement measures) is anticipated to result in an overall net gain in biodiversity and this aligns with Highways England's objective in working towards no net loss of biodiversity.

8.8 Assessment of effects

8.8.1 The effects have been assessed following consideration of the potential impacts outlined in section 8.6 and the mitigation measures in section 8.7.

8.8.2 As set out in section 8.6 and Table 8.5 above, Biodiversity Receptors have been identified, the potential impacts from the scheme on those receptors have been described and the effects assessed, based on the current stage of the scheme design, the draft Environmental masterplan and the baseline information available. At the time of writing, the evaluation of the geographic scale of importance of the receptors has not yet been carried out for all the receptors in accordance with CIEEM (2016). The full assessment will be included in the ES after completion of baseline surveys and their analysis, further surveys as necessary, and the further development of the draft Environmental Masterplan (Figure 2.4).

8.8.3 A Habitat Regulations Assessment (HRA) Screening will be conducted for each SAC and SPA. If a likely potential significant effect is expected, this will determine the requirement for an Appropriate Assessment. Details of the HRA Screening and any subsequent assessments will be included within the ES. Notwithstanding this, Highways England has been and will continue to liaise with the relevant stakeholders to ensure that the proposed scheme includes the requisite measures to ensure that the integrity of the River Avon SAC and the Salisbury Plain SAC and SPA is not adversely affected.

8.8.4 Two biodiversity Receptors for which the potential for significant adverse effects prior to mitigation is being considered are: a) a section of the River Avon SAC comprising the River Till SSSI (and associated species); and b) breeding stone curlew.

8.8.5 At the River Till, in the vicinity of the viaduct, there is the potential for adverse effects due to runoff during construction and from shading by the viaduct. The mitigation provided by design avoids any need for temporary or permanent construction within the SSSI/SAC. A twin-deck viaduct across the River Till SSSI has been included in the design to avoid the loss of vegetation under the viaduct due to shading. In addition, the methods of working that will be required by the CEMP will mitigate indirect impacts of construction due to siltation. Together, this mitigation is expected to avoid significant adverse effects on the interest features of the River Till SSSI, and hence the River Avon SAC.

- 8.8.6 The stone curlew population is considered to be part of the supporting population for the Salisbury Plain SPA. There is potential for human disturbance near breeding sites during construction. After construction of the scheme there would be an indirect impact of potential improvement of access by visitors to the WHS and local recreational users.
- 8.8.7 The issue of potential disturbance to stone curlew has not been fully resolved at this stage. The long-term effects of disturbance of stone curlew by visitors to the World Heritage Site and local recreational users requires further assessment, but Highways England is committed to providing the requisite mitigation to ensure that there are no unacceptable adverse residual effects of the scheme on the integrity of the SPA.

Summary of preliminary assessment

8.8.8 Preliminary Construction Assessment:

- Construction activities would have likely significant temporary adverse effects on Stone Curlew.
- The proposed scheme would have likely significant permanent beneficial effects on chalk grassland habitat in the vicinity of Parsonage Down.
- The integrity of the River Avon SAC (incorporating the River Till SAC) and the Salisbury Plain SAC and SPA would not be adversely affected by the proposed scheme.

8.8.9 Preliminary Operational Assessment:

- Due to the increased public access across the WHS enabled by the proposed scheme, there would be likely significant local adverse effects on Stone Curlew south of the A303.
- The proposed scheme would have likely significant beneficial effects on ecological connectivity due to the tunnel and the inclusion of green bridges.

8.9 Corridors for utility connections

Western connection route

- 8.9.1 Habitats in this area include mainly arable fields, as well as broadleaved woodland, grassland, hedgerows and trees. A survey is currently being undertaken to provide baseline information for this area. The route would be mainly restricted to highways and byways and is proposed to cross over the River Avon SAC/ River Till SSSI on an existing bridge.

Potential impacts (Construction)

- 8.9.2 Direct impacts through habitat loss are anticipated during the construction of the extension to Stapleford substation. Temporary habitat loss is anticipated for the remainder of the route, although removal of hedgerows and trees would be avoided as far as reasonably practicable. Crossing the River Till on

an existing bridge would avoid loss of habitat within the River Avon SAC/ River Till SSSI. Indirect impacts associated with construction, such as siltation or pollution, would be mitigated by implementing the measures that will be included in the Outline Construction Environmental Management Plan (CEMP). The extent of land take from semi-natural habitats will be assessed in detail once the design of this component of the proposed scheme has been completed.

Potential impacts (Operational)

- 8.9.3 No direct or indirect impacts are anticipated during operation.

Design, mitigation and enhancement measures

- 8.9.4 The Outline CEMP will include measures to avoid impacts on trees located in proximity of the power connection corridor, such as fencing off tree root protection zones and preventing run-off into the River Avon SAC/ River Till SSSI.

- 8.9.5 No likely significant effects are anticipated.

Eastern connection route

Baseline

- 8.9.6 Habitats within or directly adjacent to the works associated with the eastern power connection have been identified from Phase 1 habitat survey across in the 2016 and 2017 study area and aerial photography. An update survey is currently being undertaken to provide baseline information for this area. Habitats identified within both the proposed route alternatives include grassland, broadleaved woodland, hedgerows and trees. The corridor also include the crossing of the River Avon SAC/River Avon System SSSI and Countess Farm Swamp CWS.

Potential impacts (Construction)

- 8.9.7 The direct impacts depend on the corridor alternative selected. Direct impacts are anticipated through permanent habitat loss associated with the extension of the substations and temporary habitat loss associated with the construction of the HV route. The longer alternative would involve loss of the track and verges of existing access tracks with little semi-natural habitat and it would cross the River Avon SAC on an existing road bridge, which would be re-surfaced as part of the scheme. The more direct alternative across the SAC/SSSI would include habitat loss within Countess Farm Swamp CWS. The SAC/SSSI itself would not be directly affected, as the power connection would either be routed overhead or routed beneath the river although temporary indirect impacts on the River Avon SAC/River Avon System SSSI are anticipated during the construction of the new river crossing, associated with potential run-off into the river. These potential impacts would be mitigated by the measures included in the Outline CEMP.

Potential impacts (Operational)

- 8.9.8 No direct or indirect impacts are anticipated during operation.

Design, mitigation and enhancement measures

- 8.9.9 The Outline CEMP will include measures to avoid impacts on trees located in proximity of route, such as fencing off tree root protection zones and preventing run-off into the River Avon SAC/ River Avon System SSSI. The requirement for further mitigation measures will be assessed within the ES on competition of the scheme design.
- 8.9.10 Given the additional habitats creation measures in the draft Environmental Masterplan, no likely significant effects are anticipated.

9 Noise and Vibration

9.1 Introduction

- 9.1.1 This chapter presents the findings of a preliminary assessment of temporary noise and vibration impacts during the construction phase and permanent noise and vibration impacts during the operational phase.
- 9.1.2 The assessment to date has been undertaken following the methodology for a 'scoping' assessment, as described in DMRB Volume 11, Section 3, Part 7, HD 213/11 Revision 1 (Ref 9.1) with due regard to the requirements of the National Policy Statement for National Networks (NPSNN) (Ref 9.2), the National Planning Policy Framework (NPPF) (Ref 9.3) and the aims of the Noise Policy Statement for England (NPSE) (Ref 9.4). A 'detailed' assessment will be undertaken as part of the EIA and reported within the ES, based on the methodology provided in the Scoping Report.

9.2 Stakeholder engagement

- 9.2.1 Discussions have been held with representatives from Wiltshire Council Public Health and Public Protection Department to discuss the approach to the noise and vibration assessment (including the proposed baseline noise survey), as presented in the Scoping Report, and to gather information relating to:
- a) local noise sources other than road traffic (i.e. MOD activities including firing noise from Salisbury Plain and low flying helicopters and planes from Boscombe Down);
 - b) future developments in the area, which will feed into the traffic modelling work;
 - c) any receptors requiring particular attention (nothing identified);
 - d) local concerns that Wiltshire Council are aware of (no existing noise/vibration concerns relating to the A303 identified);
 - e) specific requirements relating to construction (working hours / noise and vibration limits and preference to adopt the Control of Pollution Act (COPA) Section 61 approach. In addition Wiltshire identified the potential issue of 24hr generators at construction compounds and expressed a preference for permanent power supplies); and
 - f) local knowledge of, and current mitigation proposals (if any) for, Noise Important Areas on the A345 north/south of Amesbury, for which Wiltshire Council are responsible (no current mitigation proposals).
- 9.2.2 Subsequent to the discussion, a plan showing the study area for the noise and vibration assessment and a plan showing the proposed noise and vibration monitoring locations were provided to Wiltshire Council Public Health and Public Protection Department.

9.3 Assessment assumptions and limitations

Construction Noise and Vibration

- 9.3.1 At this stage, details of the construction traffic, construction schedule, construction methodology and plant requirements are not yet confirmed. Therefore, for this preliminary assessment a qualitative construction noise and vibration assessment has been carried out, based on the application of best practicable means to minimise noise and vibration levels. A quantitative assessment of noise and vibration impacts arising from construction works will be undertaken as part of the EIA and reported within the ES that will be submitted with the DCO application.

Operation

- 9.3.2 The operation of the proposed scheme would affect traffic noise and vibration levels as experienced by sensitive receptors, including occupiers of residential properties in the vicinity of the proposed scheme and along affected roads on the local road network. Other sensitive receptors include community facilities and scheduled monuments, as well as the WHS. The detailed noise and vibration assessment in the EIA and ES will be based on detailed traffic modelling data which is currently being prepared. In this PEI Report we have described potential increases/decreases in traffic noise levels based on traffic data estimated for the options selection stage.
- 9.3.3 Impacts on quiet areas and tranquillity will be considered as part of the landscape and visual effects assessment, and noise and vibration impacts on ecologically sensitive receptors will be considered as part of the biodiversity assessment.
- 9.3.4 Ordnance Survey (OS) Address Base data have been used to identify potentially sensitive buildings.

9.4 Study area

- 9.4.1 The study area has been defined in accordance with guidance given in DMRB which aims to identify any potentially significant effects of the proposed scheme.
- 9.4.2 The study area for the qualitative assessment of construction phase noise and vibration impacts has been focussed on the closest identified receptors to the various works.
- 9.4.3 The study area for the assessment of operational phase noise impacts comprises an area extending to 0.62 mile (1km) from the proposed scheme and the existing A303 replaced by the proposed scheme.
- 9.4.4 The proposed scheme, the 0.62 mile (1km) study area, and sensitive receptors within the study area are shown in Figure 9.1 and 9.2.

9.5 Baseline conditions

- 9.5.1 The study area is predominantly rural in nature. Road traffic noise from the existing A303 is a readily appreciable problem that affects the setting of the WHS. Other sources of road traffic noise include the A360, A345 and other local roads. The existing A303 also passes close to residential properties at Amesbury and Winterbourne Stoke, and the A345 runs through Amesbury and adjacent to Larkhill and Durrington.
- 9.5.2 The area is subject to occasional noise from light aircraft, military aircraft and other military activities.
- 9.5.3 Under the Environmental Noise Directive (END) (Ref 9.5) strategic noise mapping of major roads, railways, airports and agglomerations has been completed across England, including for the A303. Five 'Noise Important Areas' (those areas most exposed to noise) were identified in the Round 2 strategic noise mapping (carried out in 2012) in the vicinity of the proposed scheme. The two Noise Important Areas on the existing A303 in Winterbourne Stoke (3527 and 3528) are the responsibility of Highways England and mitigation will be considered as part of the proposed scheme. The three Noise Important Areas in Amesbury are the responsibility of the local Highways Authority (12681, 12682 and 12683), though the impact on these areas will be considered as part of the EIA.

Existing Noise Barriers

- 9.5.4 No existing noise barriers have been identified within 0.62 miles (1km) of the proposed scheme.

Road Surfacing

- 9.5.5 The following assumptions have been made with regard to road surfacing based on information on current road surfacing in the area, Highways England's future maintenance proposals, and Highways England's proposals for the surfacing of the proposed scheme:
- a) A303 and A36 (roads maintained by Highways England) within the study area in all scenarios both with and without the scheme - low noise surfacing; and
 - b) all other roads in the study area - standard hot rolled asphalt (HRA) in all scenarios.

Baseline Noise Survey 2018

- 9.5.6 A baseline noise survey at a selection of locations along the proposed scheme is being carried out in early 2018 as part of the detailed assessment which will be reported in the ES. The results will be used to characterise the noise climate in the area and verify that the calculated noise levels from the road traffic noise model are representative. A weather station installed at one of the monitoring locations will record weather conditions throughout the baseline survey. Baseline vibration monitoring is also proposed at Stonehenge and

Stonehenge Cottages, which represent the closest receptors to the route of the tunnel.

Do-Minimum 2026 and 2041

- 9.5.7 It is anticipated that virtually all the residential buildings and non-residential sensitive buildings in the study area will experience a negligible (0.1 - 2.9 dB) increase in traffic noise levels from 2026 to 2041 in the absence of the proposed scheme, during both the daytime and night-time. This is due to the general growth in traffic over time.

Value (Sensitivity) of Resource

- 9.5.8 Sensitive receptors identified within the 0.62 mile (1km) study area are shown in Figure 9.1 and 9.2.
- 9.5.9 The vast majority of sensitive receptors are residential properties; approximately 2600 have been identified within the study area based on OS address base data.
- 9.5.10 A number of developments are proposed in the wider area and the assessment reported in the ES will include consideration of these developments where they may introduce additional receptors (refer to Chapter 15: Assessment of Cumulative, In-combination and Project-wide Effects).
- 9.5.11 With regard to non-residential receptors, a total of six educational buildings have been identified within the study area, all located within Amesbury.
- 9.5.12 Three medical centres have been identified within the study area, all within Amesbury.
- 9.5.13 A total of five places of worship have been identified within the study area, one in Winterbourne Stoke and four in Amesbury.
- 9.5.14 A total of five community facilities (community centres, sports centres etc) and the Stonehenge Visitor Centre have been identified within the study area, mainly in Amesbury.
- 9.5.15 A total of 180 Scheduled Monuments are located within the study area, the majority of which are barrows. The existing A303 runs through the WHS and approximately 165m from Stonehenge.
- 9.5.16 A number of designated ecological areas: Special Area of Conservation (SAC), Special Protection Area (SPA), and Sites of Special Scientific Interest (SSSI) have been identified within the study area consisting of: Salisbury Plain SSSI, SPA and SAC, River Avon System SSSI and SAC, River Till SSSI and SAC, Parsonage Down SSSI and Yarnbury Castle SSSI.
- 9.5.17 Ecological receptors are specifically referenced in the NPSNN which states that noise from a proposed development can have adverse impacts on wildlife and biodiversity and that noise effects of a proposed development on

ecological receptors should be assessed in accordance with the Biodiversity and Geological Conservation section of the NPSNN. Anticipated traffic noise impacts from the operational noise assessment will inform the assessment of biodiversity impacts.

- 9.5.18 A total of five Noise Important Areas as defined in The Environmental Noise (England) Regulations 2006 (as amended 2008, 2009, 2010) are located within the study area, two of which extend along the existing A303 in Winterbourne Stoke, as shown in Figure 9.1. These are areas identified as currently experiencing high traffic noise levels, and therefore are particularly sensitive to any changes in traffic noise as a result of the scheme.

9.6 Potential impacts

- 9.6.1 The mitigation measures which are being incorporated in the design and construction of the proposed scheme are set out in section 9.7 below. Prior to implementation of the mitigation. A summary of the potential noise and vibration impacts (both positive and negative) associated with the construction and operation of the proposed scheme is outlined below.

Construction Noise and Vibration

- 9.6.2 The main construction activities with the potential for noise and/or vibration impacts that are likely to take place are site clearance, earthworks, retaining wall construction and road construction works, as well as the construction of bridges and the tunnel structure, as well as the related construction traffic. Further details are provided in Chapter 2: The Proposed Scheme.

Operation

- 9.6.3 The operation of the proposed scheme would result in both beneficial and adverse permanent traffic noise impacts. The proposed scheme would bring the road closer to some receptors, and further away from others. The removal of the surface section of the A303 through the WHS and the relocation of much of this section of road into tunnel and deep cutting would significantly reduce road traffic noise levels in the vicinity of Stonehenge and much of this part of the WHS. The relocation of the A303 to the north of Winterbourne Stoke would remove through traffic from the centre of the village and would significantly reduce operational traffic noise levels to receptors along this route.

9.7 Design, mitigation and enhancement measures

Construction Noise and Vibration

- 9.7.1 A Construction Environmental Management Plan (CEMP) would be prepared and implemented by the selected construction contractor. The CEMP will include a range of best practice measures to mitigate potential noise and vibration impacts. Such measures are described below:

- a) selection of quiet and low vibration equipment;

- b) review of construction programme and methodology to consider low noise/ low vibration methods (including non-vibratory compaction plant and low vibration piling methods, where required);
- c) optimal location of equipment on site to minimise noise disturbance;
- d) the provision of acoustic enclosures to static plant, where necessary;
- e) use of less intrusive alarms, such as broadband vehicle reversing warnings;
- f) local screening of equipment and employment of perimeter hoarding; and
- g) implementation of a traffic management plan to mitigate traffic impacts during construction, for example, through the choice of routes, the varying of routes and timing of construction traffic.

9.7.2 During the proposed scheme construction phase, appropriate mechanisms to communicate with local residents would be set up to highlight potential periods of disruption. Residents would be provided with a point of contact for any queries or complaints.

Operation

9.7.3 The proposed scheme would minimise operational impacts by:

- a) selecting a route alignment which takes the road away from residential receptors, most notably in Winterbourne Stoke;
- b) Using a vertical alignment which uses a combination of natural landform and 'false cuttings' to integrate the landscape whilst at the same time, enclosing traffic and reducing noise in adjacent areas;
- c) Setting the route within a tunnel and a deep cutting within the WHS in order to minimise noise impacts on the WHS; and
- d) The use of low noise surfacing to reduce noise at source.

9.8 Assessment of effects

9.8.1 The effects have been assessed following consideration of the potential impacts outlined in section 9.6 and the mitigation measures in section 9.7.

Construction Noise and Vibration

9.8.2 The construction of the proposed scheme would result in temporary noise and vibration impacts to sensitive receptors in the vicinity of the works. Industry standard best practice mitigation measures (as set out above in section 9.7) would be employed throughout the construction works to minimise noise and vibration.

- 9.8.3 The works to construct the proposed scheme would be likely to include the following:
- a) Set up and operation of the main site compound, satellite compounds and the production area for the tunnel;
 - b) Site clearance;
 - c) Earthworks;
 - d) Bridge works (including piling);
 - e) Tunnelling;
 - f) Drainage installation;
 - g) Carriageway surfacing;
 - h) Sign installation;
 - i) Landscaping; and
 - j) Traffic management.
- 9.8.4 The majority of the works would be carried out during the daytime, although night-time works would be required. In particular, the construction of the tunnel would be carried out 24 hours per day.
- 9.8.5 The works which would be likely to result in the largest noise impacts are the longer term earthworks and surface operations associated with the construction of the tunnel through the WHS. Many of the other works are very limited in duration (e.g. sign installation) or relatively fast moving (e.g. drainage installation and carriageway surfacing), resulting in noise impacts at any one receptor, or group of receptors, for limited periods of time.
- 9.8.6 There is the possibility of noise and vibration impacts to sensitive receptors close to any piling works. It is likely that this would only apply to the construction of the elevated section of the proposed scheme over Countess Roundabout where sensitive receptors are in relatively close proximity to the works. The choice of piling method can play a part in minimising these impacts, for example, using bored piling techniques, subject to engineering considerations. The bridge at Longbarrow Junction and the River Till viaduct are reasonably remote from residential properties therefore the potential for significant effects is more limited.
- 9.8.7 It is anticipated that the tunnel would be constructed using a tunnel boring machine (TBM). The ground in this area is relatively soft and it is unlikely that there will be high levels of ground borne vibration.
- 9.8.8 There is a small group of residential properties at Stonehenge Cottages close to the line of the tunnel. Again, given the working method and ground type, it is

unlikely that there would be high levels of noise or ground borne vibration at these receptors.

- 9.8.9 Given the 24 hour working for the tunnel boring, there is the possibility for large noise impacts resulting from the associated surface operations (currently proposed to be located immediately to the west of Longbarrow Junction). However, the nearest residential receptors are at substantial distances from these operations and significant noise effects are considered unlikely.
- 9.8.10 Construction traffic, including the operation of any required diversion routes, can have an impact on sensitive receptors located along existing roads used by these vehicles. The potential for traffic impacts during construction is dependent on the traffic volume and route. Such impacts would be mitigated by the choice of routes, the varying of routes and timing of construction traffic.

Operation

- 9.8.11 It is anticipated that the operation of the proposed scheme would result in an increase in traffic on the A303; including rerouting of traffic which is currently using more minor side roads onto the A303. Therefore, a corresponding decrease in traffic and traffic noise would be expected on routes such as the B3086, B390 and The Packway.
- 9.8.12 Some increases in traffic are possible on local roads such as the B3083 north and south of the A303, which is currently constrained by the junction with the A303, minor roads west of the A303 parallel to the A36 towards Warminster, and minor roads south of Wyllye. However, measures to reduce these potential increases in traffic, with greater use of adjacent A roads, are being investigated as the proposed scheme design and traffic modelling progresses.
- 9.8.13 In Amesbury the increase in traffic on the A303 and the elevation of the mainline over the Countess Junction, combined with some re-routing of traffic within Amesbury, is likely to result in a general negligible/minor increase in traffic noise across the town.
- 9.8.14 Large reductions in traffic noise level are anticipated at Stonehenge Cottages and through the majority of the WHS in the study area, including at Stonehenge, due to the relocation of approximately 1.9 miles (3km) of the A303 into a tunnel.
- 9.8.15 Large reductions in traffic noise through the centre of Winterbourne Stoke are anticipated as the A303 is relocated to the north of the village. Corresponding increases in traffic noise along the route of the proposed scheme to the north of the village are anticipated, which is likely to result in increases in traffic noise at the northern facades of some receptors towards the north of the village.
- 9.8.16 Large changes in traffic noise levels at the Noise Important Areas on the A345 north and south of Amesbury are not currently anticipated. A large reduction in traffic noise levels at the two Noise Important Areas in Winterbourne Stoke is anticipated due to the relocation of the A303 to the north of the village.

- 9.8.17 The works to realign the junction at Rollestone Corner to the north of the A303, which form part of the proposed scheme, are not anticipated to result in significant adverse effects. Traffic flows in this area are anticipated to reduce due to the proposed scheme, and there are very few receptors in the vicinity.
- 9.8.18 Two sections of road which currently connect onto the existing A303 are proposed to be closed as part of the proposed scheme, the north-west end of Stonehenge Road to the west of Amesbury, and Allington Track to the south-east of the A303 east of Amesbury. Corresponding reductions in traffic noise in the vicinity of these roads are anticipated though traffic flows are low and few receptors are located in the vicinity.

Summary of preliminary assessment

9.8.19 Preliminary Construction Assessment:

- Construction activities would have likely significant temporary adverse noise effects for nearby residential properties in close proximity to the works, such as the edge of Amesbury and the northern edge of Winterbourne Stoke.
- Significant adverse vibration effects are considered unlikely.

9.8.20 Preliminary Operational Assessment:

- Operation of the proposed scheme would have likely significant adverse noise effects for properties on the northern edge of Winterbourne Stoke closest to the section of the A303 which is realigned to the north of the village.
- Operation of the proposed scheme would have likely significant beneficial noise effects for residents of Winterbourne Stoke located in close proximity to the existing A303 through the centre of the village.
- Operation of the proposed scheme would have likely significant beneficial noise effects for visitors to the WHS.
- Significant noise effects for residents of Amesbury would not be expected.

9.9 Corridors for utility connections

- 9.9.1 The construction of the potential HV routes, either above ground or below ground, for both the western and eastern power connections and construction activities associated with expansion of the sub-stations is unlikely to result in significant adverse construction noise impacts. This is due to the relatively small scale nature of the works and the relatively short duration of the works in any one location. No works which are a potentially significant source of construction vibration are anticipated.
- 9.9.2 The operation of the extended substations may introduce an additional noise source at these existing sites, or replace an existing noise source. However, if

required, noise mitigation measures in terms of the choice of plant and/or plant enclosures are available. On this basis significant adverse noise effects at nearby receptors are not currently anticipated during the operation of the extended substations.

10 Geology and Soils

10.1 Introduction

10.1.1 This chapter describes features relevant to geology and soils in relation to the proposed scheme, and it describes the impacts and effects that are anticipated. This chapter also outlines proposed design and other measures to help mitigate these potential effects.

10.2 Stakeholder engagement

10.2.1 To inform development of the Geology and Soils assessment, discussions have taken place with Wiltshire Council during which environmental and ecological aspects of the proposed scheme were discussed. Wiltshire Council identified possible contaminated land sites which include Larkhill (former aerodrome and current Royal School of Artillery), historic landfills and areas where Ministry of Defence houses were historically present. Further consultation with Wiltshire Council will be undertaken as the EIA is completed.

10.2.2 Liaison has also been undertaken with Wiltshire Council and the Environment Agency to obtain records of licensed private and commercial groundwater abstractions within the study area. Further details are provided in Chapter 11 (Road Drainage and the Water Environment).

10.2.3 The Wiltshire Geology Group will be consulted to seek their views on any local geological features.

10.3 Assessment assumptions and limitations

10.3.1 The assessment undertaken for the PEI Report has been based on the collation and evaluation of available documentation provided by the Environment Agency, BGS, Envirocheck historical mapping (Ref 10.7), Groundsure Geo and Enviro Reports (Ref 10.2 and 10.6) and other data sources made available including the Preliminary Sources Study Report (Ref 10.8). Further information will be obtained to complete the EIA.

10.3.2 Baseline information on ground stability will be included in the ES, although the assessment of structural and engineering geology will be undertaken as part of the Ground Investigation Report (GIR). An additional and separate land stability report will also be prepared that will assess ground stability with a particular focus on slope stability, chalk dissolution and also tunnel movement and the impact on infrastructure, structures and heritage assets. Both the GIR and land stability report will be submitted as part of the application. The ES will summarise these assessments but reference the reports accordingly.

10.3.3 The currently available Envirocheck and Groundsure data does not include coverage for the full extent of the study area. There are currently data gaps in the areas to the east and west of the proposed scheme and along the amended High Load Route and the Diversion Route. This additional data will be obtained and included in the EIA.

