A303 Sparkford to Ilchester Dualling Scheme TR010036

6.1 Environmental Statement

Chapter 11 Noise and Vibration

APFP Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
July 2018

Volume 6.0

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A303 Sparkford to Ilchester Dualling Scheme

Development Consent Order 201[X]

6.1 Environmental Statement
Chapter 11 Noise and Vibration

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference:	TR010036
Application Document Reference:	6.1
Author:	A303 Sparkford to Ilchester Dualling Scheme Project Team, Highways England

Version	Date	Status of Version
Rev 0	July 2018	Application Issue

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11 Noise and Vibration

11.1 Introduction

11.1.1 This chapter considers the likely significant effects of the proposed A303 Sparkford to Ilchester Dualling scheme (hereafter referred to as 'the scheme') on noise and vibration.

11.1.2 This assessment considers both construction and operational phase impacts including the effects on human health by reference to the concepts from toxicology of adverse effect levels for both daytime and night-time periods and has been prepared in accordance with the guidance detailed in Section 11.3 of this chapter.

11.1.3 Chapter 2 The Scheme, Volume 6.1 of this Environmental Statement (ES) contains a detailed description of the scheme. The supporting figures referenced in this chapter (Figures 11.1 to 11.7) can be found in Volume 6.2, while the technical appendices are presented in Volume 6.3.

11.2 Competent expert evidence

11.2.1 The competent expert has a BA(Hons) in Engineering Science from the University of Oxford, has over 30 years' experience in noise and vibration, is a Chartered Engineer, and a Fellow of the Institute of Acoustics (FIOA) and has experience in civil and criminal litigation as an expert witness.

11.3 Legislative and policy framework

National legislation

Control of Pollution Act 1974

11.3.1 Whilst residents may accept that there would be some disturbance caused to those living nearby during the construction phase, the *Control of Pollution Act 1974* offers further protection to them.

11.3.2 Section 60 of the Act enables a local authority to serve a notice specifying its noise control requirements covering plant or machinery (which is or is not being used), hours of working, and levels of noise that can be emitted.

11.3.3 Section 61 relates to prior consent in which the contractor consults with the local authority and provides an application prior to construction works commencing to obtain approval for the methods to be used and the steps proposed to minimise noise resulting from the works. If the local authority considers that the application contains sufficient information and that "best practicable means" of noise control are being implemented, and if the works are

being carried out in accordance with the application, it would not serve a notice under Section 60.

11.3.4 'Best practicable means' are defined in Section 72 of the Act as *"reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications"*.

Noise Insulation Regulations 1975 (amended 1988)

11.3.5 The *Noise Insulation Regulations 1975 (amended 1988)* were made under Part 2 of the *Land Compensation Act 1973*[1