10.4 Study area

- 10.4.1 The study area for the land contamination assessment comprises the proposed scheme, which includes the proposed High Load Route and the Diversion Route and an additional buffer of 250m. This area is considered appropriate for the consideration of historical and current potentially contaminative land uses and it aligns with established industry practice for defining land contamination study areas for EIA.
- 10.4.2 An extended buffer of 0.62 miles (1 kilometre) has been considered for groundwater, surface water and potable water abstractions as potential receptors to any land contamination.
- 10.4.3 For the remainder of the topic and other receptors e.g. minerals and geological sites, the study area comprises the proposed site boundary; since these receptors are only likely to be impacted on where the proposed scheme directly crosses, or interfaces with them.
- 10.4.4 Groundwater risk assessments will take into account a larger study area, to encompass areas to be used for construction, and the zone of influence on Water Framework Directive (WFD, 2000/60/EC) (Ref 10.1) groundwater bodies and groundwater Source Protection Zones (SPZ) from de-watering required for construction. Further details are provided in Chapter 11 (Road Drainage and the Water Environment).

10.5 Baseline conditions

Geology

- 10.5.1 Made Ground is not mapped within the proposed scheme study area. However, it is anticipated to be present in areas of previous and existing development and along existing highways. Available historical reports indicate that occasional anthropogenic inclusions of brick, bitumen, concrete, tarmac, ash, clinker, geotextile and metal have been identified in Made Ground present at the existing Countess and Longbarrow roundabouts. Within the northern section of the proposed scheme, south of the eastbound carriageway of The Packway (road), there are areas indicated by the British Geological Survey (BGS) as being areas of “artificial ground”. Areas of “artificial land” are also shown associated with Larkhill, within 250m of the proposed scheme. There is also the possibility for Made Ground associated with infilled ground. Based on information contained in the Groundsure Geo Insight Report (Ref 10.2), it is known that there are chalk pits, gravel pits, ground workings, cuttings, covered reservoirs, and infilled ponds within the study area.
- 10.5.2 Localised superficial deposits are present underlying the proposed scheme. River Terrace Deposits, Alluvium and Peat associated with the River Avon are present in the eastern part of the proposed scheme. Alluvium surrounds the channel of the River Till towards the west of the proposed scheme. Head Deposits are present within the study area, typically following the dry valley bottoms which are associated with former/seasonal surface water and/or groundwater flows.

- 10.5.3 The bedrock underlying the study area comprises an Upper Cretaceous succession of the Chalk group, including the Newhaven and Seaford Chalk Formations. The majority of Chalk lithologies exposed in the study area belong to the Seaford Formation. An area in the vicinity of Stonehenge Down is underlain by the Newhaven Chalk Formation (which is known to contain distinct Phosphatic Chalks of limited lateral extent). A fault line exists on the eastern boundary of the Newhaven Chalk Formation and trends in a north-south direction, located approximately 500m to the east of the Stonehenge Monument (hereafter referred to as 'the Stones'). The fault crosses the existing A303 immediately east of the former A303 and A344 junction.
- 10.5.4 Historical ground investigations in and around the study area have shown Alluvium to be present in the Till Valley in Winterbourne Stoke to depths of between 3m and 5m below ground level (bgl) and in the Avon Valley to depths of up to 7.5m bgl. The Alluvium associated with the River Till was recorded to comprise flint gravel with Chalk clasts, and lenses and layers of sand, silt and clay. Alluvium associated with the River Avon consists of three distinct units of cohesive Alluvium, Peat and granular Alluvium. Local Head deposits, where encountered, were recorded at depths no greater than 1m to 2m bgl in the base of dry valleys. River Terrace Deposits were encountered in one exploratory hole location in the vicinity of the River Till to a depth of 8.6m bgl and it was proven here to be 8m thick.
- 10.5.5 Highly weathered Chalk bedrock has been found to outcrop at the surface in so-called 'interfluvial' zones (areas between watercourses) where superficial deposits are absent. Phosphate nodules were encountered in the Chalk at depths of between 4.3m and 22.45m bgl in three exploratory holes located to the south east of the proposed western tunnel portal.
- 10.5.6 Information contained within the Groundsure Geo Insight Report (Ref 10.2) indicates that the following natural ground hazards may exist across the proposed scheme study area:
- a) there is a negligible to very low potential for shrinkage/swelling of clays;
 - b) there is a negligible to moderate potential for landslides;
 - c) there is a very low to low potential for ground dissolution of soluble rocks;
 - d) there is a negligible to high potential for compressible deposits;
 - e) there is a negligible to very low potential for collapsible deposits; and
 - f) there is a negligible to low potential for running sands.
- 10.5.7 There are no geological Sites of Special Scientific Interest (SSSI) or Local Geological Sites (LGS) within the study area (Ref 10.3). These features are therefore scoped out of the assessment.

Mining and mineral resources

- 10.5.8 The Wiltshire and Swindon Aggregate Minerals Site Allocations Local Plan (2013) (Ref 10.4) identifies no Mineral Consultation Areas (MCA), Mineral Safeguarding Areas (MSA) or Preferred Areas (PA) within the study area. Similarly, there are no active mines, quarries or designated mineral resources in the study area. These features are therefore scoped out of the assessment.

Soils

- 10.5.9 The 1:250,000 soil map of South East England published by the Soil Survey of England and Wales in 1983 (Ref 10.5) shows the soils to be mainly shallow, calcareous soils over Chalk. Most widespread on the gently rolling downland is the Andover 1 association of calcareous silty soils over Chalk at shallow depth. Almost as extensive is the Icknield association of soils distinguished from the Andover by their blackish humose topsoils. On steeper slopes there is the Upton 1 association of shallow, well drained, silty soils over Chalk. In the valley of the River Till at Winterbourne Stoke there is the Coombe 1 association of deep calcareous silty soils in colluvium (soil material deposited by hillwash and soil creep).
- 10.5.10 Agricultural Land Classification and associated soils are addressed further in Chapter 13 (People and Communities).

Land contamination

- 10.5.11 Data obtained from the Environment Agency and the local authority that is contained in the Groundsure Enviro Insight Report (Ref 10.6), along with historical Ordnance Survey mapping (Ref 10.7), aerial mapping and site walkover records, have been reviewed to identify current and historical possible contaminative land uses. A summary of the key areas of land identified within the study area is presented in Table 10.1.

Table 10.1: Summary of possible sources of land contamination within the study area

Possible Sources Within the Study Area	Number of Features Within the Scheme
Fourteen Farms/Farm Buildings	Three within the proposed scheme
Military Land Use: a) Former RAF Oatlands Hill (1941–1946); b) Rolleston Camp; c) Weapons Store (Tank Artillery) (associated with Larkhill); d) Larkhill (Former Aerodrome and Current Royal School of Artillery); e) Former RAF Stonehenge (1917–1921); and f) Former RAF Lake Down (1917–1924).	Three within the proposed scheme: a) RAF Oatlands Hill; b) RAF Stonehenge; and, c) RAF Lake Down.
Fuel Filling Stations: a) Winterbourne Stoke Filling Station; b) Amesbury Filling Station; c) Countess Filling Station;	High Pressure Esso Oil Pipeline.

Possible Sources Within the Study Area	Number of Features Within the Scheme
d) Coop Filling Station; and e) Larkhill Road Filling Station. High Pressure Esso Oil Pipeline	
Industrial Uses (current and former) including: a) Dairy; b) Historic Engine House; c) Former Larkhill Military Light Railway; d) Grain Production/Store facility; e) Former RAF Stonehenge Sewage Works and sewage outfall; f) Scrap Yard; g) Former Gas Works; h) Household Waste Facilities; i) Historic Engine Sheds (1926); j) Five Vehicle Repair Garages; k) Former SR Bulford Extension Railway (1924–1937); l) Industrial Repairs and Servicing; m) Precision Engineers (Engineering Services); n) Depot and Warehousing; o) Historic Barn and Above Ground Tank (1877–1961); p) Former Stonehenge Pedigree Stock Farm (1924–1926, on the site of the former RAF Stonehenge); q) Painting Contractors; r) Laundry; s) Ready Mix Concrete Plant; and t) Business Park.	Four within the proposed scheme a) Former Larkhill Military Light Railway; b) Former sewage outfall associated with former RAF Stonehenge Sewage works; c) Historic barn and above ground tank (1877–1961); and d) Former Stonehenge Pedigree Stock Farm (1924–1926, on the site of the former RAF Stonehenge).
Eight Electricity Substations	None within the proposed scheme.
Four Pumping Houses/Stations	All within the proposed scheme.
High pressure oil pipeline	Within the proposed scheme
17 areas of potential infilled ground including former pits, former reservoirs, infilled cuttings, ponds, quarries and tips.	Four within the proposed scheme.

10.5.12 The Groundsure Enviro Insight (Ref 10.5) shows the following features to be absent from the study area:

- a) authorised landfills;
- b) recorded historical landfills;
- c) industrial facilities with Integrated Pollution Prevention and Control;
- d) Control of Major Accident Hazards facilities; and

e) hazardous substance consents.

10.5.13 The route of a high pressure Esso oil pipeline, aligned south-east to north-west, is intersected by the proposed scheme alignment in the vicinity of Berwick St James and Winterbourne Stoke. Although this is considered as a possible source of contamination, there are no recorded pollution incidents on or around the route of this pipeline within the study area.

Identified receptors

10.5.14 Human receptors to possible ground and groundwater contamination are considered to comprise residents, workers in, and visitors to, commercial properties, together with members of the public accessing areas of open space and community facilities. Construction workers represent additional human receptors that are introduced during the construction phase only.

10.5.15 Controlled waters receptors comprise groundwater and surface water. The Chalk, which underlies the study area, is classified by the Environment Agency as a Principal aquifer of high and intermediate vulnerability. There are four groundwater SPZ for public drinking water supply abstractions within 0.62 miles (1 kilometre) of the proposed scheme which are applicable to the study area. These are described below and presented on Figure 10.1.

- a) one located north of Amesbury at Durrington (SPZ1, SPZ2 with the SPZ1 located within the proposed scheme);
- b) one located north of Amesbury at Bulford (SPZ1 and SPZ2, located approximately 100m north of the proposed scheme);
- c) one located at Shrewton, north of Winterbourne Stoke (SPZ1, SPZ2, SPZ3 500m to 1km from the proposed scheme; and
- d) SPZ3 located within the eastern extent of the proposed scheme east of Amesbury, for a source at Little Durnford, approximately 3.1 miles (5km) south of the proposed scheme.

10.5.16 The Head Deposits located in the study area are classified as a Secondary (undifferentiated) aquifer. The Environment Agency classifies the Alluvium, River Terrace Deposits and rare Peat associated with the channels of the River Avon and River Till as Secondary A aquifers.

10.5.17 Environment Agency information indicates that there are six licensed groundwater abstractions within 0.62 miles (1 km) of the proposed scheme. Four of these abstractions are for general farming or commercial use and two relate to potable water supply abstractions. A summary of the groundwater abstraction licence details is provided in Table 10.2 below and indicated on Figure 10.1.

Table 10.2: Groundwater abstractions within 0.62 Miles (1 Km) of the proposed scheme

Abstraction Borehole Name	Type of Use	Licence Number	Location
Oatlands Hill, Winterbourne Stoke Well Point B	General farming and domestic	13/43/023/G/065	Within the proposed scheme area, in the vicinity of Oatlands Hill, west of the A360
Borehole 'A' at Airman's Corner	Energy – heating pump	SW/043/0021/003	85m east of the proposed scheme (adjacent to Stonehenge Visitor Centre)
Borehole 'B' at Airman's Corner	Private water supply: drinking, cooking, sanitary, washing, (small garden) - commercial/industrial/public services	SW/043/0021/003	5m north east of the proposed scheme (adjacent to Stonehenge Visitor Centre)
WISMA Farm Borehole Point A	General agriculture	13/43/023/G/246	440m south of the western area of the proposed scheme, off Berwick Road south of Winterbourne Stoke
Durrington A	Potable public water supply	13/43/021/G/152	100m east of the proposed scheme at Countess Road, south west of Durrington
Druids Lodge Borehole 1	General agriculture	13/43/021/G/251	Adjacent to the southern area of the proposed scheme, adjacent to the A360, and south of Longbarrow Roundabout

- 10.5.18 Borehole 'B' at Airman's Corner is located very close to the High Load Route and the Diversion Route, approximately 0.93 miles (1.5km) to the north of Longbarrow Roundabout. This is a receptor of high sensitivity given its proximity to the proposed scheme.
- 10.5.19 The EIA assessment will incorporate any other wells and springs identified as part of ongoing water feature surveys. These are described further in Chapter 11: Road Drainage and the Water Environment.
- 10.5.20 Two main rivers are located in the study area as shown in Figure 10.1; the River Avon at the eastern extent of the study area and the River Till flowing southwards through Winterbourne Stoke at the western extent of the study area. Furthermore, there are a number of surface water features that have been identified to be fed mainly, or entirely, by groundwater from the Chalk aquifer and are therefore vulnerable to changes in groundwater level and quality. A detailed review of the Water Environment is provided in Chapter 11.

- 10.5.21 Ecological receptors have been identified in the study area. They are the River Till in the west and the River Avon in the east. These are designated as SSSI and are within a SAC. Biodiversity is considered further in Chapter 8.
- 10.5.22 Property receptors within the study area comprise residential and commercial properties, agricultural crops, livestock and infrastructure such as below ground utilities.

10.6 Potential impacts

- 10.6.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out in section 10.7. Prior to implementation of the mitigation, the potential impacts of the proposed scheme are presented below.

Geology

- 10.6.2 Phosphatic Chalk is known to be present within the Stonehenge Bottom area of the study area and these deposits are likely to be encountered during tunnel boring. The engineering and hydrogeological characteristics and spatial extents of this material will be investigated further as the design develops and will be reported in full in the ES.
- 10.6.3 Additional investigations are being undertaken to establish the leachate potential of phosphorus in the Phosphatic Chalk at Stonehenge Bottom and the possible risks posed to controlled waters should the material be excavated and re-used within the study area. Further discussion is included within section 10.8.
- 10.6.4 There are also uranium-bearing minerals within the Phosphatic Chalk which could give rise to increased radon emissions. However, since radon is a noble gas, it does not absorb to air particulates and in an outside environment, it is dispersed to such an extent that it represents no significant risk. The impact and any possible effect during construction within confined environments, like the tunnel, will be mitigated.

Land Contamination

- 10.6.5 An assessment of the risk posed by land contamination has been undertaken by first assigning a 'risk score' to each identified historical or current area of possible contamination identified from the baseline review within the study area. The risk score has been determined using the tables provided in Appendix 10.A. The risk score is based on the relationship between the identified area of possible land contamination and its proximity to the proposed scheme (Appendix Table 10.A.1) together with the vertical alignment of the proposed scheme design at its closest point (Appendix 10.A.3). The risk score also considers the nature of the current and/or historical land use where certain land uses typically result in greater levels of contamination of the ground to have occurred (Appendix 10.A.2). The lower the score then the lower the risk. Generally, risk scores of two or less will not be considered for further assessment. Risk scores of three or more will be considered for further impact assessment as described in Table 10.3, depending on their actual or potential relationship with defined receptors.

Table 10.3: Possible areas of contamination (baseline risk scores 3 to 5)

Site ID	Site Name	Proximity Zone ¹	Land Use Class	Vertical Alignment	Baseline Risk Score ²
CL001	Pig Farm	1	1	At Grade /Cutting	3
CL003	Cherry Lodge Farm	1	1	Cutting	3
CL005	Pumping House	1	2	Embankment	3
CL009	Winterbourne Stoke Filling Station	1	3	Embankment	4
CL010	Winterbourne Stoke Chalk Pit	1	2	Cutting	4
CL014	Unspecified pit (1878 to 1926). Adjacent/within area of fill (demolition rubble)	1	2	Cutting	4
CL015	Area of Fill (Demolition Rubble)	1	2	Cutting	4
CL016	Historic barn and above ground tank (1877–1939)	1	1	Cutting	3
CL018	Former RAF Oatlands Hill (1941–1946)/infilled and unspecified pits and ground workings 1926 to 1957)	1	3	Cutting/At Grade/Embankment	5
CL019	Pumping House	1	2	Cutting/Embankment	4
CL020	Unspecified Pit 1926	1	2	Cutting	4
CL021	Pump House -(and associated former covered reservoir - potentially infilled)	1	2	Cutting/Embankment	4
CL023	Former RAF Lake Down (1917 – 1924)	1	3	Cutting	5
CL024	Historic Engine House	1	2	Cutting	4
CL025	Former Larkhill Military Light Railway (Dismantled)	1	2	Cutting	4
CL027	Greenland Farm	1	1	At Grade	3
CL028	Rollestone Camp	1	3	At Grade	5
CL029	Grain Production/Store Facility	1	2	At Grade	4
CL030	Truck Repair Shop	2	2	At Grade	3
CL031	Scrap Yard	1	2	At Grade	4
CL032	Weapons Store (Tank Artillery) (associated with Larkhill)	1	3	At Grade	5
CL033	Larkhill (Former Aerodrome and Current Royal School of Artillery)	1	3	At Grade	5
CL034	Pig Farm	1	1	Cutting	3
CL035	Former RAF Stonehenge (1917–1921)	1	3	Cutting/Bored Tunnel	5

Site ID	Site Name	Proximity Zone ¹	Land Use Class	Vertical Alignment	Baseline Risk Score ²
CL041	Former Quarry	1	2	At Grade/ Embankment	4
CL045	Former Gas Works (1879–1901) and ground works (1961)	1	3	Embankment	4
CL046	Amesbury Filling Station	1	3	Embankment	4
CL048	Electricity Sub Station	1	2	Embankment	3
CL050	Pumping Station	1	2	Embankment	3
CL051	Countess Filling Station	2	3	Embankment	3
CL057	Former SR Bulford Extension Railway (1924–1937)	1	2	Grade	4
CL058	Cuttings potentially associated with SR Bulford Extension Railway - potentially infilled	1	2	Grade	4
CL059	Industrial Repairs and Servicing	2	2	Grade	3
CL061	Electricity Sub Station	1	2	Grade	4
CL063	Former Chalk Pit (1878-1961)	2	2	Grade	3
CL066	Depot and Warehousing	1	2	Grade	4
CL068	Unnamed Farm	1	1	Grade	3
CL071	Coop Filling Station	2	3	Grade	4
CL072	Unnamed Farm	1	1	Grade	3
CL074	Packway Garage	1	2	Grade	4
CL075	Ready Mix Concrete Plant	1	2	Grade	4
CL076	Garage (Vehicle Maintenance)	1	2	Grade	4
CL077	Larkhill Road Filling Station	1	3	Grade	5
CL079	Business Park	1	1	Grade	3
CL080	High Pressure Esso Oil Pipeline	1	3	Embankment	4

¹ Proximity zone definition is included within Appendix 10.A

² Baseline risk scoring method is defined within Appendix 10.A.3

Construction Impacts

10.6.6 In the locations of the identified land uses in Table 10.3, and in the event of disturbance of contaminated soils/groundwater, there is the possibility, in the absence of any mitigation measures, that construction may affect human, ecological or controlled waters receptors, and for the ground conditions to impact on the design of the proposed scheme.

10.6.7 Potential impacts include but are not limited to:

- a) mobilising existing contaminants in soil and groundwater as a result of exposure following ground disturbance and de-watering during construction;
- b) increasing the potential for contaminants in unsaturated soils to leach to groundwater in open excavations during construction, for example, any ground contamination that may be present at the tunnel portals from the pig farm and former RAF Stonehenge;
- c) increasing the potential for contaminated surface run-off to migrate to surface water and groundwater receptors as a result of leaching from uncovered stockpiles;
- d) introducing new sources of contamination, such as fuels and oils used in construction plant and fluids and chemicals used in tunnel boring;
- e) creating preferential pathways for the migration of soil contamination and ground gases, for example, along new below ground service routes, service ducts and as a result of de-watering; and
- f) introducing new human health receptors such as site staff during construction.

10.6.8 There is the possibility for radon exposure for construction workers within confined environments, for example, during tunnel construction. Further investigation will be undertaken as part of design development and this is discussed in section 10.7.

10.6.9 Construction activities can also result in physical damage to soil, including soil compaction as a result of heavy construction vehicle movements or the exacerbation of soil erosion through handling and storage of soils. This will be mitigated by the measures outlined in section 10.7.

Operational Impacts

10.6.10 During the operational stage of the proposed scheme, conditions may have altered from the baseline as a result of, but not limited to:

- a) introducing road users, operational maintenance staff and the road infrastructure as new receptors;
- b) contamination which has been encountered having been removed or remediated;
- c) revised road drainage and discharge routes; and
- d) reduction in soil erosion through improved drainage design.

10.7 Design, mitigation and enhancement measures

10.7.1 Mitigation by design has been the primary consideration in the route chosen for the proposed scheme. Opportunities have been taken to avoid geological, geomorphological and hydrogeological constraints.

- 10.7.2 Further ground investigation including an Agricultural Land Classification and soils survey will be undertaken as part of design and EIA development (refer to Chapter 13 People and Communities). These further studies will enable a robust assessment of risks from possible historical contamination areas, notably within the former RAF Oatlands Hill and RAF Stonehenge, and also the potential for migration of possible contaminants from the current Countess Service Station.
- 10.7.3 Where risks are deemed to be significant, remediation options and strategies will be developed accordingly. Appropriate mitigation will be included within the proposed scheme design to ensure the Esso pipeline is fully protected where it would be crossed by the new alignment.
- 10.7.4 The potential for radon generated from the Phosphatic Chalk during construction of the tunnel to accumulate within confined spaces and affect the health of construction personnel will be mitigated by appropriate ventilation of the tunnel boring operation.
- 10.7.5 A Construction Environmental Management Plan (CEMP) will be developed that will contain measures to ensure compliance with relevant standards and legislation. The CEMP will set out the environmental mitigation requirements and also the project level expectations on how the proposed scheme would be constructed. Measures contained within the CEMP will be designed to limit the possibility for dispersal and accidental releases of potential contaminants, soil derived dusts and uncontrolled run-off to occur during construction. For example the CEMP will set out how material is to excavated, segregated and stockpiled to minimise the possibility for run-off, soil quality degradation and wind dispersal of dusts. The CEMP will also establish procedures for dealing with unexpected soil or groundwater contamination that may be encountered.
- 10.7.6 Defra (Department for Environment, Food and Rural Affairs) has worked with the Department of Trade and Industry to develop a Code of Practice for Sustainable Use and Management of Soils on Construction Sites (2009) (Ref 10.9). The code of practice, which will be adopted, encourages the following:
- a) identification of soil resources at an early stage in the development process;
 - b) improved planning of soil use;
 - c) a better level of soil management during project implementation, including sustainable use of surplus soil;
 - d) maintenance of soil quality and function both on and off site;
 - e) avoidance of soil compaction and erosion (with a consequent reduction in flooding and water pollution); and
 - f) an improved knowledge and understanding of soil at all levels in the construction industry, including soil amelioration techniques.

- 10.7.7 Topsoil and subsoil would need to be removed during construction in order to prevent permanent burial beneath other earthworks. Such soils would be stockpiled and re-used, subject to acceptability, in the general earthworks such as landscaping and noise bunds. In particular, topsoil excavated from areas of known high quality agricultural land would be stored separately and, where possible, would be reused on-site in areas that would be returned to agricultural use.
- 10.7.8 The effects on soil resources would be mitigated by employing high standards of soil handling and management during construction, and by avoiding the creation of bare areas of permanently exposed soil that would be vulnerable to erosion processes.
- 10.7.9 Topsoil stripped during the construction of the proposed scheme would be re-used as soon as is practicable and stored in such a way as to minimise structural damage from weathering, construction traffic movements, and multiple handling, and which would also minimise the potential for leaching of nutrients from soils.
- 10.7.10 All materials proposed for re-use would be required to meet risk-based acceptability criteria. Soils would be protected from accidental contamination during storage and transit. Methods of soils handling and storage, including measures to prevent erosion by wind and surface water, would be detailed in method statements that would be prepared prior to the commencement of construction activities.
- 10.7.11 The re-use of excavated soils during construction will be governed by either a Materials Management Plan developed in accordance with the CL:AIRE Code of Practice (Ref 10.10), an environmental permit or a relevant exemption. The CL:AIRE Code of Practice is a voluntary framework for excavated materials management and re-use. Following this framework results in a level of information being generated that is sufficient to demonstrate that excavated material has been re-used appropriately and is suitable for its intended use. It demonstrates that unsuitable material or waste has not been used in the development. The Materials Management Plan details the procedures and measures that would be taken to classify, track, store, reuse and dispose of all excavated materials that would be encountered during the development/construction works.
- 10.7.12 Where there is a requirement to dispose of surplus soils off site as waste, the material would be characterised to determine firstly whether it is Hazardous or Non-Hazardous waste in accordance with the EA's Technical Guidance WM3 (Ref 10.11). Once this is established the appropriate disposal facility would be determined through Waste Acceptance Criteria (WAC) analysis, as required.
- 10.7.13 Potential impacts specific to construction workers during site preparation and construction would be mitigated by the following measures and through working in accordance with CIRIA C692 3rd Edition 'Environmental Good Practice On Site' (2010) (Ref 10.12).
- a) measures to minimise dust generation;

- b) provision of PPE, such as gloves, barrier cream, overalls etc. to minimise direct contact with soils;
- c) provision of adequate hygiene facilities and clean welfare facilities for all construction site workers;
- d) monitoring of confined spaces for possible ground gas accumulations, restricting access to confined spaces, i.e. to suitably trained personnel only, and use of specialist Personal Protective Equipment (PPE), where necessary; and
- e) preparation and adoption of a site and task specific health and safety plan as is required under Health and Safety legislation.

10.7.14 Any remediation works, or the removal of contaminated soils associated with the construction of the proposed scheme would be expected to result in the enhancement of the local environment.

10.7.15 No specific mitigation, over and above that included in the design of the proposed Scheme, is considered necessary for geology and soils and the operation of the proposed Scheme.

10.8 Assessment of effects

10.8.1 A preliminary assessment following consideration of the potential impacts outlined in section 10.6 and the mitigation options in section 10.7 is presented below.

Construction effects

Geology and soils

10.8.2 It is anticipated that Phosphatic Chalk will be encountered during tunnel boring in the Stonehenge Bottom area of the proposed scheme. This material is expected to have a higher phosphorus content compared to normal Chalk.

10.8.3 The key environmental effect is considered to be the potential adverse effect of the degradation in water quality of the River Till or Avon through eutrophication as a result of nutrient loading, should the material be placed nearby and leaching then occur. To mitigate this, additional investigations and risk assessment, will be undertaken prior to any storage and re-use of excavated materials. These assessments will ensure that the storage and re-use of Chalk arisings at any particular location would not result in an impact on water quality.

Land contamination

10.8.4 For land contamination, there are not anticipated to be significant adverse effects provided that the mitigation measures outlined in section 10.7 are implemented.

- 10.8.5 There is the potential for beneficial effects from any possible existing land contamination that may require remediation/ removal as part of the proposed scheme.

Operational effects

- 10.8.6 There are not expected to be any significant operational effects on geology and soils as the design of the proposed scheme will include measures that will contain and control any releases of contaminants along the highway and its associated infrastructure.

Summary of preliminary assessment

- 10.8.7 Preliminary Construction assessment:

- With mitigation measures in place, no significant adverse effects are considered likely during the construction of the proposed scheme.
- Construction of the proposed scheme could have beneficial effects due to the remediation of sources of contamination.

- 10.8.8 Preliminary Operational Assessment:

- No significant effects are considered likely during the operation of the proposed scheme.

10.9 Corridors for utility connections

Eastern power connection route

- 10.9.1 The electricity substation and the sewage works adjacent to this section of the scheme are additional possible areas of land contamination to those defined in Table 10.3. These have been assigned a risk score rating of 4 based on their proximity to the scheme and the possibility for land contamination.
- 10.9.2 The gravel pit (site CL052), historical engine sheds (site CL055) and the Amesbury Motor Garage (site CL056) have been reviewed and as a consequence their risk rating has increased to be 3 or above. This is primarily due to the increased proximity of these sites to the scheme.

Western power connection route

- 10.9.3 Additional possible areas of land contamination associated with the proposed western power connection route include an Esso petrol station, Riverside Garage, the electricity substation and Druid's Head farm. The Esso petrol station has been assigned a risk rating of 5 based on its proximity to the scheme and the potential for land contamination. The other possible land contamination areas are deemed to have a risk rating of 3 or 4.
- 10.9.4 The extension of the site boundary to the south in association with the proposed western power connection route has resulted in the addition of groundwater abstraction borehole to the study area. The abstraction is

referred to as Stapleford Well Point A and groundwater is abstracted for agricultural purposes.

Assessment of effects

- 10.9.5 There are no likely additional significant effects with regards to geology and soils identified as a result of the site boundary revision for the utilities corridors, provided the mitigation measures described are in place.

11 Road Drainage and the Water Environment

11.1 Introduction

11.1.1 This chapter presents information on the likely effects of the proposed scheme on hydrology, surface water quality, groundwater resources (quantity and quality) and flood risk during the construction and operational phases.

11.2 Stakeholder engagement

11.2.1 The responses to the non-statutory consultation that was carried out between January and March 2017, along with separate discussions with stakeholders, have been considered to identify issues raised regarding road drainage and the water environment. Subsequent discussions have been held with the Environment Agency, Wiltshire Council, Wessex Water and the Wiltshire South Operational Flood Working Group (including community representatives).

11.2.2 The issues identified that the design of the proposed scheme should address in both its construction and operational stages are:

- a) No unacceptable detrimental impacts on groundwater flows or water quality, particularly in relation to abstractions for public, private and agricultural supplies and as a source of water feeding the River Avon and River Till and other surface water features;
- b) No unacceptable detrimental impacts on the hydrology and water quality of the River Avon or River Till nor on the designated habitats and species for the Special Area of Conservation (SAC) and Sites of Special Scientific Interest (SSSI) associated with those rivers;
- c) No unacceptable detrimental impacts that could affect the integrity (hydrology) of the Blick Mead spring;
- d) No infringement of the Water Framework Directive (WFD);
- e) No increase in pollution from highways water runoff and/or drainage;
- f) No increase in flood risk from groundwater, rivers, surface water or other sources; and
- g) Encourage contributions to the enhancement of the River Avon Restoration Plan and its SAC and SSSI designated habitats and species.

11.2.3 The statutory consultees' responses in December 2017 to the Scoping Report echoed the issues made in the non-statutory consultation, outlined above, with the addition of the following points:

- a) The Environment Agency believes impacts on groundwater may extend beyond 5km and impacts on surface water may extend beyond 1km. Therefore the study area has been extended as outlined in section 11.4;

- b) Public Health England stated that an assessment of potential pollution impacts on human health should consider recreational users (e.g. fishing, canoeing, etc.) ingesting water. The scope of the assessment has been expanded to include this and will be considered further in the ES.

11.2.4 The proposed methodologies for assessing the effects on groundwater, surface water hydrology and quality, flood risk and WFD water bodies have each been designed to take account of the identified key issues. Liaison with the Environment Agency is also ongoing to explore enhancement opportunities regarding the River Avon Restoration Plan.

11.3 Assessment assumptions and limitations

11.3.1 The assessment in this chapter is based on the design for the proposed scheme to date, as described in section 2.3.

11.3.2 The quality of water environment receptors has been defined using published data sources, with no sampling surveys undertaken. The availability of contemporary data with which to define the importance (sensitivity) of these attributes is considered robust and therefore this approach is considered acceptable.

11.3.3 The level of understanding provided in this chapter will be consolidated through sampling surveys and quantitative modelling to inform the ES. The modelling will include an assessment to quantify the potential impact of the presence of the tunnel on groundwater levels, the groundwater flow regime and discharges to rivers.

11.3.4 Groundwater level data coverage: all but one of the groundwater monitoring boreholes installed in 2001 (R158) have been lost. Additional groundwater level monitoring boreholes were installed in 2017. Long term data available from Environment Agency monitoring boreholes has been used to extrapolate groundwater levels where only short term data is present in the vicinity of the proposed site boundary area.

11.3.5 Model resolution: It is assumed that the Environment Agency Product 4 data was derived from a coarse JFlow model with a 20m grid in 2D. This source of information is outdated and will be replaced by a more refined ESTRY-TUFLOW (1D-2D) model throughout the EIA. The methodology will be discussed and agreed with the Environment Agency and Wiltshire Council, and set out in the ES.

11.4 Study area

11.4.1 The spatial scope of the assessment includes, as a minimum, features of the water environment within 1km of the proposed site boundary. The two main surface water bodies in the study area are the River Avon and the River Till (see Figures 11.1 and 11.2).

11.4.2 Following comments on the Scoping Report, for the groundwater and WFD assessments the study area has been extended to encompass Water

Framework Directive surface water and groundwater bodies and groundwater Source Protection Zones (SPZ). In places some of the study area boundary will therefore now extend beyond 5km of the proposed site boundary.

- 11.4.3 The study area includes the surface water body catchments of the River Till and River Avon (upstream and downstream of the Nine Mile River) and part of the Chalk groundwater body (Upper Hampshire Avon). This will encompass the proposed areas to be used for construction and the potential zone of influence caused by any dewatering required for construction and operational purposes.

11.5 Baseline conditions

- 11.5.1 A number of activities were undertaken to gather baseline information, including identification of the appropriate study area in respect of the proposed scheme and consideration of issues raised during consultations. A desk study was undertaken (including requesting information from third parties) and a gap analysis of data to identify further data gathering requirements, for example groundwater level and quality data and pumping tests.
- 11.5.2 Site walkovers were undertaken where possible to complete a visual assessment of the study area to develop an understanding of the hydraulic interactions and hydrology of the water environment. Further site surveys will be undertaken and reported in the ES.
- 11.5.3 The desk-based assessment for the water environment included obtaining and reviewing all available information sources. These sources included: Environment Agency datasets in relation to water quality, pollution incidents, groundwater, flood risk; Ordnance Survey (OS) mapping; topographic data; British Geological Survey Mapping; MAGIC Interactive Mapping; information collated for the previous stages of the proposed scheme; and accessible published literature.

Surface Water and Road Drainage

- 11.5.4 The study area lies within the South West River Basin District and Avon Hampshire management catchment, as set out within the River Basin Management Plan (RBMP) (Ref 11.1). Monitoring and assessment of surface waterbodies for their chemical and ecological quality is currently directed by the WFD, requiring the physical, ecological and chemical condition of waters to be evaluated, with plans to be put in place to outline any required actions to improve the condition of the water body to 'Good' status. A WFD compliance assessment report will be produced alongside the ES.

The River Avon

- 11.5.5 Based on the Environment Agency Water Abstraction Licences map (Ref 11.2), there are three surface water abstraction points from the River Avon within the study area (Table 11.1).

Table 11.1: Surface water abstraction points within the study area

ID Number	Source	Location	Approximate distance from proposed scheme
24	River Avon	Lake	2.6km south
21	River Avon	West Amesbury	1km south
20	River Avon	Lower Woodford	7.1km south

- 11.5.6 The River Avon is a classified WFD surface water body. It is also a designated SAC for water dependent populations of Desmoulin’s whorl snail (*Vertigo moulinsiana*), sea lamprey (*Petromyzon marinus*), brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar*) and bullhead (*Cottus gobio*). Further information on the SAC designation is presented in Chapter 8 Biodiversity.
- 11.5.7 The study area lies within the Hampshire Avon (Upper) upstream of the Nine Mile River confluence WFD waterbody catchment (GB108043022351) and is linked to a protected area under the Habitats and Species Directive and Nitrates Directive. It has an overall status of ‘Poor’ with an objective to reach ‘Good’ status by 2027 (Table 11.2).

Table 11.2: Classification elements of less than Good status for the Hampshire Avon (Upper) upstream of the Nine Mile River confluence

Classification Element	Current Status (2015)	Reasons for Not Achieving Good Status (Activity & Certainty)	Objective
Fish	Poor	Livestock – Probable	Good by 2021
Macrophytes & Phytobenthos	Poor	Sewage discharge (continuous) - Confirmed	High by 2027
		Natural mineralisation - Confirmed	
Phosphate	Moderate	Sewage discharge (continuous) - Confirmed	Good by 2027
		Natural mineralisation - Confirmed	

- 11.5.8 The study area also lies within the Hampshire Avon (Upper) downstream of the Nine Mile River confluence WFD waterbody catchment (GB108043022352) and is linked to a protected area under the Habitats and Species Directive and Nitrates Directive. It has an overall status of ‘Moderate’ and an objective to reach ‘Good’ status by 2021 (Table 11.3).

Table 11.3: Classification elements of less than Good status for the Hampshire Avon (Upper) downstream of the Nine Mile River confluence

Classification Element	Sector	Activity	Activity Certainty
Phosphate	Water Industry	Sewage discharge (continuous)	Confirmed
	Agriculture	Mixed agricultural	Confirmed
	No sector responsible	Natural mineralisation	Confirmed

11.5.9 Further information will be collected about existing discharges to the River Avon and recorded pollution incidents within the study area and will be included in the ES. The River Avon supports water based recreational activities and the effects on human health from any changes to water levels and flows or quality due to the proposed scheme will be considered further in the ES.

11.5.10 The River Avon is designated as a Main River. There are also a number of small channels, ponds and ditches located within its floodplain. These are classed as Ordinary Watercourses by the Environment Agency and are not classified under the WFD. However these watercourses are hydrologically connected to the River Avon and will therefore contribute to its water quality.

The River Till

11.5.11 The River Till is designated as a Main River and in its upper reaches north of Berwick St James it flows as a winterbourne on an intermittent basis. A small number of channels, ditches and ponds are located to the north and south of Winterbourne Stoke throughout the floodplain. These watercourses are hydrologically connected to the River Till and will therefore contribute to the water quality in the river.

11.5.12 Based on the Environment Agency Water Abstraction Licences map (Ref 11.2), there are no surface water abstraction points from the River Till within the study area.

11.5.13 The study area lies within the Till, Hampshire Avon WFD waterbody catchment (GB108043022570) which has an overall status of ‘Good’ and is linked to protected areas under the Habitats and Species Directive and Nitrates Directive. Its designation as a SAC represents the site as an example of a winterbourne Chalk stream containing “floating vegetation of water crowfoot *Ranunculus* of plain and sub-mountainous rivers”. Further information on these species and the designations is presented in Chapter 8 Biodiversity.

11.5.14 Further information will be collected about existing discharges to the River Till and recorded pollution incidents within the study area; these will be included in the ES.

- 11.5.15 Based on the analysis of historic maps, the channel of the River Till appears to be stable but has been subject to man-made interventions for land drainage related to the relic water-meadow. These historical changes may have altered flow dynamics within the river leading to increased areas of both erosion and sedimentation in the sections upstream and downstream of the proposed scheme crossing point which are evident in the present day river.

Lakes, ponds and other surface water features

- 11.5.16 There are a number of surface water features within the study area that are fed entirely by groundwater. These include: a seasonal spring at Spring Bottom Farm, which is linked to the dry chalk valley below Stonehenge Bottom; a seasonal groundwater-fed lake near the village of Lake, just to the west of the River Avon; a spring in West Amesbury; and Blick Mead Spring, in the grounds of Amesbury Abbey. These features are shown on Figure 11.1.
- 11.5.17 The water quality of these smaller watercourses, ditches and ponds or lakes located in the study area is not assessed by the Environment Agency under the WFD and no dataset is available to define their baseline quality. The value of their water quality attributes has therefore been inferred based on their physical characteristics and surrounding land use.

Contaminated land

- 11.5.18 There are several sites that could contain contaminants within the soils, associated with historical military uses, which could affect baseline water quality conditions within the study area. The existence of contaminants within the soils could become mobilised by construction activities which could lead to an adverse effect on the water quality of surface water and groundwater bodies. Further details on land contamination are provided in Chapter 10 Geology and Soils.

Highway drainage

- 11.5.19 At the western extent of the proposed scheme the existing A303 carriageway is drained by gullies that discharge directly into roadside ditches which infiltrate the runoff to ground. Filter drains are also used to convey and discharge runoff to the ditches. At Winterbourne Stoke, the highway runoff outfalls directly to the River Till.
- 11.5.20 The existing A303 between Winterbourne Stoke and Countess Roundabout is drained via gullies, grip outlets or combined kerb drains. These discharge to either a filter drain or directly into the roadside ditches. The ditches attenuate the runoff before discharging to ground via infiltration.
- 11.5.21 At Countess Roundabout the carriageway is drained via gully and combined kerb drain systems. To the west of the roundabout the existing eastbound carriageway gullies outfall northwards to a ditch located at the base of the earthworks. The ditches in this locality outfall into a culvert which passes under the existing A303 and outfalls to the River Avon on the south side of the highway. The runoff from the westbound carriageway is also collected in ditches and conveyed to the point of confluence with the culvert, before discharging freely to the River Avon. To the east of Countess Roundabout the highway runoff is discharged via gullies to either a ditch or carrier pipe

network. The majority of the eastbound carriageway drains in an easterly direction, discharging to the Avon at a point north of the River Avon bridge. A small length of the eastbound carriageway drains in a westerly direction before discharging into a culvert which passes beneath the existing A303 and ultimately to the River Avon to the south. The runoff from the westbound carriageway also discharges to ditches at the base of the embankment to the south which outfall to the River Avon at various locations.

- 11.5.22 Drainage of surface water runoff does not meet current standards on any part of the existing road from Yarnbury Castle to east of the River Avon Bridge. Runoff discharges via infiltration to the ground or via conveyance into watercourses and SAC designated Rivers Till and Avon without any modern standards of treatment to mitigate pollution.
- 11.5.23 There are no recorded incidents on the A303 between Winterbourne Stoke and Amesbury in Highways England's spills register.

Groundwater

Regional geology

- 11.5.24 The study area is underlain by the White Chalk, including the Seaford Chalk and a north-east south-west trending outcrop of Newhaven Chalk present in the area between the Avenue and Normanton Down. The Lewes Nodular Chalk beneath the Seaford Chalk outcrops at Berwick St James in the Till valley, and from Upper to Lower Woodford in the Avon valley.
- 11.5.25 The dry valleys contain head deposits, comprising clay, silt, sand and gravel, overlying the Chalk. The river valleys of the Avon and Till contain Alluvial and Terrace Gravel deposits, as well as Head deposits of gravel. Additional superficial Head deposits of clay with flints are located on a number of hill tops. The Chalk on the western side of the Stonehenge Bottom valley has been found to contain Phosphatic Chalk, comprising a sand and gravel peletal Chalk. The geology of the study area is described and assessed in detail in Chapter 10 Geology and Soils.

Regional hydrogeology

- 11.5.26 The White Chalk bedrock in the region is classified by the Environment Agency as a Principal aquifer, and is within the WFD Upper Hampshire Avon groundwater body.
- 11.5.27 The details for the WFD waterbody, as available at the time of reporting, are shown in Table 11.4. As a Principal aquifer the Chalk provides water supply on a strategic scale and river base flow, and the aquifer is of regional importance. The effects from any changes to water levels, flows and/or quality on the groundwater available for public water supply (including any effects on drinking water quality) and river base flow will be considered further in the ES.

Table 11.4: WFD Groundwater Body Summary

Water body name	Water body ID	Current Chemical Status (2016)	Objective	Current Quantitative Status (2016)	Objective
Upper Hampshire Avon	GB40801G806900	Poor ²	Good by 2027	Poor	Poor by 2015 ³

11.5.28 The superficial deposits present in the study area are classified by the Environment Agency as Secondary aquifers:

- a) The Secondary A aquifers are associated with the alluvial and terrace gravel deposits, which provide groundwater that flows to the River Avon and River Till. These are permeable layers with a moderate to high primary permeability and which are capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of baseflow to rivers.
- b) The Secondary B aquifers are associated with sand and clay deposits located on hill tops. These are predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These aquifers are not crossed by the proposed scheme.
- c) The Secondary (undifferentiated) aquifers are associated with the head deposits present across the study area. These aquifers are defined where it has not been possible to provide an A or B category.

11.5.29 The Chalk is a dual porosity medium with groundwater flow principally through fractures and fissures. The majority of aquifer storage is derived from secondary porosity within these fractures. A strong topographical control on aquifer transmissivity is evident with high transmissivity values occurring within valleys decreasing towards the interfluves.

Hydrogeology - Groundwater levels and flows

11.5.30 Groundwater monitoring data from ground investigation boreholes installed in 2001 near the proposed tunnel alignment covered the 2001-2006 period. All but one of these investigation boreholes (R158) has since been lost. Additional groundwater level monitoring boreholes were installed in 2017. Telemetry monitoring commenced in these boreholes from April 2017 and data collection is currently ongoing. Additional long term groundwater level data in the study area is available from twelve Environment Agency monitoring boreholes. This long term data has been used to extrapolate groundwater

² This is through the dependent surface water body and general chemical tests.

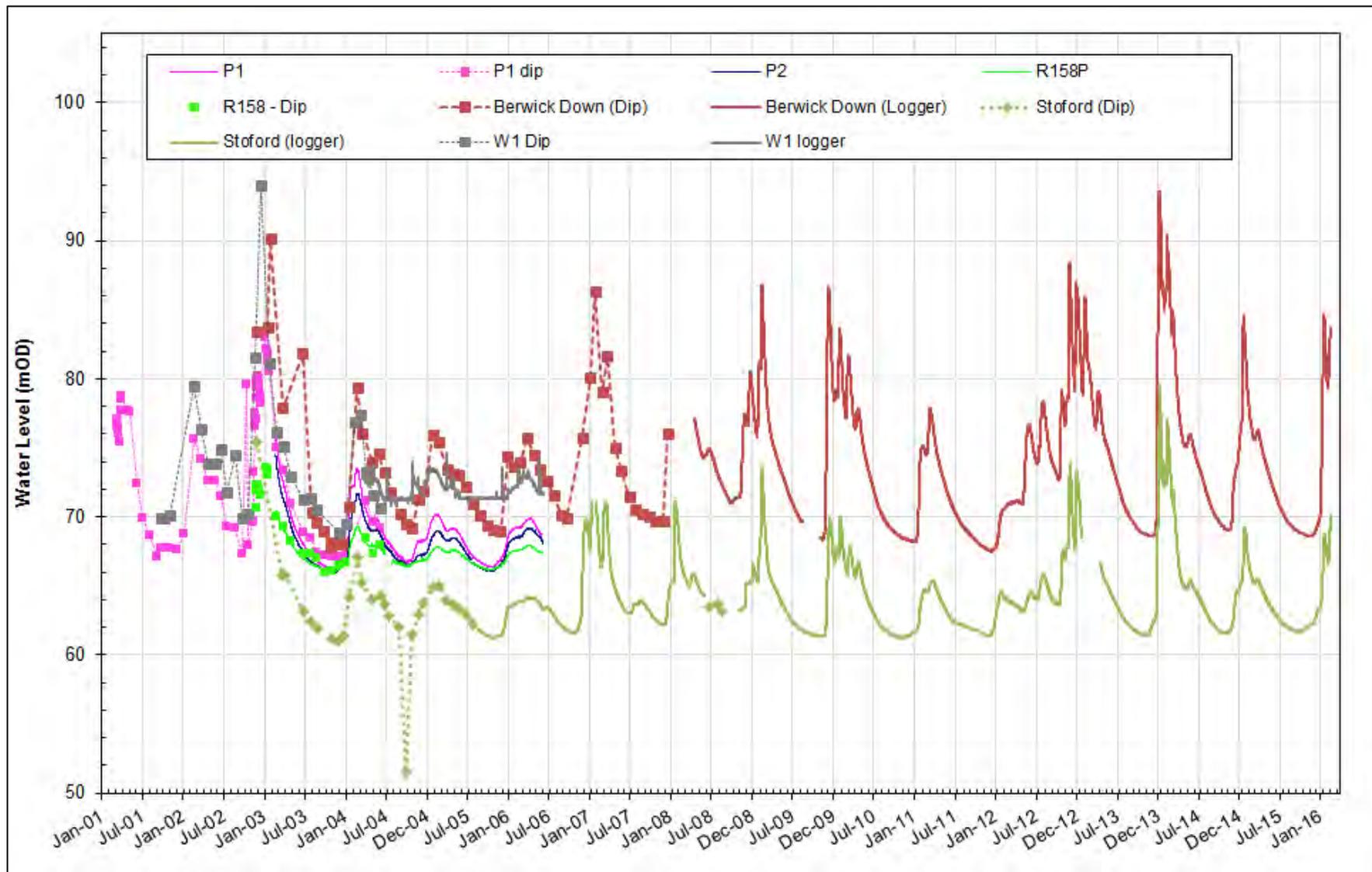
³ The objective of Poor status by 2015 was met in that year, no current improvement from current status has been identified as a future objective, as the Environment Agency has deemed this disproportionately expensive.

levels where only short term data is present in the proposed scheme area. The location of the groundwater monitoring boreholes is presented on Figure 11.1.

- 11.5.31 Monitoring data shows that groundwater levels in the Chalk aquifer between the river valleys (in the interfluvial areas) respond rapidly to recharge events at the surface due to a low aquifer storage capacity, and large fluctuations in groundwater level can occur over short periods of time. Annual fluctuations shown in the Environment Agency borehole at Berwick Down are between approximately 6m and 25m, with rapid rises in excess of 10m occurring over approximately one month. Data for the Berwick Down observation borehole collected between 2001 and 2015 is presented on Figure 11.3 and shows high groundwater levels in 2003 and 2013.
- 11.5.32 The seasonal fluctuations in the groundwater level tend to be less in the dry valleys than below topographic divides as the storage capacity is usually greater beneath dry valley systems, than in the interfluvial areas.
- 11.5.33 Groundwater is known to rise to the surface in otherwise dry valleys during periods of high rainfall, including in Stonehenge Bottom (80m AOD near piezometer P2 shown on Figure 11.1) and the River Till north of Berwick St James.
- 11.5.34 Groundwater elevation contours produced by the Environment Agency (Ref 11.3) for the area indicate that regionally groundwater in the Chalk aquifer flows in a southerly direction with flow converging towards the River Till in the west of the study area and towards the River Avon in the east of the study area, creating a groundwater divide within the study area. The groundwater discharges naturally as baseflow to the Rivers Avon and Till. The discharge to the River Avon is perennial whereas the River Till is a winterbourne (dry through periods of low groundwater levels) north of Berwick St James.
- 11.5.35 At low groundwater levels, the Environment Agency groundwater level contours indicate that the upper River Avon north east of Larkhill may lose flow to the Chalk aquifer with groundwater flow occurring in a south-westerly direction towards the Stonehenge Bottom dry valley catchment.
- 11.5.36 At low groundwater levels, the groundwater level contours indicate that the River Till loses flow to the aquifer in its central reaches flowing over the higher transmissivity Chalk units in the syncline (Chalk Rock), with groundwater flow across catchment into the Stonehenge Bottom dry valley catchment. However the Environment Agency modelling predicts gaining flow in these reaches due to the high volume of groundwater flow along the Chalk Rock and upper units of Chalk. The Environment Agency modelling shows less accretion in the lowest reaches of the River Till as the river flows over lower transmissivity older Chalk units toward the anticlinal axis.
- 11.5.37 In the southern part of the study area groundwater flow in the Stonehenge Bottom valley flows in a south-easterly direction to discharge into the River Avon at Lake. The River Avon accretes flow significantly below Amesbury reflecting the discharge of the Stonehenge Bottom catchment.

- 11.5.38 Localised ephemeral flow occurs within the dry valleys in the Chalk landscape, where preferential pathways are formed by more permeable zones during periods of high groundwater level. The dry valleys are corridors where the majority of the flow occurs beneath the surface and occasionally partially above surface when groundwater levels are particularly high. This is the case in the Stonehenge Bottom area.
- 11.5.39 There are also north-south trending dry valleys to the east of Coneybury Hill and above the existing A303 to the north of the Blick Mead area. There is no evidence that there is flow in these dry valleys. The geological map shown in Figure 11.1 indicates that these dry valleys contain valley infill material of head deposits.

Figure 11.3: Groundwater Elevations 2001 - 2016



Aquifer Properties

- 11.5.40 Packer hydraulic testing which was carried out during the ground investigations for the former scheme resulted in the interpretation (Ref 11.4) that the permeable part of the Chalk aquifer extends to around 50m AOD (30m depth) in the Stonehenge Bottom valley and to 55m AOD elsewhere.
- 11.5.41 Pumping tests were carried out close to the route alignment in 2002 (winter) and 2004 (summer), at two locations close to Stonehenge Bottom (W148 in the dry valley, W137 in the interfluvial area) (Refs 11.5 and 11.6). Transmissivities of 1,430 - 2,650m²/d for the dry valley, and 400 – 850m²/d in the interfluvial area are quoted, with the lower values reported in the summer. The results of the winter pumping tests and water levels observed in December 2002 and January 2003 were used to estimate groundwater throughput in Stonehenge Bottom (Ref 11.7). The analysis undertaken using the Darcy flow equation calculated a range of between 11MI/d to 19MI/d, with an extreme recharge event estimated to reach around 30MI/d.
- 11.5.42 These tests were conducted in structured Chalk. There are several ‘cuvette’ structures within the Chalk on the Stonehenge Bottom valley side that contain phosphatic Chalk, comprising a sand and gravel pebbled Chalk. This is anticipated to be a higher transmissivity zone of the dry valley, though no pumping tests specific to this horizon have yet been undertaken.
- 11.5.43 Falling head tests in investigation boreholes in the Coneybury Hill area showed lower hydraulic conductivities, indicating this interfluvial area could be limiting flow from the upper reaches of Stonehenge Bottom eastwards towards the River Avon.

Springs

- 11.5.44 In general, groundwater baseflow enters the rivers as seepages rather than at discrete springs. Springs are located at:
- a) A seasonal spring at Spring Bottom Farm (understood to be present at peak high seasonal groundwater levels only);
 - b) A seasonal groundwater-fed lake near the village of Lake, just to the west of the River Avon;
 - c) A spring system at West Amesbury; and
 - d) Blick Mead Spring and its associated pond (adjacent to the archaeological site of Vespasian’s Camp), in the grounds of Amesbury Abbey.
- 11.5.45 Local archaeological work in the area at Blick Mead (further described in Chapter 6 Cultural Heritage) has described an area of boggy ground close to the existing A303. This is situated along a dry valley to the east of the West Amesbury dry valley, on the northern bank of the River Avon north of the Abbey. This may also be an area of groundwater discharge and will be confirmed within the ES.
- 11.5.46 Previous investigations identified the West Amesbury Spring system as a water feature in the area. It is situated on the north bank of the River Avon south of West Amesbury village, approximately 1.5 km west of Amesbury. Groundwater level monitoring is not at a sufficient density to delineate the catchment of the springs.

- 11.5.47 The catchment to this spring is likely to be largely along the north-south orientated dry valley with the spring representing an outflow point. Based on spring flow and recharge the catchment area was estimated in previous investigations to be approximately 0.235km^2 , which is a small proportion of the dry valley topographic catchment (1.7km^2). Therefore it was concluded that the spring flows are derived from a very local catchment recharge area unrelated to the Stonehenge Bottom catchment.
- 11.5.48 Spring flows from the West Amesbury Spring system were monitored between 2003 and 2005. The maximum flow over the monitoring period was approximately $800\text{m}^3/\text{d}$ during the very high groundwater levels in January 2003. The following winters had more typical winter peaks and had spring flows of $340\text{m}^3/\text{d}$ in 2003-4 and $200\text{m}^3/\text{d}$ in 2004-5. Spring flows were 10 to $30\text{m}^3/\text{d}$ when groundwater levels were at their lowest during the monitoring period.
- 11.5.49 The spring at Spring Bottom Farm and the groundwater-fed lake at Lake are located in the dry Chalk valley below Stonehenge Bottom.

Abstractions

- 11.5.50 Thirty one active Environment Agency licensed groundwater abstractions are located within the study area and the locations provided are presented on Figure 11.2. Eight are licensed for drinking water supply, one is licensed for the production of energy, 17 are licensed for agricultural purposes and five are licensed for agriculture and drinking water supply. Details of their source will be given in the ES. The locations of the abstractions provided by the Environment Agency are shown in Figure 11.2.
- 11.5.51 Wiltshire Council's register of Private Water Supplies (PWS) lists 20 private groundwater supplies (abstracting less than $20\text{m}^3/\text{d}$) within the study area. Of these PWS, three records are confirmed as being licensed by the Environment Agency, with a further four possibly licensed. The abstractions locations as provided by Wiltshire Council are presented on Figure 11.2. A survey will be undertaken to confirm the location of the PWS and reported in the ES.
- 11.5.52 SPZ's are areas designated by the Environment Agency in order to protect significant potable water groundwater abstractions. The zones identify areas which may be at risk of pollution resulting in contamination of the groundwater source. They are classified into three zones depending on travel time of pollutants and therefore potential risk to the source: the inner zone (or zone 1), the outer zone (or zone 2) and the total catchment (or zone 3). The zones have been determined to represent respectively a 50 day travel time, a 400 day travel time, and the whole groundwater catchment for public water supply and other sensitive groundwater sources.
- 11.5.53 There are eight SPZs for public drinking water supply abstractions within the study area. There is one SPZ located north of Amesbury at Durrington, where the SPZ1 lies partially within the proposed site boundary. The eastern most point of the proposed site boundary intersects the SPZ3 (outer catchment) of an abstraction south of Amesbury, near Little Durnford. The SPZs are shown in Figure 11.2.
- 11.5.54 In SPZ 1 and 2, the Environment Agency will request that drainage is via Sustainable Drainage Systems (SuDS) designed and maintained to current good

practice standards, including the provision of suitable treatment or pollution prevention measures. The point of discharge of such systems should normally be outside SPZ1 and ideally outside SPZ2. Compliance with this requirement will be included in the design of the scheme.

Groundwater chemistry

- 11.5.55 The baseline groundwater chemistry has been informed by data from water quality samples taken in the study area and from nearby Environment Agency boreholes (Refs 11.5, 11.8, and 11.9). Water quality was measured at 14 different boreholes for a large variety of parameters. The groundwater quality data is compared to the UK Drinking Water Standards (DWS) and the baseline quality for the Chalk in Hampshire as determined by the BGS (Ref 11.10).
- 11.5.56 The mean concentration of coliform organisms, faecal coliforms, cyanide and PAHs exceed the DWS at four sites. The maximum concentrations recorded at some sites also exceeded the DWS for iron, ammonium, sodium, nitrate and lead, however the average across the study area was less than the DWS.
- 11.5.57 Overall the concentration of the parameters in the study area are consistent with the BGS baseline data for Chalk groundwater with the exception of arsenic, boron, cadmium, chlorine, chromium, dissolved organic carbon, molybdenum, nitrite, phosphorus and sulphate. The mean concentration of these determinants is higher in the study area than that recorded by the BGS.
- 11.5.58 The presence of phosphate nodules in the Chalk in the vicinity of Stonehenge Bottom has been highlighted as a possible natural source of higher phosphorus in groundwater. Further information is to be collected to address the uncertainty in the phosphorus leaching potential of the Phosphatic Chalk and reported in the ES. Soil and groundwater contamination and details on Phosphatic Chalk are further discussed in Chapter 10 Geology and Soils.

Flood risk

Surface water flood risk

- 11.5.59 The Environment Agency surface water flood risk map (Appendix 11.A) shows the main overland pluvial flow paths (following saturation) that flow south within the dry valleys, such as Stonehenge Bottom, past the existing A303 between Longbarrow Roundabout and Amesbury. The Environment Agency surface water flooding is classified into four flood risk categories: Very Low (Annual Exceedance Probability (AEP) of less than 0.1%), Low (AEP between 0.1% and 1%), Medium (AEP of between 1% and 3.3%) and High (AEP of greater than 3.3%). The majority of the surface water flood risk in the study area is categorised as Low. There are also relatively small areas at Medium or High flood risk. These are typically in valley bottoms such as Stonehenge Bottom, the Till and Avon river valleys and where surface water flow paths are impeded by artificial structures such as road embankments.

Groundwater flood risk

- 11.5.60 This type of flooding occurs when receptors are affected by water emerging from the ground rather than by direct rainfall. The River Avon and River Till are Chalk rivers fed both by groundwater and also from overland sources during periods of heavy or prolonged rainfall (Ref 11.11). There is a notable history of groundwater

flooding within the study area including locations such as at Stonehenge Bottom, Spring Bottom Farm to Lake, and parts of Amesbury.

Fluvial flood risk

- 11.5.61 The River Avon and the River Till are both designated by the Environment Agency as Main Rivers. The Environment Agency's 'Flooding from Rivers' online mapping (Ref 11.12) classifies some parts of the study area as Flood Zone 2 or 3, indicating that there are areas at medium or high probability of flooding. Areas in Flood Zone 1 are shown to be at less than 0.1% AEP. Areas in Flood Zone 2 have an indicative AEP of flooding between 0.1% and 1%, and those in Flood Zone 3 an AEP greater than 1%. The presence of Flood Zone 3 requires that flood risk is assigned high importance. These areas are generally located at valley saddles and along Main River and tributary corridors. Within the proposed scheme, the River Till viaduct does not intersect the Flood Zone 3 boundary to the north of Winterbourne Stoke
- 11.5.62 The Environment Agency Product 4 information consists of a series of maps displaying fluvial flood risk in different scenarios (Appendix 11.B). The River Avon 'water depth without flood defences' map shows that the floodwater depth is approximately 2.0m where the existing A303 crosses the River Avon in both the 1% AEP and 0.1% AEP scenarios.
- 11.5.63 According to the River Till 'water depth without flood defences' map there is an estimated floodwater depth of up to 0.5m within the floodplain for both the 1% AEP and 0.1% AEP.
- 11.5.64 A Flood Risk Assessment will be undertaken to provide a more detailed understanding of flood flows and depths will be obtained through hydraulic modelling for each existing source of flooding and the findings presented in the ES.

Other sources of flood risk

- 11.5.65 Rapid snow melt run-off over still frozen ground is another source of flood risk in the study area. When these circumstances occur, the impermeable nature of the frozen ground results in the meltwater flowing overland or discharging into the River Avon and River Till catchments.

Historic Flooding Events

- 11.5.66 From the available information there have been a number of minor and major historic flood events in the study area. Groundwater flooding and rapid snow melt run-off over frozen ground are the two primary causes. Examples of major historic flood events are outlined below.
- 11.5.67 On the 16th January 1841, snow melt and rainfall on frozen ground caused extensive flooding along the River Till and River Avon (Ref 11.13). The communities affected by this included Tilshead, Berwick St James, Winterbourne Stoke, Orcheston, Shrewton and Salisbury. The extent of flooding in these locations is unconfirmed other than flood depths of 2.1- 2.4m recorded at Shrewton (Ref 11.14).

- 11.5.68 A combination of snow melt, fluvial and groundwater flooding also occurred in January 1915 (Ref 11.15) on the River Till, affecting the village of Elston near Shrewton. It also created flooding on the River Avon including in Salisbury.
- 11.5.69 A flood event recorded in September 2008 was caused by surface water flooding with a number of properties in Durrington affected.
- 11.5.70 Data provided from the Environment Agency for the river level gauge at Amesbury shows that the highest water level since recording began was on January 3rd 2003 at 68.05m AOD. Since this time, the most recent highest level recorded at this gauge is 68.02m AOD on January 5th 2014. The Environment Agency have stated that flooding is possible where the Amesbury gauge records a water level above 67.72m AOD, which suggests that flooding occurred in Amesbury on the two dates stated above.
- 11.5.71 Severe flooding between December 2013 and March 2014 resulted in over 500 properties being flooded and a number of roads having to be closed to traffic, including the A360 which was affected due to groundwater flooding for a number of weeks, requiring temporary management measures to be introduced. Many communities affected in Wiltshire during the winter of 2013 – 14. In Tilshead, 11 properties were flooded during the 2013 - 14 event. Extreme rainfall events in combination with high groundwater levels during the winter of 2013 – 2014, meant that the flows in the River Till exceeded culvert capacities and the surface water sewer system, causing public highway and property flooding.
- 11.5.72 Apart from 2013 – 2014, the other flood events described do not coincide with peak levels shown in the borehole records, so the source of flooding is interpreted to have been fluvial for these events.
- 11.5.73 A map of properties flooded between December 2013 and March 2014 from the Wiltshire Local Flood Risk Management Strategy (Ref 11.16) shows that Tilshead, Orcheston, Shrewton, Winterbourne Stoke and Lake were flooded. This report states that surface water and groundwater were the primary causes of flooding in 2013 – 2014, which is in line with records of prolonged periods of wet weather through that winter.
- 11.5.74 Amesbury, Durrington and Bulford experienced extensive flooding in fields on the 10th February 2014. The flooding was caused by heavy rainfall resulting in groundwater and river levels increasing and overflowing (Ref 11.17).
- 11.5.75 Reports from the Amesbury Flood Action Group documented that the cause of surface water flooding in Amesbury in July 2015 and June 2016 may have been a result of highway drains becoming blocked or their capacity overwhelmed (Ref 11.18). Church Street and Salisbury Road were badly affected and up to 0.6m of internal flooding was recorded in properties.
- 11.5.76 Highways England's Drainage Data Management System (HADDMS) contains information on seventeen events where flooding affected the current A303 between Winterbourne Stoke and Amesbury. These occurred in 2006, 2007, 2010, 2013, 2014 and 2015. Of these, 15 were rated between 0 – 4 out of 10 and two rated as 5 out of 10. The severities of these events were rated by Highways England using the following factors: impact on traffic, duration of impact, road

classification and annual average daily traffic for one carriageway. Information on the sources of these flood events are not noted in HADDMS.

11.6 Potential impacts

- 11.6.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out in section 11.7 below. Prior to implementation of the mitigation, a summary of the potential impacts (both positive and negative) associated with the construction and operation of the proposed scheme is outlined below.
- 11.6.2 The potential temporary impacts arising from the construction of the proposed scheme include:
- a) risks to the water environment due to:
 - i. excavation, and the subsequent deposition of soils, sediment, or other construction materials causing pollution;
 - ii. spillage of fuels or other contaminating liquids causing pollution;
 - iii. temporary physical modifications interrupting the natural passage of surface and sub-surface flow; and
 - iv. mobilisation of contaminants following disturbance of contaminated ground or groundwater, or through uncontrolled site runoff.
 - b) risks to groundwater associated with cuttings/foundations and/or tunnel construction including:
 - i. contamination risk to the underlying Chalk aquifer;
 - ii. temporary dewatering, if required, for diverting water away from groundwater-dependent receptors, or bypassing part of the system, leading to reduced groundwater level and flow; and
 - iii. release or leaching of substances (e.g. cement or grout) used in the tunnelling process, which may negatively impact groundwater quality.
 - c) impacts on existing abstractions and springs from dewatering activities, if required, which could cause drawdown of the local water table.
 - d) an increase in flood risk arising from activities such as:
 - i. construction work temporarily impacting on the function of the floodplain and existing processes;
 - ii. temporary and/or permanent deposition of excavated material impacting on existing flood flow paths or flood storage areas; and
 - iii. during the construction process, operations within the floodplain could result in an increase in flood risk elsewhere.
 - e) impacts on water dependent designated sites (namely the River Avon SAC including the Rivers Avon and Till) from, for example discharge of

abstracted water during construction resulting in excess summer flows and/or increased silt loading that could impact the ecological features of the system.

11.6.3 The potential permanent impacts arising from the construction of the proposed scheme include:

- a) physical and hydromorphological impacts from watercourse crossings and other hydraulically linked surface water features with potential for direct effects on the biological, chemical and physical WFD parameters for surface waters and hydraulically connected groundwater bodies;
- b) the presence of underground structures (piers) that could cause interference to groundwater flow in close proximity to the internationally-designated groundwater-fed Rivers Avon and Till that could affect habitats and/or species;
- c) any pumping of surface water and groundwater required due to the presence of the tunnel, which could cause changes in flows and groundwater level;
- d) those impacts caused by lengths of the tunnel below the groundwater level in the Chalk interfering with groundwater flow. This could lead to a rise in groundwater levels on the northern, upstream side, which could cause additional groundwater flooding, and a reduction of groundwater levels on the southern, downstream side. There are a number of springs in the area down hydraulic gradient of the tunnel including the spring system around Amesbury Abbey, which could be affected;
- e) any increase in discharges to ground that may have implications for groundwater quality; and,
- f) construction of proposed bridge piers in the River Till floodplain, other structures, cuttings, embankments and other landscaping features or material deposited, within the floodplain or intersecting key overland flow paths (within both River Till and River Avon catchments) that could alter flood flows and increase flood risk.

11.6.4 The potential impacts on the water environment during the operational phase are:

- a) impacts on surface water and groundwater arising from pollutants, e.g. oils from fuel combustion/accidental spillages and salts or herbicides from road maintenance.

11.7 Design, mitigation and enhancement measures

11.7.1 Influencing the proposed scheme's design, even at this preliminary stage, has been a key consideration to maximise the opportunities for delivering mitigation of impacts by avoidance and reduction. Opportunities have been taken, where possible, to avoid identified hydrological, hydrogeological, hydromorphological and flood risk constraints. The extent of the proposed site boundary allows for refinement of the proposed scheme to take place, once detailed design and

additional survey data has been collected. This will provide flexibility to reduce possible adverse impacts as the EIA develops.

11.7.2 Mitigation of potentially significant adverse environmental effects is an iterative part of the proposed scheme's development following the hierarchy outlined in Chapter 4: Avoidance; Reduction; Compensation/Remediation and Enhancement.

11.7.3 Opportunities realised to date to avoid or mitigate impacts by influencing the proposed scheme's design are:

- a) selecting a location for the crossing of the River Till that requires the minimum length to span it, minimising any impacts on surface water and groundwater flows and quality, hydromorphology and flood risk;
- b) designing the crossing of the River Till as a twin deck open structure viaduct, allowing light to penetrate the gap between decks and reduce shading impacts on the river, floodplain and associated vegetation;
- c) the River Till viaduct would be a five span structure with the location and orientation of the piers and foundations optimised to place them as far away from the River Till as possible and to minimise obstruction of water flows over the floodplain;
- d) the option for the cutting to the western tunnel portal within the proposed scheme to be a retained cut for two thirds of its depth, to allow for the inclusion of structures that will reduce the ingress of groundwater that could occur when groundwater levels are high;
- e) application of tunnel construction techniques that would limit the requirement for dewatering during construction. This would minimise any changes to groundwater levels and flows in the Chalk aquifer that could adversely alter the hydrological regime of the rivers, springs and other surface water features dependant on groundwater discharge;
- f) the strategy for managing surface water runoff from the road would be based on good practice embodied in the DMRB and include provision of appropriate measures for treatment to mitigate pollution to notably higher standards than at present. This would minimise any impacts upon the quality of surface water and groundwater and cease the current impacts caused by drainage gullies and roadside ditches discharging directly to the River Till and River Avon or infiltrating the runoff to ground without treatment;
- g) the road will be designed to minimise the risk of it flooding by incorporating current design standards and future climate change allowances to improve its resilience;
- h) the road and its drainage measures will be designed to minimise the risk of it causing flooding elsewhere, including attenuation features to detain runoff from all events expected to occur with 1% annual probability or more frequently; and
- i) selecting a route that avoids any new crossing of the River Avon.

- 11.7.4 Mitigation relevant to potential construction phase effects would include:
- a) works undertaken with regard to Government planning practice, water-land management guidance matters, the principles of the non-statutory technical standards for SuDS (Ref 11.19) and the DMRB (Ref 11.20);
 - b) works undertaken in line with a Construction Environmental Management Plan (CEMP) for the proposed scheme;
 - c) close communications with the Environment Agency and Wiltshire Council in relation to groundwater and flood risk;
 - d) bunding for areas that may generate contaminated water;
 - e) the extent of groundwater dewatering would be minimised where practically possible by the construction techniques, the need to relocate existing abstractions and discharges would be limited wherever possible;
 - f) water discharged to self-contained units with appropriate treatment facilities;
 - g) no direct discharges to groundwater;
 - h) tests to be undertaken to ensure contaminated material is identified, isolated and reworked or removed to appropriate landfill or treatment to avoid any leachate problems;
 - i) floodplain working to be minimised as far as possible; and
 - j) temporary land-take to include adequate areas of land set aside for robust control measures, for example sustainable drainage control.
- 11.7.5 Mitigation relevant to potential operational phase effects would include:
- a) pollution treatment measures incorporated into the design where a risk of pollution has been identified (for example in the drainage system);
 - b) works undertaken in line with an operational management plan that would include training of personnel, frequency of inspection, maintenance and replacement of drainage systems; and
 - c) drains would be designed in such a way to ensure no loss of habitat or flood conveyance, and where practicable to enhance biodiversity, geomorphology and flood storage; and ensure any discharge of dewatered water is balanced to greenfield runoff rates before discharge to surface water, or recirculated to the groundwater environment.
- 11.7.6 Highways England has been and will continue to liaise with the relevant stakeholders to ensure that the proposed scheme includes the requisite measures to ensure that the integrity of the River Avon SAC (incorporating the River Avon SAC) is not adversely affected.
- 11.7.7 Effects that remain after mitigation are referred to as residual effects. The assessment of the significance of the residual effects after mitigation and/or enhancement is the key outcome of the EIA and will be reported in the ES.

11.7.8 Enhancement opportunities that are under consideration as part of the proposed scheme include:

- a) the use of groundwater monitoring boreholes to provide early warning systems for groundwater flooding;
- b) implementation of actions from relevant management plans and strategies that are within proximity of the proposed scheme.

11.8 Assessment of effects

11.8.1 The effects have been assessed following consideration of the potential impacts outlined in section 11.5 and the mitigation options in section 11.6, reflecting the development of the proposed scheme's design to date.

11.8.2 Table 11.5 and Table 11.6 summarise the potential effects (both temporary and permanent) and mitigation options for the construction phase and operational phase respectively to the water environment receptors of high and very high importance within the study area.

Summary of preliminary assessment

11.8.3 Preliminary Construction Assessment:

- With the implementation of the CEMP and the design measures above there would be no likely significant temporary adverse effects during construction activities.
- The proposed scheme would have no likely significant permanent adverse effects.
- The integrity of the River Avon SAC (incorporating the River Till SAC) would not be adversely affected by the proposed scheme.

11.8.4 Preliminary Operational Assessment:

- No likely significant effects are anticipated.

Table 11.5: Summary of Potential Effects (Temporary and Permanent) arising from the Construction of the Scheme

Receptor	Attribute	Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Potential Temporary Construction Effects						
River Till	Water quantity	Designated SSSI/SAC	Very High	Reduction of groundwater baseflow as a result of construction dewatering (for bridge foundations and cuttings)	Tunnel and cross passage construction techniques are developed to take into account measures to minimise any dewatering requirements Any dewatering for bridge pier foundations are to be discharged to down hydraulic gradient aquifer	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
	Water quality	WFD classification 'Good'	Very High	Alteration to hydrological regime Increased sediment transport Alteration to floodplain connectivity Mobilisation of contaminants as a result of disturbance of contaminated sediments	Avoid river diversions, realignments and culverting through the design and layout of haul roads Suitable drainage for construction phase with no direct discharge to waterbodies without prior treatment Adoption of best practice construction methods and operational management Tunnel and cross passage construction techniques are developed to take into account measures to minimise any dewatering requirements. Any dewatering for bridge pier foundations are to be discharged to down hydraulic gradient aquifer	No

⁴ The mitigation measures are currently considered likely to be included within the DCO application for the proposed scheme, subject to further design and assessment work.

Receptor	Attribute	Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
River Till	Conveyance of flow (fluvial flood risk)	Main River watercourse	Very High (owing to Areas of Flood Zone 3 along the River Till)	Temporary increase in peak flood level from bridge crossing over the River Till during scheme construction	The proposed route crosses the River Till floodplain and the bridge crossing would be an open structure rather than an embankment structure to maintain flood flow. Watercourses are not planned to be diverted or amended to avoid loss of in-channel conveyance or storage	No
River Avon	Water quantity	Designated SSSI/SAC	Very High	Reduction of groundwater baseflow as a result of construction dewatering (for bridge foundations and cuttings)	Tunnel and cross passage construction techniques are developed to take into account measures to avoid any dewatering requirements Any dewatering for pier foundations are to be discharged to down hydraulic gradient aquifer	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
River Avon	Water quality	WFD classification 'Moderate'	Very High	Alteration to hydrological regime Increased sediment transport Alteration to floodplain connectivity Mobilisation of contaminants as a result of disturbance of contaminated sediments	Avoid river diversions, realignments and culverting through the design and layout of haul roads Suitable drainage for construction phase with no direct discharge to waterbodies without prior treatment Adoption of best practice construction methods and operational management Tunnel and cross passage construction techniques are developed to take into account measures to minimise any dewatering requirements Any dewatering for pier foundations are to be discharged to down hydraulic gradient aquifer	No

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
River Avon	Conveyance of flow (fluvial flood risk)		Main River watercourse	Very High (owing to Areas of Flood Zone 3 along the River Avon)	Temporary increase in peak flood level during scheme construction	No planned changes to the structure of the bridge crossing the River Avon Watercourses are not planned to be diverted or amended to avoid loss of in-channel conveyance or storage	No
Groundwater	Water quantity	Principal Chalk aquifer	Water resource used for public water supply and supporting flow in rivers designated as SACs	Very High	Lowering of the groundwater levels and reduction of groundwater flow as a result of construction dewatering (for cuttings)	Tunnel and cross passage construction techniques are developed to take into account measures to avoid dewatering requirements Any dewatering for pier foundations are to be discharged to down hydraulic gradient aquifer	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
Groundwater	Water quantity	Springs	Water resource supports a river ecosystem	High	Lowering of the groundwater levels and reduction of groundwater flow as a result of construction dewatering (for cuttings)	No direct impact anticipated but requires assessment within the ES. Chalk groundwater dewatering discharge returned to Chalk aquifer minimising changes to flow regime	No
	Water supply – water quantity	Water supply Chalk abstraction	Water resource for drinking water supply with published SPZ1	Very High	Lowering of the groundwater levels and reduction of groundwater flow as a result of construction dewatering (for bridge foundations, cuttings)	The main construction compound and production area will be located away from any published SPZ1 Tunnel and cross passage construction techniques are developed to take into account measures to avoid dewatering requirements Chalk groundwater dewatering discharge returned to Chalk aquifer minimising changes to flow regime	No

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Groundwater	Water supply – water quantity	Water supply Chalk abstraction	Water resource for local drinking water supply without a published SPZ	High	Lowering of the groundwater levels and reduction of groundwater flow as a result of construction dewatering (for bridge foundations, cuttings)	Tunnel and cross passage construction techniques are developed to take into account measures to avoid dewatering requirements Chalk groundwater dewatering discharge returned to Chalk aquifer minimising changes to flow regime	No
Groundwater	Water quality	Principal aquifer	Water resource used for water supply and supporting flow in rivers designated as SACs	Very High	Mobilisation of contaminants as a result of disturbance of contaminated ground or groundwater or dewatering	Chalk groundwater dewatering discharge returned to Chalk aquifer minimising changes to flow regime	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
					Impact on groundwater quality from spillage of fuels or other contaminating materials	Water treated to appropriate standards before discharge to aquifer	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Groundwater	Water quality	Principal aquifer	Water resource used for water supply and supporting flow in rivers designated as SACs	Very High	Release or leaching of substances used in construction of tunnel (e.g. cement/grout/phosphate)	Adoption of best practice construction methods and operational management to minimise impacts	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
	Water supply – water quality	Water supply Chalk abstraction	Water resource for drinking water supply with published SPZ1	Very High	Mobilisation of contaminants as a result of disturbance of contaminated ground or groundwater or dewatering	Adoption of best practice construction methods and operational management to minimise impacts	No
					Impact on groundwater quality from spillage of fuels or other contaminating materials	Water treated to appropriate standards before discharge to aquifer	No
					Release or leaching of substances used in construction of tunnel (e.g. cement/grout/phosphate)	The main construction compound and production area will be located away from any published SPZ1	No
		Water resource for local drinking water supply without a published SPZ	High	Mobilisation of contaminants as a result of disturbance of contaminated ground or groundwater or dewatering	Adoption of best practice construction methods and operational management to minimise impacts	No	

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Groundwater	Water supply – water quality	Water supply Chalk abstraction	Water resource for local drinking water supply without a published SPZ	High	Impact on groundwater quality from spillage of fuels or other contaminating materials	Water treated to appropriate standards before discharge to aquifer	No
			Water resource for local drinking water supply without a published SPZ	High	Release or leaching of substances used in construction of tunnel (e.g. cement/grout/phosphate)	Adoption of best practice construction methods and operational management to minimise impacts	No
Floodplain (and overland flow routes)	Conveyance of flow (fluvial and surface water flood risk)		Floodplain for River Avon and River Till and overland flow routes	Very High (conveyance and storage of low probability river flood events)	The proposed route crosses the River Till floodplain, which could increase in peak flood level and / or decrease in flood storage during scheme construction	Construction work directly on the floodplain and direct discharge to infiltration regions would be controlled and kept to a minimum.	No
					Temporary barriers and temporary topographic changes as a result of the construction work (e.g. material stockpiles) may impact on the function of the floodplain by altering surface water flow paths and storage areas.	A Construction Environmental Management Plan will set out most appropriate methodology for mitigating against any risk in relation to this aspect.	No

Receptor	Attribute	Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Floodplain (and overland flow routes)	Conveyance of flow (groundwater flood risk)	Presence of groundwater supported watercourses Possibility for groundwater flooding Groundwater interception by road structures, tunnel, or drainage	Very High (owing to Areas of Flood Zone 3 and groundwater pathways to the Rivers Till and Avon)	Impedance and change in river baseflow, surface water overflow and groundwater flood risk	Any dewatering for pier foundations are to be discharged to down hydraulic gradient aquifer Tunnel and cross passage construction techniques are developed to take into account measures to minimise any dewatering requirements Discharge of any dewatered water will be balanced to greenfield runoff rates	No
Potential Permanent Construction Effects						
River Till	Water quantity	Designated SSSI/SAC	Very High	Less groundwater baseflow due to flow interference from tunnel and other underground structures (e.g. piers, foundations)	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
	Water quality	WFD classification 'Good'	Very High	Alteration to hydrological regime Alteration to floodplain connectivity Groundwater flooding liberation of unsaturated zone contamination and discharge to rivers	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime within the river and water quality. Water treated to appropriate standards before discharged to surface water or groundwater	No

Receptor	Attribute	Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
River Till	Conveyance of flow (fluvial flood risk)	Main River watercourse	Very High (owing to Areas of Flood Zone 3 along the course of the River Till)	Increase in peak flood level	The proposed route crosses the River Till floodplain and the bridge crossing would be an open structure rather than an embankment structure. Watercourses are not planned to be diverted or amended to avoid loss of in-channel conveyance or storage.	No
River Avon	Water quantity	Designated SSSI/SAC	Very High	Less groundwater baseflow due to flow interference from tunnel and other underground structures (e.g. piers, foundations)	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
	Water quality	WFD classification 'Moderate'	Very High	Alteration to hydrological regime Alteration to floodplain connectivity Groundwater flooding liberation of unsaturated zone contamination and discharge to rivers	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime within the river and water quality Water treated to appropriate standards before discharge	No
	Conveyance of flow (fluvial flood risk)	Main River watercourse	Very High (owing to Areas of Flood Zone 3 along the River Avon)	Increase in peak flood level	No planned changes to the structure of the bridge crossing the River Avon. Watercourses are not planned to be diverted or amended to avoid loss of in-channel conveyance or storage.	No

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Groundwater	Water quantity	Principal aquifer	Water resource used for water supply and supporting flow in rivers designated as SACs	Very High	Less baseflow due to presence of flow interference from tunnel and other underground structures (e.g. piers, foundations)	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
		Springs	Water resource supports a river ecosystem	High			No
	Water supply – water quantity	Water supply Chalk abstractions	Water resource for drinking water supply within published SPZ1	Very High	Less baseflow and lowering of groundwater levels downstream of tunnel due to presence of flow interference from tunnel and other underground structures (e.g. piers, foundations) and any lowering of groundwater level at Portals	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime	No
			Water resource for local drinking water supply without a published SPZ	High			No

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Groundwater	Water quality	Principal Aquifer	Water resource used for water supply and supporting flow in rivers designated as SACs	Very High	Contamination of aquifer through infiltration of storm water storage discharge	Design of storage to incorporate pollutant capture and/or treatment and removal	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
					Groundwater flooding liberation of unsaturated zone contamination	Monitoring of groundwater trigger levels and where feasible the possible transfer of groundwater to minimise any change in flow regime and surface water quality	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.
Floodplain (and overland flow routes)	Highways drainage				Increase in impermeable area and discharge volume of highways drainage, which could increase flood risk	The proposed Scheme would be designed to reduce the risk of flooding from road drainage structures through sustainable highways drainage techniques.	No

Receptor	Attribute	Quality	Receptor Importance	Potential Effects	Mitigation ⁴	Likely significant effect?
Floodplain (and overland flow routes)	Conveyance of flow (fluvial and surface water flood risk)	Floodplain for River Avon and River Till and overland flow routes	Very High (conveyance and storage of low probability river flood events)	Increase in peak flood level and / or decrease in storage	The River Till bridge crossing to be designed to produce minimal obstruction to floodplain flows.	No
				Permanent topographic changes following tunnel spoil deposition may impact on the function of the floodplain by altering flow paths.	The fluvial floodplain will not be impacted through mitigation in design. The primary overland flow routes that are impacted through topographic changes have been designed to produce minimal obstruction to overland flow conveyance.	No
Floodplain (and overland flow routes)	Conveyance of flow (groundwater flood risk)	Presence of groundwater supported watercourses Possibility for groundwater flooding Groundwater interception by road structures, tunnel or drainage	Very High (owing to Areas of Flood Zone 3 and groundwater pathways to the Rivers Till and Avon)	Impedance and change in river baseflow and surface water overflow	Avoidance or minimising the need for long-term groundwater dewatering, culverting and diversion of watercourses and drains. Discharge of dewatered water where required will be balanced to greenfield runoff rates.	No

Table 11.6: Summary of Potential Effects arising from the Operation of the Scheme

Receptor	Attribute		Quality	Receptor Importance	Potential Effects	Mitigation ⁵	Likely significant effect?
River Till	Water quality		WFD classification 'Good'	Very High	Increased pollution from road runoff Increased sediment transport	Control surface water runoff at its source through the use of sustainable highways drainage techniques to manage road runoff	No
River Avon	Water quality		WFD classification 'Moderate'	Very High	Increased pollution from road runoff Increased sediment transport	Control surface water runoff at its source through the use of sustainable highways drainage techniques to manage road runoff	No
Groundwater	Water quality	Principal Aquifer	Water resource used for water supply and supporting flow in rivers designated as SACs	Very High	Increased pollution from road runoff	Control surface water runoff at its source through the use of sustainable highways drainage techniques to manage road runoff	No With Highways England's commitment to include the requisite mitigation measures, the integrity of the SAC will not be adversely affected.

⁵ The mitigation measures are currently considered likely to be included within the DCO application for the proposed scheme, subject to further design and assessment work.

11.9 Corridors for utility connections

- 11.9.1 The western power connection route lies within the catchment of River Till WFD waterbody and the Hampshire Avon (Upper) downstream Nine Mile River confluence WFD water body. It is near to, but not in, the catchment of the River Wylde (Lower) WFD waterbody. The existing Stapleford substation and the area of the proposed extension is located on alluvial superficial deposits overlying the Lewes Nodular Chalk Formation, with a very low probability of surface water flooding and a low probability of fluvial flooding (Flood Zone 1). Where the connection route crosses the River Till via the existing A36 bridge, the route is in an area at medium risk of surface water flooding and high risk of fluvial flooding (Flood Zone 3).
- 11.9.2 The eastern power connection route lies within the Hampshire Avon (Upper) downstream Nine Mile River confluence WFD water body catchment. The existing substations and the areas of any required extension are located on gravel head superficial deposits overlying the Seaford Chalk Formation, with a very low probability of surface water flooding and a low probability of fluvial flooding (Flood Zone 1). Where the connection route crosses the River Avon floodplain it is in an area at low risk of surface water flooding and high risk of fluvial flooding (Flood Zone 3).
- 11.9.3 The potential temporary and permanent impacts arising from the construction of the expanded substation(s) and power cable installation include:
- a) the potential for pollution to the water environment from: excavation and construction materials; spillage of fuels or other contaminating liquids; mobilisation of contaminants following disturbance of contaminated ground or groundwater; or through uncontrolled site runoff.
 - b) the presence of underground structures (foundations or cables) that could affect groundwater flows to the River Till or River Avon SAC; and
 - c) an increase in flood risk from the installation of above ground structures such as electricity pylons or substation extensions.
- 11.9.4 Mitigation relevant to potential construction phase effects such as the above will include those measures outlined in 11.7.4 such as an appropriate Construction Environment Management Plan. The design for the cable crossing of the River Avon would avoid impacts upon the river channel and SAC and would locate any pylons outside of Flood Zone 3 where practicable. The design of the substation extension(s) would ensure it is resilient to any future increase in flood risk due to climate change.
- 11.9.5 As the designs would avoid the SAC and pylons would be located outside of Flood Zone 3 where practicable, all potential operational effects will be mitigated against.
- 11.9.6 With this appropriate mitigation in place, no additional significant effects are identified for the power connection routes.

12 Materials

12.1 Introduction

- 12.1.1 This chapter describes the material resources and waste arisings preliminary assessment for the proposed scheme.
- 12.1.2 For the purpose of this PEI Report, materials are defined as comprising:
- The use of material resources; and,
 - The generation and management of waste.
- 12.1.3 Material resources are defined by IAN 153/11 (Ref 12.1) as “the materials and construction products required for the construction, improvement and maintenance of the trunk road network. Material resources include primary raw materials such as aggregates and minerals, and manufactured construction products”.
- 12.1.4 Waste is defined as per the Waste Framework Directive (2008/98/EC) (Ref 12.2) as “any substance or object which the holder discards or intends or is required to discard.”
- 12.1.5 The proposed scheme will aim to prioritise waste prevention, followed by preparing for re-use, recycling, recovery and lastly disposal to landfill as per the internationally recognised waste hierarchy (see Figure 12.1).

Figure 12.1: Waste Hierarchy



- 12.1.6 This PEI Report has been written in accordance with IAN 153/11 which is intended for the "identification of impacts associated with materials resource use and waste arisings" for construction, improvement and maintenance projects and is relevant guidance for this scheme. In addition to this, DMRB HA204/08 (Ref 12.3), HA200/08 (Ref 12.4), and Annex A of IAN 125/15 (Ref 12.5) have also been followed.

12.2 Stakeholder engagement

- 12.2.1 Discussions have been held with Wiltshire Council (the Waste Disposal Authority for the proposed scheme area) and the Environment Agency, the regulator for waste management in England. Officers from Wiltshire Council and the EA have

provided information on local waste management facilities and regulatory requirements.

12.3 Study area

12.3.1 The study area comprises the proposed site boundary and the wider region within which waste management facilities are located and from where construction materials may be sourced.

12.4 Baseline conditions

12.4.1 Baseline information consists of the current capacity of the waste infrastructure in the waste disposal authority (Wiltshire), and in the wider South East and South West planning regions.

12.4.2 Information on baseline waste conditions has been collected from sources including local planning documents published by Wiltshire Council and data on waste facility capacity published by the Environment Agency.

12.4.3 The Wiltshire and Swindon Waste Site Allocations Development Plan Document Evidence base part B: Waste (Ref 12.6) provides waste data as shown in Table 12.1 below:

Table 12.1: Data provided in the Evidence base part B: Waste report

Waste type	Waste generation in 2009 (tonnes)	Waste sent for landfill in 2009 (tonnes)	Indicative landfill requirements in 2020 (tonnes per annum)	Landfill capacity to be delivered (2011-2026) (m ³)
Commercial & Industrial (C&I)	452,513	114,925	120,000-130,000	363,204
Construction & Demolition (C&D)	105,032	Data not provided	190,000	Sufficient capacity available
Hazardous waste	69,061	40,071	Data not provided	Sufficient capacity available

12.4.4 The Environment Agency's Waste Management Information 2016 (Ref 12.7) (published in 2017) includes the following information about waste sent to landfills in 2016 and remaining landfill capacity in Wiltshire, and in the wider South East and South West regions as shown in Table 12.2, Table 12.3 and Table 12.4 below:

Table 12.2: Wiltshire landfill inputs and capacity 2016

Landfill Type	Inputs (000 tonnes)	Capacity (000 m ³)
Hazardous Merchant	29	424
Hazardous Restricted	-	-
Non Hazardous with SNRHW* cell	64	929
Non Hazardous	301	4,545

Landfill Type	Inputs (000 tonnes)	Capacity (000 m ³)
Non Hazardous Restricted	-	-
Inert	264	134
Total	658	6,033

Table 12.3: South West landfill inputs and capacity 2016

Landfill Type	Inputs (000 tonnes)	Capacity (000 m ³)
Hazardous Merchant	148	1,748
Hazardous Restricted	-	-
Non Hazardous with SNRHW* cell	481	4,362
Non Hazardous	1,750	11,025
Non Hazardous Restricted	-	-
Inert	660	9,763
Total	3,038	26,898

Table 12.4: South East landfill inputs and capacity 2016

Landfill Type	Inputs (000 tonnes)	Capacity (000 m ³)
Hazardous Merchant	14	550
Hazardous Restricted	21	10
Non Hazardous with SNRHW* cell	2,692	29,386
Non Hazardous	2,517	17,237
Non Hazardous Restricted	-	-
Inert	2,792	29,795
Total	8,036	76,979

*SNRHW = selected non-reactive hazardous waste

12.4.5 Baseline information on nationwide demand data for material resources has been collected for the key raw materials: aggregates, concrete, asphalt and steel, as shown in Table 12.5 below.

Table 12.5: UK Demand for Material Resources

Material	UK Demand (tonnes, year)	Source
Steel	10.90 million tonnes (2016)	International Steel Statistics Bureau http://www.issb.co.uk/news/news/uk.html
Aggregates of which:	225 million tonnes (2015)	The Mineral Products Industry at a Glance (2016 Edition) – Mineral Products Association (Ref 12.8)
Crushed Rock	104 million tonnes	
Sand & gravel - land won	46 million tonnes	
Sand & gravel - marine	12 million tonnes	

Material	UK Demand (tonnes, year)	Source
<i>Recycled & secondary</i>	<i>63 million tonnes</i>	
Asphalt	24 million tonnes (2015)	
Concrete <i>of which:</i>	81 million tonnes (2015)	
<i>Ready-Mixed Concrete</i>	<i>54 million tonnes</i>	
<i>Concrete products</i>	<i>27 million tonnes</i>	

12.5 Potential impacts

12.5.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out in section 12.7 below. Prior to implementation of the mitigation, the potential impacts of the proposed scheme with regards to material resources and waste arisings include:

- a) Temporary reduction in material resources required for construction available within the relevant markets; and
- b) Effects that on-site generated materials (e.g. soils) and waste arisings have on the existing capacity of waste management facilities.

12.5.2 Table 12.6 below summarises the types of materials that would be used and wastes that may be generated.

Table 12.6: Types of Material Use and Waste Generation

Project Activity	Material use	Material and waste generation
Site remediation / preparation / earthworks / tunnelling	<ul style="list-style-type: none"> • Fill material for construction purposes. • Primary and secondary/recycled aggregates for ground stabilisation. • Stripped topsoil and subsoil • Tunnel arisings 	<ul style="list-style-type: none"> • Surplus excavated materials. • Stripped topsoil and subsoil. • Contaminated soils. • Tunnel arisings.
Demolition	<ul style="list-style-type: none"> • Materials are not required for demolition works. 	<ul style="list-style-type: none"> • Waste arisings from the demolition of any existing buildings or structures.
Site construction	<ul style="list-style-type: none"> • Construction materials including: • Concrete; • Asphalt and bituminous material; • Cement bound granular material; • Well graded granular material; • Precast concrete kerb; • Timber; • Plywood; 	<ul style="list-style-type: none"> • Packaging from materials delivered to site. • Excess and broken/damaged construction materials. • Existing highway infrastructure and technology as removed by excavation works. • Waste oils from construction vehicles.

Project Activity	Material use	Material and waste generation
	<ul style="list-style-type: none"> • Cementitious grout; • Reinforcing steel; • Reinforcing fabric; • Geotextile; • Geo-composite drainage system; • Pipe bedding aggregate; • Filter drain material; • Tunnel lining; 	<ul style="list-style-type: none"> • Waste additives and conditioning agents from tunnel arisings management • Construction worker wastes.
Operation and maintenance	<ul style="list-style-type: none"> • Routine maintenance of infrastructure and technology including surfacing asphalt and servicing of electronic equipment. 	<ul style="list-style-type: none"> • Waste arising during operation and maintenance expected to be minimal.

12.5.3 Material use and waste generation is expected to be very small during operation of the proposed scheme. Routine maintenance would include gully emptying and litter collection. Periodically, maintenance activities such as resurfacing would be required. Waste arising from these maintenance activities is expected to be generally the same (in both type and quantity) to that generated by the existing road; and the wastes would be managed using the established procedures and facilities that are used across the strategic highways network.

12.5.4 For these reasons, materials and waste during the operational phase have been scoped out of the assessment, as has been agreed by PINS, on behalf of the Secretary of State in his Scoping Opinion.

12.6 Design, mitigation and enhancement measures

12.6.1 The following mitigation measures would be implemented during the design and construction phases:

- a) waste arisings would be prevented and designed out;
- b) opportunities to re-use material resources would be sought;
- c) opportunities to support the circular economy would be considered.

12.6.2 A Construction Environmental Management Plan (CEMP) will be prepared in accordance with Interim Advice Note IAN 183/14 (Ref 12.9), and this CEMP will include a Site Waste Management Plan. Proposals for the handling of waste material will be in accordance with the CLAIRE Definition of Waste Code of Practice (Ref 12.10)

12.6.3 Construction of the proposed scheme would generate various types of waste, as described in Table 12.6 above.

12.6.4 Excavation would be required to form cuttings for the highway, and material would be required in other places to form embankments. The proposed scheme design balances these requirements as far as practicable, to minimise the

amount of surplus excavated material that would need to be either imported or exported from the proposed scheme.

- 12.6.5 In addition, approximately 1 million cubic metres of chalk would be produced from tunnel excavations. It is assumed that the tunnel would be formed using a tunnel boring machine. The excavated material from the tunnelling operation would be processed as part of the tunnelling works to produce a material suitable for use on site.
- 12.6.6 In the proposed scheme, the tunnel arisings would be used on land to the east of Parsonage Down National Nature Reserve to:
- a) blend the new highway embankments into the existing topography and so reduce the landscape impacts of the new alignment;
 - b) create new chalk grassland and other habitats and extend the existing Parsonage Down habitats. This has been successfully achieved at other sites where chalk tunnelling excavations have been used for habitat creation, such as at Samphire Hoe near Dover using spoil from the channel tunnel.
- 12.6.7 Use of the tunnel arisings to the east of Parsonage Down would remove the need to transport surplus material on the highway network to off-site disposal facilities. This would avoid the adverse environmental effects on people and communities living along the routes to the off-site disposal facilities.
- 12.6.8 Options for the off-site disposal of surplus tunnel arisings include: reuse as a raw material in manufacturing processes, use as restoration material for quarries or as final cover at landfill sites, or disposal to a landfill site.
- 12.6.9 If material requires off-site deposition, there are a large number of quarries and landfill sites in Wiltshire and the surrounding counties which could act as receptor sites.

12.7 Assessment of effects

- 12.7.1 The existing landfill capacity in the south of England (of all types) has been determined, from Environment Agency data, as being approximately 100 million cubic metres.
- 12.7.2 Given the large landfill capacity in southern England and the potential for the re-use of most of the excavated material on site, it is considered unlikely that the proposed scheme will result in a significant reduction in the available landfill capacity in the wider region, and hence significant effects are not anticipated.
- 12.7.3 The proposed scheme would minimise the amount of material that would need to be taken to off-site disposal sites. This would avoid the likely significant adverse noise and air quality impacts associated with the transportation of these large quantities of materials to disposal sites.
- 12.7.4 Although the quantities of material used for construction are not yet available, it is anticipated that these quantities will represent only a very small proportion of the overall UK demand for construction materials. It is therefore considered unlikely

that the proposed scheme will result in a significant reduction in the availability of construction materials within the regional or national market.

13 People and Communities

13.1 Introduction

13.1.1 This chapter identifies and proposes measures to address the potential impacts of the proposed scheme on people and communities, both during construction and operation. This includes consideration of the potential for impacts arising with regard to the following:

- a) agricultural land, in particular agricultural land classified as Grade 1, 2 or 3a (referred to as “best and most versatile” (BMV) agricultural land);
- b) Non-Motorised Users (NMUs) (pedestrians, cyclists and equestrians);
- c) Motorised Travellers (drivers and passengers of both public and private vehicles);
- d) community severance;
- e) private assets (including residential properties, local businesses, community facilities and land); and
- f) development land.

13.1.2 Consideration has been given to the potential for impacts on civil and military aviation and defence interests within the context of effects on people and communities in accordance with the National Policy Statement for National Networks (NPSNN) (Ref 13.1). It is acknowledged that the proposed scheme is located within proximity to military aviation and defence interests, principally at Boscombe Down Airfield and Larkhill Artillery range. It is considered that the proposed scheme will not likely impact on the operation of these during construction or operation given the nature of the scheme, landtake required (temporary and permanent) and works required during construction and the understood nature of operations taking place at these interests. No effects are considered to be likely and as such consideration of these impacts has been scoped out of the EIA.

13.2 Stakeholder engagement

13.2.1 Consultation on the approach to the People and Communities assessment is ongoing with Wiltshire Council. Regarding agricultural land, a number of site visits to the potentially affected land holdings/farms and consultation with the owners/occupiers have been undertaken and will continue as the environmental assessment progresses.

13.3 Assessment assumptions and limitations

13.3.1 Limitations to the assessment comprise:

- a) This chapter addresses only the direct effects on commercial land in terms of land take, and not any potential loss in financial terms.
- b) The assessment methodology excludes, for the purposes of reporting amenity and isolation effects only, residential properties where the total

number of dwellings affected is fewer than five. Impacts on individual residential properties do not constitute a significant community effect. There are a number of individual residential properties scattered along the route where impacts may be experienced, such as noise and vibration. These impacts are reflected in other topic assessments where relevant.

13.4 Study area

- 13.4.1 The study area varies depending on the effect or type of resource being assessed. The proposed scheme site boundary and effects on adjacent land through severance has been used for consideration of effects on agricultural land, development land, and open space.
- 13.4.2 All the agricultural land physically affected during the construction process is a resource to be considered and assessed during the EIA process. Agricultural holdings considered are whole farm units within the study area which would lose some land, be severed, and/or which would have adverse effects on access between the farmsteads and any of the relevant land.
- 13.4.3 Effects on motorised users and NMUs of existing routes consider all such resources likely to be affected by alterations in traffic distribution and flows as well as users of the proposed scheme. The types of resources considered include roads, public rights of way (PRoW) and footpaths located within 0.62 miles (1km) of the proposed scheme.
- 13.4.4 The study area for 'private assets' (including agricultural businesses, residential properties, local businesses, community land and facilities) consist of those assets containing land parcels required to accommodate the proposed scheme during both construction and/or operation.
- 13.4.5 The study area for 'community severance' is extended to 6.2 miles (10km) to include communities that may potentially be directly and indirectly affected by the proposed scheme, for example, through severance caused by the new road or the redistribution of vehicles on the affected road network. This includes communities directly connected by the NMU and motorised traveller routes.

13.5 Baseline conditions

- 13.5.1 This section establishes the current provision and condition of facilities and routes serving local communities for the defined study area (see section 13.4).
- 13.5.2 Community resources⁶ are mentioned expressly in the environmental baseline only where they contribute to the local context or where they may be affected by the proposed scheme. Consequently, not all community resources within the study area are referred to.

Overview

- 13.5.3 The proposed scheme is located in the County of Wiltshire which has an estimated population of 488,400 (Ref 13.2). The study area surrounding the proposed scheme mostly comprises agricultural land and is sparsely populated. Small settlements are scattered around the area, the main settlement being

⁶ Defined as including agricultural land and holdings, public rights of way, open space, recreational facilities, residential properties, business premises, and community facilities.

Amesbury, located at the eastern end of the proposed scheme. Amesbury is the main location for services and community facilities in the study area and has a population of 10,700 inhabitants (Ref 13.2). Winterbourne Stoke located 5 miles (8 km) west of Amesbury, and Larkhill, located 1.9 miles (3km) north-west of Amesbury also offer a number of services. Smaller communities include Shrewton to the north of the existing A303 and several villages to the south of the existing A303 along the Avon and Till valleys and along the A338. The study area is serviced by a comprehensive network of B and C roads as well as PRoW.

Agricultural land and holdings

- 13.5.4 The agricultural land within the alignment of the proposed scheme is mapped at a large-scale under the Agricultural Land Classification (ALC) system as mainly Class 3 (good to moderate) with small areas of Grade 2 and Grade 4 land.
- 13.5.5 The majority of the land within the alignment of the proposed scheme is in arable use, though some alongside the River Till and around the major archaeological monuments is permanent grassland. It is important to recognise that much of the World Heritage Site land is managed for its intrinsic archaeological value. A large part of the landscape is owned by the National Trust whilst the area within and immediately surrounding the Stonehenge monument is owned and managed by English Heritage.
- 13.5.6 Cattle and sheep are the main livestock within the study area but there is also a large outdoor pig enterprise and free-range poultry. Farms are generally large but smaller holdings are found around Winterbourne Stoke where a more diversified land use includes campsites and paddocks for horses, ponies, goats and alpacas.
- 13.5.7 Small areas of woodland are scattered throughout the landscape, some of which contain stands of coniferous trees indicating commercial management (although this may be historic). Management of game for commercial shoots, principally pheasants, is an important activity and the survival of small woodlands on the otherwise open downland is linked to this.

Non-motorised users

- 13.5.8 There is a comprehensive network of PRoWs in the study area as shown within Figure 13.1 of this PEI Report. These routes connect Shrewton and Rolleston to Berwick St James and Winterbourne Stoke as well as Larkhill and Countess to Stonehenge. One PRoW (AMES6) crosses the existing A303 slightly to the west of Stonehenge and passes directly through the WHS to the west of Stonehenge connecting the community of Larkhill to Druids Lodge on the A360.
- 13.5.9 These routes serve a wide range of users, including equestrians, hikers and cyclists, locals and tourists alike. The footpaths and byways situated in proximity to the Stones are well used by visitors and tourists.
- 13.5.10 On the Amesbury to Berwick Down section of the existing A303, several PRoW can be accessed on either side of the road. PRoWs ending at the A303 road (WSTO3 including along road B3083, WSTO6B, AMES10 and AMES11) or crossing it (AMES12) present safety risks as NMUs use the verges of the A303 or cross it (refer to Figure 13.1).

- 13.5.11 There is no designated safe crossing point on the existing A303 through Winterbourne Stoke and there is poor visibility brought about by the alignment of the road at this location. The existing NMU underpass at Countess Roundabout is of a design that could be considered to be unattractive or impractical to users. These factors combine to inhibit movement across the road.
- 13.5.12 To the east and south of Boscombe Down Airfield are BULF11, AMES34, ALLI13, IDMI3 and IDMI5. Further to the south there is a network of PRoW connecting communities within and between the villages in the Avon and Till valleys including Great Durnford. Existing within the Avon and Till Valleys are Bridleways DURN4, DURN13 and BSJA3, Footpaths WFOR11, BSJA8 and BSJA6 and Byways BSJA11, BSJA10 and BSJA3A.
- 13.5.13 Amesbury and the surrounding areas contain a range of cycling infrastructure including segregated paths, on-carriageway markings or off-road routes. The majority of cycling routes pass through the centre of Amesbury and do not cross the Amesbury to Berwick Down section of the existing A303. The only National Cycle Route (NCR) lying in proximity to the proposed scheme is the Wiltshire Cycle Way (Route 45). It passes through Amesbury and does not intersect with the proposed scheme.

Motorised travellers

- 13.5.14 The existing A303 is used as the primary through route for journeys to the South West, requiring road users to pass through the WHS, offering views within approximately 0.1 mile (165m) of the Stones. The volume and speed of traffic as well as journey time reliability causes stress to motorised users.
- 13.5.15 Considerable congestion is experienced along the existing single carriage A303 alignment between Amesbury and Berwick Down. The 40 mph speed limits operating within Winterbourne Stoke as well as the queuing at the roundabout junctions at Countess and Longbarrow, and at the junction of the A303 and A344 at Stonehenge Bottom increase congestion. Rat-running also affects the villages of Larkhill and Shrewton, increasing travel distances.
- 13.5.16 The effect of the existing arrangements during periods of heavy traffic and emergency closures on driver stress is considered to be the key variable affecting motorised travellers, both at a local and regional level. Therefore, driver stress is likely to be highly sensitive to change.
- 13.5.17 Currently, there are eleven laybys along the existing A303 between the Countess Roundabout and Berwick Down allowing for drivers to stop temporarily, six on the westbound and five on the eastbound carriageway. Local services can be found in Amesbury and in Winterbourne Stoke. The Countess Services located east of the Countess Roundabout, also offers services to motorised travellers.
- 13.5.18 The A360 currently crosses the A303 causing congestion at the existing Longbarrow Roundabout. Other routes either intersect or lie adjacent to the proposed scheme alignment, one of B-classification (B3083), and several are unclassified, and are used predominantly for local journeys. There are a number of byways open to all traffic (BOAT) in the Winterbourne Stoke area and south of Stonehenge. One BOAT passes to the west of the Stones and crosses the existing A303 connecting Larkhill to Druids Lodge settlement on the A360 route. Several byways can be accessed on either side of the existing A303 and connect

with the communities of Berwick St James, Great Durnford, Larkhill and Shrewton.

Community severance

- 13.5.19 Community severance is the separation of residents from the facilities and services they use within their community. Residents of Winterbourne Stoke are served by a full range of services and facilities in Amesbury. The existing A303 is the primary route between facilities in Amesbury and inhabitants of Winterbourne Stoke. Services at Amesbury include three primary schools, a secondary school, two surgeries, a library and a range of other town centre uses.
- 13.5.20 The village of Shrewton, situated approximately 1.6 miles (2.6km) to the north of Winterbourne Stoke experiences rat-running associated with congestion along the existing A303. This results in severance within the village and increased journey times for residents of Winterbourne Stoke accessing the school and limited services on offer in Shrewton.
- 13.5.21 Within Winterbourne Stoke the facilities are limited to St Peters Church, the petrol station shop and a public house (The Solstice Rest). These services suffer from severance caused by the existing A303 passing through the village.
- 13.5.22 There are several villages along the A338 and within the Avon and Till Valleys. These villages are primarily residential in nature and rely on larger service centres for the majority of services and community facilities.
- 13.5.23 The PRoW network connects residences in rural communities with services and community facilities in local service centres.

Private assets

Residential properties

- 13.5.24 The study area is mostly rural and relatively sparsely populated. The main settlement close to the proposed scheme is Amesbury. Residential properties within the study area are mainly found in Winterbourne Stoke. This village is currently crossed by the existing A303, lies directly south of the proposed scheme and has a population of approximately 200 people (Ref 13.2). East of Stonehenge, the study area also includes residential properties located in West Amesbury and south of Larkhill. Dispersed dwellings and farms are scattered through the study area, mainly in the Winterbourne Stoke area. Several isolated dwellings are also present within the study area, including the Stonehenge Cottages situated on the existing A303, south of The Avenue. Sparsely distributed residential farmhouses are present within the southern half of the study area with greater congregations of residential housing at Great Durnford and High Post.

Business premises

- 13.5.25 There are no business premises lying directly on the alignment of the proposed scheme. In Winterbourne Stoke, business premises comprise a bed & breakfast, a motorcycle manufacturer, an events venue, a training business, an equine business at Scotland Lodge farm and a campsite as well as a filling station and shop off the A303. Another filling station, a hotel and a restaurant are located at the Countess Services area. A shop and café form part of the Stonehenge Visitor

Centre situated at the intersection of the A360 and the B3086 north of the proposed scheme.

- 13.5.26 East of the proposed scheme, there is an industrial estate located in Amesbury with housing located immediately to the north. South east of Amesbury, Boscombe Down Airfield occupies a large tract of land whilst the Porton Down military science park lies just to the south of the A338.

Community facilities

- 13.5.27 A public house (The Solstice Rest) and a church (St Peters Church) are located in Winterbourne Stoke with residents using the existing A303 to access other community facilities in Amesbury. Facilities available in Amesbury include three primary schools (Amesbury Archer Primary School, Amesbury Church of England Voluntary Controlled Primary School, Christ The King Catholic Primary School), a secondary school (The Stonehenge School), a library, a leisure centre (Amesbury Sports & Community Centre), a community centre (Bowman Centre), several churches, a cemetery and a range of other services such as a post office and a police station.
- 13.5.28 Winterbourne Stoke residents can also access community facilities in Shrewton, located 1.6 miles (2.6km) north using the B3083. Facilities at this location include a cricket club, a primary school (Shrewton CE VC Primary School), three churches (Shrewton Methodist Church, St Mary's Church, St Andrew's Church), a village hall (Maddington Church Room) and a social club (Shrewton Sports & Social Club).
- 13.5.29 In terms of primary care facilities, two pharmacies and two surgeries (Barcroft Medical Centre, St Melor House Surgery) are located in Amesbury. There are two additional surgeries in Shrewton (Shrewton Surgery and The Till Orchard Surgery). The nearest general hospital is Salisbury District Hospital.
- 13.5.30 Regarding open space, part of the route lies within the WHS. National Trust and English Heritage owned land in the immediate vicinity of the Stones is publicly accessible. The proposed scheme borders the Parsonage Down National Nature Reserve (NNR) and crosses two rivers, the River Till and the River Avon. In Amesbury, several open spaces lie within 500m of the proposed scheme including the Holders Field and the Amesbury Sports & Community Centre pitches.

Development land

- 13.5.31 Current information regarding development land allocations and significant planning applications / permissions will be identified within the ES and will also be used in the assessment of cumulative effects (see Chapter 15 of this PEI Report for a summary of how such sites are being identified).

13.6 Potential impacts

- 13.6.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out in section 13.7 below. Prior to implementation of the mitigation, a summary of the potential impacts (both positive and negative) associated with the construction and operation of the proposed scheme is outlined below.

Agricultural land and holdings

- 13.6.2 The principal potential impacts on agricultural land and farm and farm-based enterprises are anticipated to occur during the construction of the proposed scheme. These potential impacts include the agricultural land required temporarily and permanently for the proposed scheme (in particular that classified as BMV) and, the use of the soil resource generated by the construction of the proposed scheme.
- 13.6.3 The potential impacts on farm holdings relate primarily to the loss, severance and fragmentation of agricultural holdings and the loss of agricultural infrastructure (such as field drainage, field water supplies, fencing, etc) and the consequent impacts for the continued operation of the agricultural holdings and businesses.
- 13.6.4 Other construction effects include the deposition of dust on sensitive crops, land uses or buildings (see Chapter 5 Air Quality), noise and vibration (see Chapter 9 Noise and Vibration) and disruption to drainage systems.

Non-motorised users

- 13.6.5 With regards to NMUs, potential impacts include:
- a) permanent land take associated with the footprint of the at-grade sections, portals and junctions;
 - b) temporary land take, closure or diversion during construction;
 - c) reducing severance and improving connectivity of PRoWs;
 - d) the redistribution of traffic on local roads during and after construction on creation or removal of severance of PRoWs; and
 - e) provision of opportunities for walking and cycling on patterns of active travel and physical activity.

Impact on the amenity of users of PRoW

- 13.6.6 With regard to amenity of users of PRoWs, potential impacts include:
- a) temporary disruption to PRoWs during construction;
 - b) possible changes in the amenity experience caused by the construction activities generating noise and vibration and emissions; and
 - c) improving the amenity experience and safety of PRoW users through the tunnelling, downgrading or de-trunking of the A303 and the provision of newly created NMU routes (see section 13.6).

Motorised travellers

- 13.6.7 With regard to driver views and driver stress, potential impacts include:
- a) permanent loss of driver views of the WHS and associated landscape along the tunnelled sections;
 - b) widened views in the River Till valley;

- c) temporary increase in driver stress across the local network during the construction period and during operation if the tunnel has to be temporarily closed;
- d) permanent decrease in driver stress related to improvements in journey time reliability and a reduction in congestion on the existing A303;
- e) permanent improvement in access to local employment and training opportunities through improved journey time reliability leading to improved health and wellbeing; and
- f) possible changes in levels of driver stress across the wider road network from redistribution of traffic.

Community severance

13.6.8 Potential impacts in terms of community severance include:

- a) changes in severance for residents of villages to community facilities and social infrastructure as a result of revised access to the A303 via new grade separated junctions;
- b) permanent reduction of community severance in Winterbourne Stoke improving social cohesion;
- c) improved access to and within the WHS to enhance learning and interpretation; and
- d) possible changes to journeys for residents accessing community facilities on local roads and users of PRowS resulting from the redistribution of traffic on the wider network including during tunnel closure events.

Private assets

13.6.9 Potential impacts on private residences, local businesses and community facilities include:

- a) temporary land take during construction;
- b) potential for noise and vibration and air quality effects arising from construction activities to impact on the health of residents and local workers;
- c) severance or disruption to access to residences and community facilities during and after construction;
- d) severance of open space leading to impact on residents' physical activity and health; and
- e) reduction in severance currently experienced within the WHS.

Impact on the amenity and enjoyment experience of residents and users of community facilities

- 13.6.10 Potential impacts on amenity and enjoyment experience of residents and users of community facilities include:
- a) temporary and permanent changes to residential amenity due to changes in traffic levels during and after construction; and
 - b) changes to the accessibility of community facilities due to changes in traffic levels and potential diversions during and after construction.

Development land

- 13.6.11 Potential impacts on development land include:
- a) permanent land take of development land affecting viability for future development of the land allocation; and
 - b) severance or disruption to access during and after construction.

13.7 Design, mitigation and enhancement measures

Agricultural land and holdings

- 13.7.1 There are no universally applicable measures available to mitigate the direct permanent loss of agricultural land resulting from land take required for the proposed scheme.
- 13.7.2 The primary measures to mitigate the loss of soil resources will be set out in a soil resources plan, which will confirm the soil types, the most appropriate re-use for the different types of soils and proposed methods for handling, storing and replacing soils on-site, (see Chapter 10 Geology and Soils and Chapter 12 Materials).
- 13.7.3 Measures to mitigate the severance of agricultural holdings will be incorporated into the design and will include ensuring continuance of private means of access. Other mitigation for individual land holdings will relate to the reinstatement of land used temporarily during the construction period to an agricultural use.

Impact on Non-Motorised users including amenity and enjoyment

- 13.7.4 The scheme provides the opportunity to enhance the amenity and enjoyment of NMUs, providing additional benefits, as well as addressing adverse effects via mitigation. Proposals include:
- a) new PRoWs created in the western section along the de-trunked/downgraded A303, including a new cycleway on the north and new route for other users on the south side of the new alignment both tying in with PRoW SLAN3, and a new segregated cycleway east from Winterbourne Stoke to the new Longbarrow Junction;
 - b) the provision of 'green bridges' at three locations, to provide two new NMU routes and the realignment of the existing Winterbourne Stoke 6B PRoW; and

- c) the tunnelling of the A303 and downgrading the current road in that section to a route open to NMUs only and extending to the Stonehenge Visitor Centre to the north and PRow 12 to the south.

Development land

13.7.5 Mitigation of effects on development land will be specific to each of the circumstances identified, with steps undertaken to inform mitigation likely to include:

- a) discussions with the promoters of proposed developments to ensure compatibility of proposals;
- b) discussions with promoters to identify potential cumulative effects during the construction and operational phases;
- c) continued monitoring of planning applications for new development proposals in or around the route alignment; and
- d) monitoring of the plan preparation process for the Wiltshire Housing Sites Development Plan Document.

13.8 Assessment of effects

13.8.1 The effects have been assessed following consideration of the potential impacts outlined in section 13.6 and the mitigation measures in section 13.7.

Agricultural land and holdings

13.8.2 The agricultural land that would be affected by the construction of the proposed scheme will be surveyed to determine its agricultural land classification (grade). The preliminary assessment has determined that, of the agricultural land which would be required for the construction of the proposed scheme, the majority is likely to be BMV in subgrade 3a. The removal of this area of land (albeit some will be restored) would be a likely significant adverse effect of the scheme.

13.8.3 The preliminary assessment has identified eleven farm businesses that would be likely to be directly affected by the proposed scheme (in terms of land loss):

- a) Berwick Hill Farm, Berwick St James;
- b) Guinness Estate, Winterbourne Stoke;
- c) Little Wishford Farm, Stoford;
- d) Manor Farm, Stapleford;
- e) Scotland Lodge Farm, Winterbourne Stoke;
- f) Manor Farm, Winterbourne Stoke (including land rented from National Trust);
- g) Boreland Farm with Westfield Farm, Woodford;
- h) West Amesbury Farm with Park Farm (including land rented from National Trust and Antrobus Estate);

- i) Beacon Hill Land Ltd, Amesbury (including land rented from National Trust and DCMS);
- j) Ratfyn Farm, Amesbury (including land rented from Lincoln College, Oxford); and
- k) Shrewton Farm, Shrewton.

13.8.4 Discussions with the owners/occupiers of each of these holdings are ongoing. The construction of the proposed scheme is likely to generate significant adverse effects on holdings in terms of the area and quality of land required; the area of agricultural land severed (and, where relevant, proposed means of access); removal of farm infrastructure; and other effects, such as arising from dust deposition or noise.

Non-Motorised Users

Journey length and local travel patterns

13.8.5 The proposed scheme's provision of a tunnel and extensive improved and new NMU routes provided along and across the proposed scheme would support improved links between the Stonehenge WHS and surrounding villages. This would be likely to result in a significant permanent beneficial effect on journey times and connectivity for users of the PRow network.

Amenity

13.8.6 Construction of the proposed scheme may result in likely significant temporary adverse effects on amenity for users of the PRow network, due to the volume of construction traffic using roads in the study area.

13.8.7 During operation, the downgrading of the existing A303 through Winterbourne Stoke, and to a NMU route through the Stonehenge WHS, would likely result in a permanent significant beneficial effect related to the improved amenity of NMUs.

Community severance

13.8.8 During construction, the proposed scheme involves a new A303 alignment north of Winterbourne Stoke to form a Winterbourne Stoke bypass which would result in improved connectivity within the village. The retained B3083 with a new re-aligned underbridge under the new A303 alignment would mitigate any severance effects around Winterbourne Stoke and between the village and Shrewton to the north.

Motorised travellers

Driver stress

13.8.9 Construction of the proposed scheme would generate HGV movements and associated traffic management measures, and delays arising from these may result in a significant temporary adverse effect on driver stress.

13.8.10 The operation of the proposed scheme is likely to result in significant beneficial effects in terms of reducing driver stress, principally through the upgrading of the A303 to a dual carriageway. These would be in the form of reduced journey

times, the improved condition of the road network, improved route certainty and a reduced fear of potential accidents.

Driver views

- 13.8.11 The closure of the existing at-grade section of the A303 between Longbarrow Roundabout and Stonehenge Road would result in likely temporary (during construction) and permanent (during operation) significant adverse effects on driver views of the WHS as views of the Stones would be lost.

Private assets

- 13.8.12 Construction of the proposed scheme may temporarily disrupt access and result in amenity effects on assets where these lie in proximity to construction activities, although this is not anticipated to result in significant adverse effects.

Development land

- 13.8.13 There are not anticipated to be significant adverse effects on land allocations and planning applications / permissions resulting from permanent land take or severance or disruption to access during or after construction.

Summary of preliminary assessment

- 13.8.14 Preliminary Construction Assessment:

- Construction of the proposed scheme would result in likely significant adverse effects on best and most versatile agricultural land and agricultural holdings.
- Construction of the proposed scheme would result in likely significant temporary adverse effects on amenity for users of the PRoW network.
- Construction of the proposed scheme would result in likely significant adverse temporary effects on driver views and stress.

- 13.8.15 Preliminary Operational Assessment:

- Operation of the proposed scheme would result in likely significant adverse effects on driver views;
- Operation of the proposed scheme would have likely significant beneficial effects on amenity and connectivity for users of the PRoW network;
- Operation of the proposed scheme would have likely significant beneficial effects on improved amenity and reduced severance for the community of Winterbourne Stoke;
- Operation of the proposed scheme would have likely significant beneficial effects of improved journey time reliability and reduced stress for drivers on the A303.

13.9 Corridors for utility connections

- 13.9.1 The agricultural land lying on or within the route of the western and eastern power connections and construction activities associated with expansion of the

sub-stations is mapped at a large-scale under the Agricultural Land Classification (ALC) system as mainly Class 3 (good to moderate) with small areas of Grade 2 and Grade 4 land. The majority is in arable use, with livestock and equestrian grazing also undertaken.

- 13.9.2 For NMUs, sections of PRoWs STAP8, STAP13, BSJA9, BSJA10, and WSTO6A lie along the western connection route, and AMES35 abuts the eastern connection route. Private assets lie in proximity to the connection routes and sub-stations including:
- a) isolated dwellings on Over Street, Chain Hill, and along unnamed roads near Winterbourne Stoke in proximity to the eastern connection route; and business premises in Serrington (a public house and a Garage) and Stapleford (a bed & breakfast), in proximity to the western connection route and sub-station extension; and
 - b) a small number of dwellings and a mechanic business in Ratfyn near to the eastern route and sub-station expansions.
- 13.9.3 For agricultural land and holdings, the principal potential impact for both eastern and western connections would occur during construction with the agricultural land required temporarily for the works identified, in particular that classified as BMV. Potential impacts on farm holdings relate mainly to disturbance and possible loss of agricultural infrastructure such as temporary disruption to drainage systems. The preliminary assessment has determined that the agricultural land required for construction is likely to be classified as best and most versatile in either Grade 2 or 3a. The removal of the additional areas of land for each connection during construction (albeit most would subsequently be restored) would add to the previously reported likely significant adverse effect of the scheme on agricultural land. There would be no additional significant effects on agricultural holdings.
- 13.9.4 Any restrictions placed on NMUs on their use of PRoWs to facilitate the laying of the connection routes would be expected to only be for a short amount of time at any one location and thus no significant effect on users is anticipated.
- 13.9.5 Construction activities would be relatively limited in extent and for the majority of the two connection routes would not be in close proximity to human receptor locations. Therefore no likely significant effects on the amenity of residents and local workers at private assets are anticipated during construction or in operation. There would be no significant effects with regard to driver stress and driver views in either construction or operation associated with corridors for utility connections.

14 Climate

14.1 Introduction

- 14.1.1 This chapter addresses the likely climate impacts of the proposed scheme. To align with the requirements of the IP EIA Regulations 2017 (Ref 14.1) and the NPSNN, the chapter is divided into two separate assessments:
- a) Greenhouse gas (GHG) impact assessment – the effects on the climate of GHG emissions arising from the proposed scheme, including how the project will affect the ability of Government to meet its carbon reduction plan targets (in accordance with NPSNN para 5.17);
 - b) Climate resilience assessment – the resilience of the proposed scheme to impacts resulting from a changing climate, including how the proposed scheme design will take account of the projected impacts of climate change (in accordance with NPSNN para 4.40 and the IP EIA Regs 2017).
- 14.1.2 For purposes of clarity, this chapter addresses each of the two climate topic assessments separately where appropriate. In-combination effects of a changing climate and the proposed scheme on the surrounding environment are considered in Chapter 15 Cumulative, In-Combination and Project-wide Effects of this PEI Report.
- 14.1.3 As stated in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Synthesis Report (Ref 14.2), mitigation (i.e. reducing GHG emissions) and adaptation (i.e. responding to climate change impacts) are complementary approaches to reducing risks of climate change impacts over different timescales. Mitigation, in the short-term and medium-term, can substantially reduce climate change impacts in the latter decades of the 21st century. Benefits from adaptation can be realised now to address current risks, and can be realised in the future to address emerging risks. Innovation and investments in environmentally sound infrastructure and technologies can both reduce lifecycle GHG emissions and enhance resilience to climate change.

14.2 Stakeholder engagement

- 14.2.1 Both Wiltshire Council and the Environment Agency will be consulted further as the GHG assessment progresses, although neither body provided detailed comments on climate change at the scoping stage. The Environment Agency may wish to understand the impact on national carbon targets while Wiltshire Council may wish to understand how the proposed scheme complies with their local climate strategy.
- 14.2.2 With regard to resilience of the proposed scheme to a changing climate, a number of statutory stakeholders including both Wiltshire Council and the Environment Agency have been consulted. Further details on the consultation specifically in relation to future flood risk and water flows and levels in periods of water scarcity can be found in Chapter 11 Road Drainage and the Water Environment.

14.3 Study area

GHG impact assessment

- 14.3.1 The study area covers all direct GHG emissions arising from activities undertaken within the proposed site boundary during the construction, operation and maintenance of the proposed scheme. It also includes indirect emissions embedded within the construction materials arising as a result of the energy used for their production as well as emissions arising from the transportation of materials and waste to and from the site.

Climate resilience assessment

- 14.3.2 The study area for the resilience assessment is the proposed site boundary, i.e. it covers all assets and infrastructure which constitute the proposed scheme.

14.4 Baseline conditions

GHG impact assessment

- 14.4.1 The baseline for the GHG impact assessment is a “business as usual” scenario whereby the proposed scheme does not go ahead. Under this scenario GHG emissions associated with the future use and maintenance of the existing road are included. The detailed baseline is being developed using traffic models based on the current road scheme layout and its predicted use, accounting for any increase in traffic and associated congestion, through to 2041 (the design year for the proposed scheme). This model will establish a baseline against which the proposed scheme can be compared to identify any variation in GHG emissions over time.
- 14.4.2 To allow for an assessment of the GHG emissions impact due to land use change, the baseline also includes GHG emissions sequestered by the existing vegetation and habitats which will be subject to land acquisition when the proposed scheme is constructed. This greenfield land, including the soils and vegetation, is currently acting as a carbon sink which will be lost once the scheme is built, unless compensatory habitat is created.

Climate resilience assessment

- 14.4.3 A review of all available and relevant information sources has been undertaken to establish existing and future baseline data and current understanding with regards to climate and extreme weather risks.

Existing baseline

- 14.4.4 The Local Climate Impacts Profile for Wiltshire (LCLIP) (2010)(Ref 14.4) assessed the vulnerability of council services to severe weather events, and was based on a review of media stories in the local press over an eight year period between January 2003 and March 2010. The LCLIP review found that Wiltshire is already experiencing major weather events and that several highly significant events occurred over the eight year LCLIP period. The most frequent impacts of these events were infrastructure disruption which had a direct impact on frontline service delivery as well as indirectly impacting all services through access to offices or workplaces.

- 14.4.5 Several events which took place during the study period were recognised as being highly significant, these being:
- a) High temperatures / heat waves in August 2003 and July 2006: leading to strain on water and energy utilities, significant damage to road infrastructure (and also to rail infrastructure in 2003), danger to vulnerable groups (and excess deaths reported nationally in 2003);
 - b) Excessive rainfall / flooding in July 2007 and January 2008: leading to flooding of properties in several towns across Wiltshire, infrastructure disruption (particularly road and rail infrastructure in 2008); and
 - c) Frost / snow / ice in February 2009 and January 2010.
- 14.4.6 The LCLIP also identifies possible impacts arising due to weather events. Examples relevant to road infrastructure include:
- a) High temperatures / heat waves: ‘melting’ roads, damage to structures
 - b) High winds: health and safety risks, infrastructure disruption and damage, property damage
 - c) Excessive rainfall / flooding: health and safety risks, infrastructure disruption and damage.
- 14.4.7 The LCLIP also notes that subsidence can result in significant damage to infrastructure and can be the result of high temperatures and corresponding changes in the moisture content of soil or growth of vegetation.
- 14.4.8 There is strong agreement that the climate is changing beyond that of expected natural fluctuations. Met Office records show that Central England temperatures have increased by 1°C since the 1970s, total summer rainfall has decreased in most parts of the UK, and the UK has experienced 9 of the 10 warmest years on record since 1990.
- 14.4.9 Met Office historic climate data from the Boscombe Down Weather Station (the closest Weather Station to the proposed scheme area) (Ref 14.9) show that for the period 1981-2010, average annual maximum daily temperatures were 14.1°C, with July being the warmest month on average (mean maximum daily temperature of 21.9°C) and January being the coldest month on average (mean daily minimum temperature of 1.1°C). Mean annual rainfall levels were 748.6mm, with November being the wettest month on average (84.0mm of rainfall on average for the month) and July being the driest month on average (48.9mm of rainfall on average for the month). January is, on average, the windiest month, with July and August being the least windy.

Future baseline

- 14.4.10 The UK Climate Projections 2009 (UKCP09) (Ref 14.5) provide the best scientific picture of how global climate change is likely to affect the south west region of England. UKCP09 projections for Wiltshire suggest that, by the 2080s (2070-2099), the county will experience an increase in summer mean temperature of up to around 5.2°C, and of winter mean temperatures of up to around 3.6°C compared to the 1961-90 baseline records. For the same time period, winter

mean precipitation is expected to increase by up to 29% and summer mean precipitation is expected to decrease by up to 30%.

14.4.11 The frequency of severe weather events is also projected to increase due to climate change. UKCP09 medium projections indicate that, by the 2080s (2070-2099), there could be up to 5 annual heatwaves per year i.e. two days of hot weather with a maximum temperature of >29°C and a minimum of >15°C and up to 11 dry spells lasting more than 10 days. As noted by the Climate Change Risk Assessment (CCRA 2017) (Ref 14.6), England is already impacted by extreme weather events. The report also identifies key risks and implications from a changing climate, which include:

- a) Changes in extreme weather conditions, which will impact on infrastructure, in particular through storm damage, flooding and high temperatures.
- b) Flooding of transport, including roads and rail is likely to increase, affecting both urban and rural access routes.

14.4.12 In relation to key infrastructure such as roads, the CCRA report notes that England has a number of roads and railways at significant likelihood of river and tidal flooding. Flooding of transport infrastructure and the associated disruption is projected to increase, affecting both urban and rural access routes.

14.5 Potential impacts

14.5.1 Mitigation measures being incorporated in the design and construction of the proposed scheme are set out in section 14.6 below. Prior to implementation of the mitigation, the potential impacts of the proposed scheme are presented below.

GHG impact assessment

14.5.2 To assess the GHG emissions arising from the construction, operation, maintenance and use of the proposed scheme a lifecycle assessment approach is being undertaken using design, construction and transportation data. This approach is consistent with the principles set out in BS EN 15804 (Ref 14.7), PAS 2080 (Ref 14.8), the IEMA guidance (Ref 14.9) and Chapter 4 of the TAG Unit A3 Environmental Impact Appraisal (Ref 14.10). The final outputs from the GHG assessment will be presented in the Environmental Statement. The key GHG emission sources that are being considered in the GHG assessment are set out in Table 14.1 below:

Table 14.1: Key anticipated GHG emission sources

Lifecycle stage	Activity	Primary emission sources
Pre-construction stage	Enabling works to prepare the site for construction.	Vehicles and fuel use for generators on site. Workers travelling to and from the site of the proposed scheme.
	Land clearance for example removal of any vegetation or habitats for replacement with other land use.	Losses of carbon sink i.e. removal of a natural environmental that has the ability to absorb GHG emissions.

Lifecycle stage	Activity	Primary emission sources
Product stage	Use of products and/or materials required to build the proposed scheme.	Embodied GHG emissions within the construction materials i.e. emissions resulting from the extraction of raw materials, the manufacturing/processing of materials into secondary/final products for use and the transportation of those materials.
Construction process stage	On-site construction activity including: Use of construction vehicles and plant including tunnel boring machinery; Transport of materials to the construction site (where these are not included in embodied GHG emissions); Transportation of construction workers to site; Disposal of any waste or other materials generated by the construction processes.	GHG emissions from vehicle and plant use. GHG emissions from disposal of waste.
Operational stage	Operation of the associated road and tunnel lighting, overhead gantries etc. Maintenance including re-surfacing. Proposed planting of new vegetation.	GHG emissions from energy and fuel use. Embodied emissions associated with re-surfacing materials. Sequestration of GHG emissions by new vegetation acting as a carbon sink.
Use stage	Vehicle journeys both on the road and within the vicinity of the road.	GHG emissions per vehicle km. Energy consumption

Climate resilience assessment

- 14.5.3 The proposed scheme area may be vulnerable to a range of climate risks, including an increased frequency and severity of prolonged and/or heavy precipitation events, prolonged droughts and heatwaves, a greater frequency of very hot days, and an increased risk of storms. Warmer temperatures may also mean that the risks associated with ice and snow will decrease over time, but retaining the ability to respond to these events will remain important.
- 14.5.4 The proposed scheme itself is identified as having the potential to be vulnerable to a range of climate risks during its use. These include, but are not limited to:
- a) Material deterioration due to high temperatures leading to deterioration of structures and pavements such as softening, deformation and cracking;
 - b) Overheating of electrical equipment, such as information and communication systems;

- c) Health and safety risks to road users and employees as a result of changing temperatures;
- d) Increased frequency of fog episodes which may reduce visibility and access;
- e) Changes in travel patterns of network users;
- f) Longer vegetation growing seasons leading to a reduction in soil moisture and/or increased tree leaf coverage with an increased magnitude and frequency of storm events which could result in tree fall and increased maintenance and management requirements;
- g) Damage to roads from periods of heavy rainfall;
- h) Flood risk on the network and damage to drainage systems with the potential for increased runoff from adjacent land contributing to surface water flooding;
- i) Health and safety risks to road users and employees as a result of reduced visibility and standing water originating from prolonged and/or heavy precipitation and storms;
- j) Increased slope instability as a result of prolonged/heavy precipitation leading to subsidence;
- k) Pollution as a result of surface runoff;
- l) Increased wind speeds leading to damage of structures and associated health and safety risks to network users;
- m) Storm damage to structures and other assets;
- n) Inaccessible network during extreme weather events; and,
- o) Reduced pavement and asset deterioration (over time) from less exposure to freezing, snow and ice, along with a reduced need for winter maintenance and a reduction in health and safety risks.

14.6 Design, mitigation and enhancement measures

GHG assessment

14.6.1 As the GHG assessment progresses, measures will be identified to reduce emissions across the lifecycle of the proposed scheme. Mitigating measures being considered include but are not limited to:

- a) A Construction Environmental Management Plan (CEMP), to be prepared and implemented by the selected construction contractor, which would need to include a range of best practice construction measures outlining an environmental management framework, operational control procedures (for example development of a site waste management plan) as well as a pollution control contingency plan.

- b) Specification of alternative materials with lower embodied GHG emissions such as locally sourced products and materials with a higher recycled content.
- c) Low carbon design specifications such as energy-efficient lighting and durable construction materials to reduce energy consumption and maintenance and decrease replacement cycles.
- d) Use of excavated material including chalk arisings from the cuttings and the tunnel boring operation to be processed and used within other elements of the proposed scheme such as embankments to reduce transport distances and embodied carbon.
- e) Inclusion of green bridges in the design that will act as carbon sinks.

14.6.2 The most appropriate mitigation measures will be confirmed within the GHG impact assessment in the ES and embedded within the proposed scheme.

Climate resilience assessment

14.6.3 A number of general mitigation and adaptation measures to address these risks are being considered, many of which have been identified by other parts of the EIA and through the proposed scheme design.

14.6.4 The proposed scheme will be designed to be resilient to impacts arising from current weather events and climatic conditions (identified within the LCLIP for instance) and designed in accordance with current planning, design and engineering practice and codes. The assessment is identifying and taking into account existing resilience measures for each climate variable and associated risks either already in place or in development for infrastructure and assets. Mitigation measures being considered include alternative pavement materials with superior properties (such as increased tolerance to fluctuating temperatures), Sustainable Drainage Systems (SUDS) and green bridges. Adaptation measures could include appropriate emergency systems being in place.

14.6.5 To mitigate against any increases in peak flow that may exacerbate flooding as a result of climate change, hydraulic models of both the fluvial and pluvial systems are being created. These models represent the baseline scenario i.e. the current state and a scenario in 100 years taking into account climate change. This allows for a more accurate scenario against which to assess the design and to identify measures to mitigate against these effects. Mitigation being considered includes flood compensatory storage, alterations to the locations of embankments, or localised re-profiling of land.

14.6.6 Further assessment on the resilience of the proposed scheme to future climate impacts will continue as the scheme design evolves and as further assessment is undertaken for other applicable EIA topic areas. The most appropriate mitigation measures (relevant to the identified risks) will be identified in the climate resilience assessment in the ES and will be embedded within the proposed scheme.

14.7 Assessment of effects

GHG assessment

- 14.7.1 The NPSNN states that it is unlikely that the impact of a single road development, such as the proposed scheme, will affect the UK's ability to meet its overarching binding GHG reduction targets. However, as the UK's trajectory to this overall target is defined by a series of five year carbon budgets, it is also important to assess the GHG impact of the proposed scheme against these budgets.
- 14.7.2 The Government's national carbon reduction strategy (provided in the Carbon Plan 2011 (Ref 14.11)) provides a plan for the UK to meet its carbon reduction targets. While the Government is legally bound to meet the commitments set out in this plan, any increase in GHG emissions as a result of the proposed scheme would not necessarily result in the scheme being refused consent unless the increase causes a materially significant effect.
- 14.7.3 While the NPSNN does not specify significance criteria for GHG emissions, it does highlight the document 'Investing in Britain's Future' which states that the Programme of investment planned for the UK Strategic Road Network would equate to below 0.1% of average annual carbon emissions allowed in the fourth carbon budget. This needs to be considered in the context of other Policy around an increase in the use of electric vehicles and the decarbonisation of the national electricity grid.
- 14.7.4 The GHG impacts of the proposed scheme should also be put into the wider context of the UK Strategic Road Network (SRN). The length of the proposed scheme represents less than 0.2% of the 4,400 mile UK SRN (DfT 2017) (Ref 14.12). Therefore, although it is important that the relative GHG impacts of the options are considered so that mitigation measures can be integrated into the scheme, the overall increase is expected to be minimal when considered in the national context.
- 14.7.5 Of all the lifecycle stages scoped in to the assessment and shown in Table 14.1 above, the embodied carbon associated with materials use is likely to be the biggest contributor to the carbon footprint of the proposed scheme. Materials such as steel, concrete and bitumen can have high embodied carbon contents depending on the specifications used. The assessment for the ES will identify the materials used and calculate the associated carbon emissions from their production as well as transport to site.
- 14.7.6 During the construction stage, activities associated with the excavation of the tunnel such as the use of tunnel boring machines which require a mains electricity supply and the disposal of excavated material are likely to contribute significantly to total emissions. The treatment, disposal and associated transport of this material have the potential to contribute a large part of the construction carbon footprint. The chalk arising from the tunnel boring process would be processed on site to enable transportation and re-use. This processing and subsequent use of the excavated materials will be taken into account during the assessment.

- 14.7.7 The ES will provide a comparison of the total emissions from the construction and maintenance of the scheme with national level carbon budgets and the associated five year reduction targets.
- 14.7.8 To put the impact of the proposed scheme into context, total emissions will also be compared against other new road schemes within the Strategic Road Network to benchmark GHG performance.
- 14.7.9 The five year carbon budgets and associated carbon reduction targets will already account for a proportion of carbon emissions resulting from the existing road network. The purpose of the GHG assessment is therefore to understand what additional emissions will arise as a result of the proposed scheme in addition to those already predicted. GHG impacts from ‘additional’ road use will therefore be assessed by comparing a business as usual baseline (i.e. where the scheme is not built) against road use for the proposed scheme. It should be noted however that not all journeys made on the new road would result in additional emissions to the associated carbon budget as it is likely that a proportion of these journeys would have been made anyway via different routes. In order to overcome this and provide a comparison a number of scenarios will be used, with the assessment conducted on this basis.

Climate resilience assessment

- 14.7.10 The proposed scheme itself has been identified as being vulnerable to a range of climate risks during its use and its resilience to these impacts will be assessed on an ongoing basis as the design develops and further data becomes available. The ES will provide the outputs of the ongoing climate resilience assessment identifying the key impacts on the proposed scheme and appropriate measures that will be implemented to mitigate these.
- 14.7.11 The proposed scheme will be inherently designed to minimise the impacts of climate change on future use as far as is reasonably feasible. Potential impacts as a result of more extreme temperature fluctuations, an increase in the frequency of storms and the risk of more flash flooding would be mitigated through the design of the scheme, the selection of materials used for its construction and operational procedures. Scheme drainage for example will be designed to be resilient to the increase in predicted levels of precipitation while materials specification considers the ability of the product to withstand a wide range of temperature scenarios.

Summary of preliminary assessment

- 14.7.12 Whilst there is no specified significance criteria currently published in relation to Highways England projects, likely GHG hotspots include embodied carbon associated with raw material use and excavation works. Mitigation options are being considered to reduce the impact of these hotspots on the scheme's effect on the national carbon budgets. Based on the information available, the expected design, mitigation and enhancement measures set out above and the preliminary assessment undertaken to date, it is anticipated that the full GHG assessment undertaken as part of the ES will comply with the NPSNN, namely that it is unlikely that the impact of the proposed scheme would affect the UK's ability to meet its overarching binding GHG reduction targets.

14.7.13 Based on the information available, the expected design, mitigation and enhancement measures set out above and the preliminary assessment undertaken to date, no likely significant effects around the resilience of the scheme to climate change are anticipated.

15 Cumulative, In-combination and Project-wide Effects

15.1 Introduction

15.1.1 This chapter considers the following:

- a) **Cumulative effects (also known as inter-project effects):** the effects of other developments in the vicinity of the proposed scheme which are proposed, under construction or have been consented, which when combined with the effects of the proposed scheme may have an incremental significant effect;
- b) **In-combination effects:** the combined effects from the proposed scheme on a single receptor from a number of individual environmental impacts, for example noise, dust and traffic; and
- c) **Project-wide effects:** the individual effects on a receptor arising as a result of the proposed scheme, which when summed over the length of the proposed scheme, result in an effect of greater significance than the sum of the individual effects, for example project wide effects on a particular species or habitat at discrete locations along the length of the proposed scheme.

15.1.2 The following sub-sections consider each of these types of effect in turn and summarise the approach that is being used for their assessment. Given that the assessments for these types of effect are undertaken towards the end of the EIA process, when other topic assessments have been well progressed and data relating to other developments in the vicinity is confirmed, it is not possible to identify likely significant effects with confidence at this stage.

15.2 Cumulative effects

Methodology

15.2.1 The Planning Inspectorate's Advice Note 17 (Ref 15.1) on the assessment of cumulative effects identifies a four stage approach, as follows:

- a) Stage 1 – establish the project's zone of influence (Zoi) and identify a long list of 'other development' (the 'development schedule');
- b) Stage 2 – identify a shortlist of 'other development' for the cumulative impact assessment;
- c) Stage 3 – information gathering; and
- d) Stage 4 – assessment.

15.2.2 This approach has been adopted for the assessment, alongside consideration of guidance set out within the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2 Part 5: Assessment and Management of Environmental Effects (HA205/08) (Ref 15.2).

15.2.3 The assessment of cumulative effects arising from the proposed scheme in combination with other proposed schemes (inter-project effects) is based upon a

review of current planning applications as well as a study of planning and policy documents.

- 15.2.4 The cumulative study for the proposed scheme is currently at Stage 1 and is focussed on the identification of relevant developments and land allocations within the Zol (see Figure 15.1) which have the potential to generate potentially significant cumulative effects. Details of developments are currently being collated and placed on an initial long-list (the development schedule) which identifies the size, type and location of each development. These long-list developments are being reviewed to assess their potential temporal and spatial interactions with the proposed scheme in order to identify whether they should be scoped into the cumulative assessment.
- 15.2.5 The Zol for each environmental topic as shown on Figure 15.1 is indicative and will be subject to review as the assessment progresses. Table 15.1 explains the current rationale for the extent of each Zol.

Table 15.1: Zol extents for assessment of potential cumulative impacts

Environmental topic	Zone of influence (Zol)
Air Quality	<p>Construction: The Zol will be 200m from construction activities for construction dust and emissions. A Zol for construction traffic will be determined based on a review of other development proposals and their construction programmes.</p> <p>Operation: The ‘affected roads’ within the detailed traffic model define the Zol. As the operational phase traffic data includes traffic associated with other developments, the air quality impact assessment to be included in the ES will inherently be a cumulative impact assessment.</p>
Cultural Heritage	<p>Construction and Operation: For the WHS, the Zol is defined by the whole designation and assets and their setting that contribute to the Outstanding Universal Value.</p> <p>Outside the WHS (for designated assets) the Zol is dictated by the Zone of Theoretical Visibility defined within the Landscape and Visual Impact Assessment (see below), although it will also be influenced by noise contour models, air quality models and traffic models.</p>
Landscape and Visual	<p>Construction and Operation: 2km from the centreline of the proposed scheme.</p> <p>Beyond this, the proposed scheme would be unlikely to give rise to any significant effects on landscape or visual receptors due to the scale and massing of the proposed built elements and associated operational elements (i.e. the traffic moving along the road); and the intervening landform and vegetation. The final Zol will be informed by a range of computer generated Zones of Theoretical Visibility which will be prepared in accordance with Guidelines for Landscape and Visual Impact Assessment, and verified by site visit.</p>
Biodiversity	<p>Construction and Operation: 2km from proposed site boundary based on proximity to statutory designated sites. The Zol for assessment purposes varies according to specific biodiversity receptors, is informed by SSSI risk zones and for species by Natural England and best practice guidance from the Chartered Institute of Ecology and Environmental Management and other sources.</p>

Environmental topic	Zone of influence (Zol)
Noise and Vibration	<p>Construction: The construction noise and vibration Zol is defined by proximity of closest identified receptors to the A303 construction works, following which an appropriate buffer will be established around receptors. The specific location of construction work areas is still to be confirmed.</p> <p>Operation: The operational noise and vibration Zol is defined by other cumulative developments which will be included in the traffic model that will accompany the application.</p>
Geology and Soils	<p>Construction and Operation: The land contamination assessment will include the working areas and an additional radial zone of 250m.</p> <p>The groundwater, surface water and potable water abstraction will consider a radial zone of 1 to 5km from the working areas.</p> <p>The above zones are defined on the basis of potential for interactions with other development at these distances.</p> <p>In terms of de-watering, the Zol will be defined by undertaking risk assessments to determine the potential for contaminants to mobilise.</p>
Road Drainage and the Water Environment	<p>Construction and Operation: The Zol has been defined by the surface water body catchments of the River Till and River Avon (upstream and downstream of the Nine Mile River), taking into account the groundwater body and groundwater source protection zones.</p>
Materials	<p>Construction: The Zol comprises the proposed scheme footprint and the region within which waste management facilities are located and from where construction materials may be sourced.</p> <p>Operation: Operational phase waste management issues are scoped out of the assessment.</p>
People and Communities	<p>Construction and Operation: The Zol is defined as 2km from the proposed scheme, as this would be the anticipated catchment area for community facilities likely to be affected by severance impacts.</p>
Climate	<p>Construction and Operation: The Zol covers all Greenhouse Gas emissions arising during proposed scheme construction and operation.</p> <p>The Zol for in-combination climate change impacts will be the area within the proposed site boundary.</p>

Initial findings

15.2.6 Based on a review of the initial long list of developments and allocations, a number of developments are currently considered to have potential to generate cumulative impacts with the proposed scheme based on their temporal scope, location and/or scale and nature, including:

- a) Kings Gate, Amesbury: New strategic housing allocation - 1,300 dwellings to be provided within the Core Strategy period (to 2026), a proportion of which have already been the subject of planning applications, located off the A345 just to the south of Amesbury; and
- b) various Core Strategy development allocations to the north and east of Salisbury which are linked to the A303 via the A360 and A345, including the Fugglestone Red mixed-use development alongside the A360 (1,250 dwellings and 8ha employment land) and the Longhedge mixed-use development alongside the A345 (450 dwellings and 8ha employment land).

- 15.2.7 It should be noted that the long list is subject to ongoing review and update, and thus further developments may be scoped into the assessment.
- 15.2.8 Consideration is also being given to the inclusion of other Highways England schemes as part of the cumulative effects assessment. It should be noted that schemes which will have a preferred route announcement before the application has been submitted for the proposed scheme, and whose scheduled year of opening is before that for A303 Stonehenge, will be included as part of the baseline (i.e. it is assumed that they will be operational before the proposed scheme), and therefore will not be included in the cumulative effects assessment for the operational phase. The assessment will, however, take account of potential cumulative impacts which may occur during the construction phase, based on the anticipated construction timescales for these developments.
- 15.2.9 A review of sites allocated for waste disposal and mineral extraction is currently underway, and these will be considered at Stage 2.

Next steps

- 15.2.10 The initial long-list (development schedule) will be further refined (aided by consultation with the relevant local planning authorities) to ensure that all development with the potential to result in potentially significant cumulative effects when considered together with the proposed scheme is taken into account by each of the environmental topic specialists.
- 15.2.11 At Stage 2, any developments not having potential to result in likely significant cumulative effects will be excluded, following discussion with the local planning authorities and consideration by the environmental topic specialists.
- 15.2.12 Stage 3 will involve the collation of information relating to the short-listed schemes, including the design and location, programme for construction, operation and demolition, and any environmental assessments carried out.
- 15.2.13 Stage 4 will involve the assessment and identification of potentially significant cumulative effects in combination with the proposed scheme.
- 15.2.14 The ES will report the results of the assessment with particular consideration given to any significant cumulative effects that are identified, and the need for mitigation. These effects will be reported within individual topic chapters as relevant with full details of Stages 1-4, including the final development schedule, reported within an ES appendix and summarised within a cumulative, in-combination and project-wide effects chapter.

15.3 In-combination effects

- 15.3.1 The combined effects of different environmental impacts from the proposed scheme on a single receptor are determined when the environmental assessments for the separate environmental topics have been completed, and as such this data is not available at this stage.
- 15.3.2 There is potential for both adverse and beneficial in-combination effects associated with the proposed scheme, for example, combined noise, severance and visual impacts on receptors in close proximity. The likelihood of in-

combination significant effects will be reported in the ES, following completion of the individual environmental topic assessments.

15.4 Project-wide effects

15.4.1 As the EIA progresses and the individual topics define localised impacts, consideration will be given to the potential for project-wide significant effects to occur due to the combination of these impacts (for example, the combination of impacts upon discrete habitats of the same type, along the length of the proposed scheme). If mitigation and avoidance measures are required at a project-wide level to eliminate such effects, these measures will be reported as part of the ES.

15.5 Human Health

Introduction

15.5.1 The EIA Directive (2014/52/EU) aims to achieve high levels of protection of human health & wellbeing and the environment. It requires that direct and indirect effects of a project on human health & wellbeing should be identified, described and assessed in a method appropriate to each individual case. This requirement is also reflected in the EIA Regulations.

15.5.2 The Directive also requires consideration of potential interactions between human health & wellbeing and other aspects included in the directive such as land, air, climate, noise and landscape when identifying and evaluating potential effects.

Potential Impacts

15.5.3 With regard to human health, potential impacts during and after construction could include:

- a) reduction in severance and improved connectivity of PROWs from the tunnelling of the A303 and downgrading the current road to a byway leading to lifestyle changes such as encouraging active travel (walking and cycling behaviours) and physical activity ;
- b) potential for adverse noise and vibration and air quality impacts arising from construction activities and the route having direct effects on health and wellbeing;
- c) reductions in journey time and improved reliability affecting access to local employment and training opportunities in turn affecting health and wellbeing;
- d) reduction in journey time and improved reliability potentially affecting access to key services and social infrastructure such as health facilities and education facilities; and
- e) reductions in journey time and improved reliability affecting access to open space and recreation space such as the WHS in turn affecting opportunities for physical activity.

- 15.5.4 In order to undertake a consideration of the proposed scheme's impacts on human health, the collated findings of the following topics, which are conducted principally in isolation as is required by their methodologies, will be utilised; Air Quality, Noise and Vibration, Landscape and Visual, People and Communities, and Climate.
- 15.5.5 The collation of these findings renders it appropriate that human health is considered as a specific type of cumulative effect and thus a qualitative assessment of the effects of the proposed scheme on human health will be undertaken and presented within the ES.
- 15.5.6 At this preliminary assessment stage, no significant human health issues are anticipated.

16 Summary of effects

- 16.1.1 The previous technical chapters 5-15 present the preliminary assessments for the individual EIA topics. Each assessment provides a preliminary assessment of the likely significant effects and Table 16.1 below provides a high level summary of these effects.

Table 16.1: Summary of preliminary assessment of likely significant environmental effects

Topic	Preliminary assessment of likely significant environmental effects*	
	Construction stage	Operational Stage
Air Quality	None anticipated.	None anticipated
Cultural heritage	<ul style="list-style-type: none"> temporary adverse effects of construction activities on the setting of monuments within and outside the WHS; temporary and permanent adverse effects on the setting of listed buildings in the vicinity of Countess roundabout. permanent adverse effects due to the loss or truncation of non-designated assets, mostly outside the WHS; permanent beneficial effects, once built, on the setting of monuments within the WHS, including Stonehenge; permanent beneficial effects, once built, due to the removal of severance of the Avenue and of relationships between monuments within the WHS. 	<ul style="list-style-type: none"> beneficial effect on public access to the WHS; beneficial effect on the setting of monuments within the WHS due to the removal of traffic using the A303.
Landscape and Visual	<ul style="list-style-type: none"> temporary adverse effects of construction activities on the rural landscape, particularly the River Till valley and at Longbarrow Junction; temporary adverse visual effects of construction activities on residents of Amesbury and Winterbourne Stoke, visitors to the WHS and users of the PRoW network; permanent adverse effects, once built, on the rural landscape, particularly the River Till valley; permanent beneficial effects, once built, on the landscape within the WHS. 	<ul style="list-style-type: none"> adverse visual effects on users of the PRoW network in the vicinity of the River Till valley; beneficial effects on the townscape within Winterbourne Stoke; beneficial visual effects on residents of Winterbourne Stoke, visitors to the WHS and users of the PRoW network within the WHS.
Biodiversity	<ul style="list-style-type: none"> temporary adverse effects of construction activities on Stone Curlew; beneficial effect, once built, on chalk grassland habitat in vicinity of Parsonage Down; 	<ul style="list-style-type: none"> likely significant local adverse effects on Stone Curlew south of the A303, due to the increased public access across the WHS enabled by the proposed scheme; beneficial effect on ecological connectivity due to the tunnel and inclusion of green bridges.

Topic	Preliminary assessment of likely significant environmental effects*	
	Construction stage	Operational Stage
Noise and vibration	<ul style="list-style-type: none"> temporary adverse noise effects of construction activities for residential properties in close proximity to the works, such as the edge of Amesbury and the northern edge of Winterbourne Stoke. 	<ul style="list-style-type: none"> adverse noise effects for properties on the northern edge of Winterbourne Stoke closest to the section of the A303 which is realigned to the north of the village; beneficial noise effects for residents of Winterbourne Stoke located in close proximity to the existing A303 through the centre of the village; beneficial noise effects for visitors to the WHS.
Geology and soils	None anticipated	None anticipated
Road Drainage and the Water Environment	None anticipated	None anticipated
Materials	None anticipated	None anticipated
People and Communities	<ul style="list-style-type: none"> adverse effects on best and most versatile agricultural land and agricultural holdings; temporary adverse effects on amenity for users of the PRoW network during construction; temporary adverse effects on drivers views and stress during construction 	<ul style="list-style-type: none"> operation of the proposed scheme would result in likely significant adverse effects on driver views; beneficial effects on amenity and connectivity for users of the PRoW network; beneficial effects on improved amenity and reduced severance for the community of Winterbourne Stoke; beneficial effects of improved journey time reliability and reduced stress for drivers on A303.
Major accidents and disasters	None anticipated	None anticipated
Climate	None anticipated	None anticipated
Human health	None anticipated	None anticipated

*Note - After inclusion of the proposed mitigation measures.

References

- Ref 1.1. HM Treasury (2014) National Infrastructure Plan 2014
- Ref 1.2. Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Statutory Instrument 2017/572)
- Ref 1.3. Department for Transport (DfT) (2014), National Policy Statement for National Networks (NPSNN), The Statutory Office
- Ref 1.4. Department for Communities and Local Government (2012), National Planning Policy Framework (NPPF), the National Archives
- Ref 1.5. Wiltshire Council (2015) Wiltshire Core Strategy, Wiltshire Local Development Framework
- Ref 1.6. Wiltshire Council (2011) Salisbury District Local Plan
- Ref 1.7. Wiltshire Council (2009) Wiltshire and Swindon Waste Core Strategy Development Plan Document 2006-2026
- Ref 1.8. Wiltshire Council (2009) Wiltshire and Swindon Minerals Core Strategy Development Plan Document 2006-2026 adopted 2009
- Ref 3.1. HM Treasury (2013) Investing in Britain's Future, HM Treasury
- Ref 3.2. Highways Agency (2015) A303/A30/A358 Corridor Feasibility Study, Stage 1 Report
- Ref 3.3. Department for Transport (2014) Road investment strategy: 2015 to 2020 <https://www.gov.uk/government/collections/road-investment-strategy>
- Ref 3.4. Highways England (2017) A303 Stonehenge Amesbury to Berwick Down Scheme Assessment Report
- Ref 3.5. Highways England (2017) A303 Stonehenge Amesbury to Berwick Down Report on Public Consultation
- Ref 3.6. Highways England (2017) A303 Stonehenge Amesbury to Berwick Down, Moving forward – the preferred route
- Ref 4.1. Highways Agency (2007) Design Manual for Roads and Bridges: Volume 11 <http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/index.htm>
- Ref 4.2. Highways England (2015), Interim Advice Note 125/15, Environmental Assessment Update
- Ref 5.1. Air Pollution Information System (APIS) (2017) website (<http://www.apis.ac.uk/>), accessed September 2017
- Ref 5.2. Arianoutsou M, Lanaras T, Zaharopoulou A. (1993), Influence of dust from a limestone quarry on chlorophyll degradation of the lichen *Physcia adscendens* (Fr.) Oliv. *Bulletin of Environmental Contaminants and Toxicology*, 50: 852-855.

- Ref 5.3. Department for Environment, Food and Rural Affairs (2016a). 2013-based background maps for NOx, NO2, PM10 and PM2.5. Available at < <https://uk-air.defra.gov.uk/data/laqm-background-home>>
- Ref 5.4. Department for Environment, Farming and Rural Affairs (2017b), Defra Air Quality Management Areas. Available at < <http://uk-air.defra.gov.uk/aqma/maps>>
- Ref 5.5. Department of Environment, Food and Rural Affairs (Defra) (2017c), Defra PCM mapping available at: <<http://uk-air.defra.gov.uk/data/gis-mapping>>
- Ref 5.6. Highways Agency (2007). DMRB, Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07).
- Ref 5.7. Highways Agency (2012). Interim Advice Note 170/12 v3, Updated air quality advice on the assessment of future NOx and NO2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07).
- Ref 5.8. Highways Agency (2013a). Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07).
- Ref 5.9. Highways Agency (2013b). Interim Advice Note 175/13 Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07).
- Ref 5.10. Highways Agency (2015). Interim Advice Note 185/15 Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07).
- Ref 5.11. Highways England (2016) AQ monitoring results located on the A303, Received from Highways England via email on 17/08/16.
- Ref 5.12. Institute of Air Quality Management (IAQM) (2014). Guidance on the Assessment of Dust from Demolition and Construction.
- Ref 5.13. Natural England (2017), Available at: <http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp>
- Ref 5.14. Ordnance Survey (2017) AddressBase Plus and MasterMap datasets.
- Ref 5.15. Test Valley Borough Council (TVBC) (2017), 2017 Air Quality Annual Status Report.
- Ref 5.16. Wiltshire Council (2015b), 2015 Updating and Screening Assessment for Wiltshire Council.
- Ref 5.17. Wiltshire Council (WC) (2016), Wiltshire Council 2016 Air Quality Annual Status Report (ASR).

- Ref 6.1. Wessex Archaeology, 2016a A303 Amesbury to Berwick Down. Geophysical Survey Report. Arup Atkins Joint Venture Document Reference HE551506-AA-EHR-SWI-RP-YE-000003
- Ref 6.2. Wessex Archaeology, 2016b A303 Amesbury to Berwick Down: Archaeological Trial Trench Evaluation, Unpublished client report ref. A303 AAJV (Wessex Archaeology) Evaluation Report 113221-01
- Ref 6.3. Historic England 2017, Exploring the Landscape of Stonehenge, Historic England Research Vol 6, July 2017
- Ref 7.1. Highways England, (2010). Interim Advice Note 135/10 Landscape and Visual Effects Assessment. [online]. Available at: <<http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian135.pdf>> [Last accessed 23rd November 2017].
- Ref 7.2. Landscape Institute with the Institute of Environmental Management and Assessment, (2013). Guidelines for Landscape and Visual Impact Assessment 3rd Edition. Routledge: Abingdon.
- Ref 7.3. Council of European Communities, (2000). European Landscape Convention. [online]. Available at: <<https://rm.coe.int/1680080621>> [Last accessed 23rd November 2017].
- Ref 7.4. Natural England, (2014). An Approach to Landscape Character Assessment. [online]. Available at: <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/396192/landscape-character-assessment.pdf> [Last accessed 23rd November 2017].
- Ref 7.5. Natural England, (2013). National Character Area 132, Salisbury Plain and West Wiltshire Downs. [online]. Available at: <<http://publications.naturalengland.org.uk/publication/5001829523914752>> [Last accessed 23rd November 2017].
- Ref 7.6. Wiltshire Council, (2005). Wiltshire Landscape Character Assessment. [online]. Available at: <<http://www.wiltshire.gov.uk/landscapeconservation/wiltshirelcafinalreport.htm>> [Last accessed 23rd November 2017].
- Ref 7.7. Salisbury District Council/CBA, (2008). South Wiltshire/Salisbury District Landscape Character Assessment. [online]. Available at: <<http://www.wiltshire.gov.uk/planningpolicyevidencebase/southwiltshirecorestrategyevidencebase.htm#SalisburyLandscapeCharacterAssessment>> [Last accessed: 23rd November 2017].
- Ref 7.8. Stonehenge and Avebury World Heritage Site, (2015). Stonehenge, Avebury and Associated Sites World Heritage Site Management Plan 2015. [online] Available at: <<http://www.stonehengeandaveburywhs.org/management-of-whs/stonehenge-and-avebury-whs-management-plan-2015/>> [Last accessed 23rd November 2017].

- Ref 7.9. Wiltshire Council, (2015). Wiltshire Core Strategy. [online]. Available at: <<http://www.wiltshire.gov.uk/adopted-local-plan-jan16-low-res.pdf>> [Last accessed 23rd November 2017].
- Ref 7.10. Landscape Institute, (2017). Technical Information Note 01/2017, Tranquillity – An Overview. [online]. Available at: <<https://www.landscapeinstitute.org/wp-content/uploads/2017/01/Tranquillity-An-Overview.pdf>> [Last accessed 23rd November 2017].
- Ref 7.11. Landscape Institute, (2011). Advice Note 01/11 Photography and Photomontage in Landscape and Visual Impact Assessment. [online]. Available at: <<https://www.landscapeinstitute.org/PDF/Contribute/LIPhotographyAdviceNote01-11.pdf>> [Last accessed 23rd November 2017].
- Ref 7.12. Landscape Institute, (2017). Advice Note 02/17: Visual Representation of Development Proposals. [online]. Available at: <<https://www.landscapeinstitute.org/wp-content/uploads/2016/01/02-17-Visual-Representation.pdf>> [Last accessed 23rd November 2017].
- Ref 7.13. Highways England. (2017). A303 Stonehenge Amesbury to Berwick Down EIA Scoping Report. [online]. Available at: <<https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010025/TR010025-000032-Scoping%20Report.pdf>> [Last accessed 30th November 2017].
- Ref 8.1. Highway Agency Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment (HA IAN 130/10) <http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian130.pdf>
- Ref 8.2. CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester
- Ref 8.3. Highways Agency (2007) Design Manual for Roads and Bridges: Volume 11 <http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/index.htm>
- Ref 8.4. Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London. ISBN-13 978-1-872745-96-1
- Ref 8.5. Cresswell, W. & Whitworth, R. (2004) An assessment of the efficiency of capture techniques and the value of different habitats for the great crested newt *Triturus cristatus*. English Nature Research Reports, Number 575. English Nature (now Natural England), Peterborough.
- Ref 8.6. Highways Agency (2005) Design Manual for Roads and Bridges Volume 10 Section 4 Part 7 HA 1164/05 Nature conservation advice in relation to reptiles and roads.
- Ref 8.7. Shawyer, C. R. and Dixon, N. (1999). Impact of Roads on Barn Owl *Tyto alba* Populations. Highways Agency, London.

- Ref 8.8. Harris, G. & Linham, P. (2017). Mammals in Wiltshire. Second Edition. Wiltshire & Swindon Biological Records Centre, Wiltshire Mammal Group & Wiltshire Bat Group. March 2017
- Ref 8.9. Defra (2011) Biodiversity 2020: A strategy for England's wildlife and ecosystem services.
<https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services>
- Ref 8.10 Natural England (2013) The Mosaic Approach: Managing Habitats for Species (B2020-009).
<http://publications.naturalengland.org.uk/publication/6415972705501184>
- Ref 9.1. Design Manual for Roads and Bridges ("DMRB") Vol. 11, Section 3, Part 7, HD 213/11 Revision 1, 2011.
- Ref 9.2. National Policy Statement for National Networks (NPSNN), Department for Transport, 2014.
- Ref 9.3. National Planning Policy Framework (NPPF), Department for Communities and Local Government, March 2012.
- Ref 9.4. Noise Policy Statement for England (NPSE), Defra, 2010.
- Ref 9.5. Directive 2002/49/EC (Environmental Noise Directive), European Commission, 2002.
- Ref 10.1. EU, (2000), The Water Framework Directive (2000/60/EC)
- Ref 10.2. Groundsure Enviro Geo Insight Report, December 2016
- Ref 10.3. Multi-Agency Geographic Information for the Countryside (MAGIC)
- Ref 10.4. Wiltshire and Swindon Aggregate Minerals Site Allocations Local Plan, 2013
- Ref 10.5. Soil Survey of England and Wales (1983) - 1:250,000 scale Soil Map of South East England. Rothamsted Experimental Station, Harpenden
- Ref 10.6. Groundsure Enviro Insight Report, December 2016
- Ref 10.7. Historical Ordnance Survey mapping - Landmark Envirocheck Report (References 95704268_1_1, 95704374_1_1 and 95704420_1_1, ordered 31 August 2016)
- Ref 10.8. AAJV, Preliminary Sources Study Report, (HAGDMS Ref. 29300), 2016
- Ref 10.9. DEFRA, Code of Practice for Sustainable Use and Management of Soils on Construction Sites, 2009
- Ref 10.10. CL:AIRE, 'Definition of Waste: Development Industry Code of Practice', March 2011
- Ref 10.11. EA Guidance on the classification and assessment of waste. Technical Guidance WM3, 2015

- Ref 10.12. CIRIA C692 3rd Edition 'Environmental Good Practice On Site', 2010
- Ref 10.13. Highways Agency, Design Manual for Roads and Bridges (DMRB) Scoping of Environmental Impact Assessments HA204/08, August 2008
- Ref 10.14. Highways Agency, Design Manual for Roads and Bridges (DMRB) Environmental Assessment HA200/08, 2008
- Ref 10.15. Highways England, Interim Advice Note 125/15, Environmental Assessment Update, 2008
- Ref 11.1. Environment Agency South West River Basin District River Basin Management Plan (February 2016)
- Ref 11.2. Environment Agency Water Abstraction Licences (2017)
- Ref 11.3. Environment Agency, 2011. Wessex Basin Groundwater Modelling Study. Phase 4 final report (prepared by Entec UK).
- Ref 11.4. AAJV, 2016. Preliminary Sources Study Report.
- Ref 11.5. WJ Groundwater, 2003. A303 Stonehenge Improvements: Pumping Test Interpretative Report.
- Ref 11.6. WJ Groundwater, 2004. A303 Stonehenge Improvement: Summer Pumping Tests - Interpretative Report.
- Ref 11.7. Balfour Beatty-Costain Halcrow Gifford, 2006. A303 Stonehenge Improvement, Preliminary Geotechnical report
- Ref 11.8. Structural Soils, July 2017. A303 Amesbury to Berwick Down. Factual Report on Ground Investigations
- Ref 11.9. Balfour Beatty-Costain Halcrow Gifford /Highways England, 2003. A303 Stonehenge Improvements Environmental Statement.
- Ref 11.10. Stuart & Smedley, 2009. Baseline groundwater chemistry: the Chalk aquifer of Hampshire. British Geological Survey (OR/09/052).
- Ref 11.11. A303 Stonehenge Improvement Environmental Statement, Chapter 8 Water, 2003
- Ref 11.12. The Environment Agency 'Flooding from Rivers' map: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=410063&northing=142800&address=10090860639&map=RiversOrSea>. Last Accessed: 18/09/2017
- Ref 11.13. The Great Till Flood of 1841, Royal Meteorological Society, 1967, Volume 22, Issue 11. (<http://onlinelibrary.wiley.com/doi/10.1002/j.1477-8696.1967.tb02966.x/abstract>). Last Accessed: 09/10/2017
- Ref 11.14. Chronology of British Hydrological Events: <http://www.cbhe.hydrology.org.uk/all-events.php?page=397>. Last Accessed 25/09/2017

- Ref 11.15. Environment Agency, Groundwater Flooding: <http://www.wiltshire.gov.uk/flood-wiltshire-groundwater.pdf>. Last Accessed: 20/10/2017
- Ref 11.16. Wiltshire Local Flood Risk Management Strategy, 2014
- Ref 11.17. Salisbury Journal: http://www.salisburyjournal.co.uk/news/salisbury/salisburynews/flooding_pictures/4/. Last Accessed: 08/11/2017
- Ref 11.18. Spire FM: <https://www.spirefm.co.uk/news/local-news/2039215/amesbury-takes-action-on-its-own-flooding-issues/>. Last Accessed: 07/11/2017
- Ref 11.19. Defra, 2015, Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems, 2015. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf
- Ref 11.20. Design Manual for Roads and Bridges Volume 11, Section 3, Part 10 HD45 – Road Drainage and the Water Environment (2018)
- Ref 12.1. Interim Advice Note 153/11. Guidance On The Environmental Assessment Of Material Resources (Highways England)
- Ref 12.2. Waste Framework Directive (2008/98/EC)
- Ref 12.3. Design Manual for Roads and Bridges Advice Note HA204/08: Scoping of Environmental Impact Assessments, Highways England
- Ref 12.4. Design Manual for Roads and Bridges Advice Note HA200/08: Aims and Objectives of Environmental Assessment, Highways England
- Ref 12.5. Interim Advice Note 125/15. Environmental Assessment, Annex A Highways England.
- Ref 12.6. Wiltshire and Swindon Waste Site Allocations Development Plan Document Evidence base part B: Waste, Wiltshire Council and Swindon Borough Council, 2012
- Ref 12.7. Waste Management for England 2016: <https://www.gov.uk/government/publications/waste-management-for-england-2016>, Environment Agency, 2017
- Ref 12.8. The Mineral Products Industry at a Glance (2016 Edition) – Mineral Products Association
- Ref 12.9. Interim Advice Note 183 /14 Environmental Management Plans
- Ref 12.10. The Definition of Waste: Development Industry Code of Practice Version 2, CL:AIRE, March 2011
- Ref 13.1. Department for Transport (DfT), 2014; National Policy Statement for National Networks

- Ref 13.2. Office National Statistics (ONS) (2011) Census 2011.
- Ref 14.1. Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Statutory Instrument 2017/572)
- Ref 14.2. IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; http://ar5-syr.ipcc.ch/topic_summary.php
- Ref 14.3. UK Climate Change Act (2008), Chapter 27 Targeting and Budgeting <https://www.legislation.gov.uk/ukpga/2008/27/contents>
- Ref 14.4. Local Climate Impacts Profile Summary Report, 30 June 2010 - <http://www.wiltshire.gov.uk/wccap-level-1-report-appendix-3-local-climate-impact-profile.pdf>
- Ref 14.5. UK Climate Change Predictions, Met Office <http://ukclimateprojections.metoffice.gov.uk/21678>
- Ref 14.6. The CCC. (2012). Climate Change Risk Assessment. Available: <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/climate-change-risk-assessment-2017/>.
- Ref 14.7. BS EN 15804:2012+A1:2013 – Sustainability of construction works, BSI
- Ref 14.8. Publically Available Specification (PAS) 2080: 2016 Carbon Management in Infrastructure, BSI
- Ref 14.9. IEMA: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2017)
- Ref 14.10. Reference: Department for Transport (2015), TAG Unit A3 Environmental Impact Appraisal https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/638648/TAG_unit_a3_envir_imp_app_dec_15.pdf
- Ref 14.11. The Carbon Plan: Delivering our low carbon future, DECC https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf
- Ref 14.12. Road Lengths in Great Britain, DfT, 2016 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/611185/road-lengths-in-great-britain-2016.pdf
- Ref 15.1. The Planning Inspectorate's Advice Note 17 Cumulative Effects Assessment (2015).
- Ref 15.2. Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2 Part 5: Assessment and Management of Environmental Effects (HA205/08).

Glossary

AADT	Annual Average Daily Traffic is a measure used in transportation engineering and is the number of vehicles that will use a new or improved road on an average day
AQMA	Places where air quality objectives are not likely to be achieved. Where an AQMA is declared, the local authority is obliged to produce an Action Plan in pursuit of the achievement of the air quality objectives.
CEMP	A site specific plan developed to ensure that appropriate environmental management practices are followed during the construction phase of a project.
Conservation Area	An area of special environmental or historic interest or importance, of which the character or appearance is protected (Section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990).
Cut and Cover	A method of constructing a tunnel by excavating a cutting to the required depth and then back filling the excavation over the tunnel roof.
Cumulative Effects	Effects upon the environment that result from the incremental impact of an action when added to other past, present or reasonably foreseeable actions. Each impact by itself may not be significant but can become a significant effect when combined with other impacts.
Department for Transport	Government department responsible for the transport network in England, and for aspects of the transport network in the devolved administrations.
Design Manual for Roads and Bridges	A series of 15 volumes that provide standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom, and, with some amendments, the Republic of Ireland.
Development Consent Order	The means of applying for consent to undertake a Nationally Significant Infrastructure Project (NSIP). NSIPs include, for example, major energy and transport projects.
Proposed Draft DCO Site Boundary	Land anticipated to be required temporarily and/or permanently for the construction, operation and maintenance of the proposed scheme.
EIA	Environmental Impact Assessment. A process by which information about environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement.
Environmental effect	The consequence of an action (impact) upon the environment such as the decline of a breeding bird population as a result of the removal of hedgerows and trees.
Environmental impact	The change in the environment from a development such as the removal of a hedgerow.

Environmental Statement	A document produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations to report the results of an EIA.
Flood Zone Three	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone Two	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Grade Separated Junction	A junction where the conflicting traffic flows are kept apart, usually by means of a bridge or tunnel.
Green Bridge	Artificial structure over road or rail infrastructure which is either vegetated or provides some wildlife function.
Mitigation	Measures including any process, activity, or design to avoid, reduce, remedy or compensate for negative environmental impacts or effects of a development
NSIP	Nationally Significant Infrastructure Projects ("NSIP") are large scale developments such as certain new harbours, power generating stations (including wind farms), highways developments and electricity transmission lines, which require a type of consent known as 'development consent' under procedures governed by the Planning Act 2008 (and amended by the Localism Act 2011).
PEI	PEI is defined in the EIA Regulations as: 'information referred to in Part 1 of Schedule 4 (information for inclusion in environmental statements) which – (a) has been compiled by the applicant; and (b) is reasonably required to assess the environmental effects of the development (and of any associated development).'
Principal Aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Receptor	A component of the natural or man-made environment that is affected by an impact, including people.
Scheduled monument	A 'nationally important' archaeological site or historic building, given protection against unauthorised change and included in the Schedule of Monuments kept by the Secretary of State for Culture, Media and Sport. The protection given to scheduled monuments is given under the Ancient Monuments and Archaeological Areas Act 1979.

Secondary A aquifer	<p>These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.</p> <p>These are generally aquifers formerly classified as minor aquifers.</p>
Secondary B aquifer	<p>These are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.</p>
Setting	<p>The surroundings within which a heritage asset is experienced and any element which contributes to the understanding of its significance.</p>
Source Protection Zone	<p>Source Protection Zones ("SPZ") show the risk of contamination from any activities that might cause pollution to groundwater sources such as wells, boreholes and springs used for public water supplies. The closer the activity, the greater the risk. SPZs can comprise of up to three main zones (inner, outer and total catchment). A fourth zone of special interest can also occasionally be applied to a groundwater source.</p>
Statement of Outstanding Universal Value	<p>To be included on the UNESCO World Heritage List, sites must be deemed to be of 'outstanding universal value'. OUV is 'cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity'. The Statement of Outstanding Universal Value shall be the basis for the future protection and management of the property.</p>
Vehicle Restraint Systems	<p>System installed on a road to provide a level of containment for an errant vehicle such as a safety barrier.</p>
Water Framework Directive	<p>The Water Framework Directive ("WFD") introduced a new system for monitoring and classifying the quality of surface and ground waters.</p> <p>The Directive requires that Environmental Objectives be set for all surface waters and groundwater to enable them to achieve Good Ecological Potential/Status by a defined date.</p>
World Heritage Site	<p>A site inscribed by UNESCO because of its Outstanding Universal Value under the terms of the UNESCO World Heritage Convention.</p>

Abbreviations

AADT	Annual Average Daily Traffic
AEP	Annual Exceedance Probability
ALC	Agricultural Land Classification
AOD	Above Ordinance Datum
AONB	Area of Outstanding Natural Beauty
APIS	Air Pollution Information System
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
BCT	Bat Conservation Trust
BGS	British Geological Survey
BOAT	Byway Open to All Traffic
BS	British Standard
CCRA	Climate Change Risk Assessment
CCTV	Close Circuit Television
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
COPA	Control of Pollution Act
CRTN	Calculation of Road Traffic Noise
CWS	County Wildlife Site
DCO	Development Consent Order
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DWS	Drinking Water Standards
EIA	Environmental Impact Assessment
END	Environmental Noise Directive
EPS	European Protected Species
ES	Environmental Statement
EU	European Union
GHG	Greenhouse Gases
HADDMS	Highways England's Drainage Data Management System
HE	Highways England
HEBAP	Highways England Biodiversity Plan
HGV	Heavy Goods Vehicle
HIA	Heritage Impact Assessment
HMAG	A303 Heritage Monitoring and Advisory Group
HRA	Hot Rolled Asphalt
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
ICOMOS	International Council on Monuments and Sites
IEMA	Institute of Environmental Management and Assessment
IPCC	Intergovernmental Panel on Climate Change
LCLIP	Local Climate Impacts Profile
LCA	Landscape Character Area
LCT	Landscape Character Type

LGS	Local Geological Sites
LNR	Local Nature Reserve
LSOA	Lower Super Output Areas
LVIA	Landscape and Visual Impact Assessment
MCA	Mineral Consultation Areas
MOD	Ministry of Defence
MSA	Mineral Safeguarding Areas
MT	Motorised Travellers
NCA	National Character Areas
NCN	National Cycle Network
NHLE	National Heritage List for England
NNR	National Nature Reserve
NMU	Non-motorised users
NNR	National Nature Reserve
NOx	Nitrogen Oxide
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPSNN	National Policy Statement for National Networks
NPSE	Noise Policy Statement for England
NRMM	Non-Road Mobile Machinery
NSIP	Nationally Significant Infrastructure Report
OS	Ordnance Survey
OUV	Outstanding Universal Value
PA	Preferred Areas
PA 2008	Planning Act 2008
PCM	Pollution Climate Mapping
PEI Report	Preliminary Environmental Information Report
PPE	Personal Protective Equipment
PRoW	Public Right of Way
PWS	Private Water Supplies
RAF	Royal Air Force
RBMP	River Basin Management Plan
RHPG	Registered Historic Park and Garden
RNAG	Reasons for Not Achieving Good
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SLA	Special Landscape Area
SNHRW	Selected non-reactive hazardous waste
SPA	Special Protection Area
SPP	Segment Production Plant
SPZ	Source Protection Zones
SRN	Strategic Road Network
SSSI	Sites of Special Scientific Interest
SuDS	Sustainable Drainage Strategy
TBM	Tunnel Boring Machine
TIN	Technical Information Note

TPO	Tree Preservation Order
TVBC	Test Valley Borough Council
ULSD	Ultra-Low Sulphur Diesel
UNESCO	United Nations Educational, Scientific and Cultural Organization
VMS	Variable Messaging Systems
VP	Viewpoints
WAC	Waste Acceptance Criteria
WC	Wiltshire Council
WCAS	Wiltshire Council Archaeological Service
WFD	Water Framework Directive
WHS	World Heritage Site
WSHER	Wiltshire and Swindon Historic Environment Record
ZTV	Zone of Theoretical Visibility
ZVI	Zone of Visual Influence

If you need help accessing this or any other Highways England information, please call **0300 123 5000** and we will help you.

© Crown copyright 2018
You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence: visit www.nationalarchives.gov.uk/doc/open-government-licence/ write to the **Information Policy Team, The National Archives, Kew, London TW9 4DU**, or email psi@nationalarchives.gsi.gov.uk.

This document is also available on our website at www.gov.uk/highways

If you have any enquiries about this publication email info@highwaysengland.co.uk or call **0300 123 5000***

Highways England creative job number BED18 0008

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.
These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone.
Calls may be recorded or monitored.

Printed on paper from well-managed forests and other controlled sources.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363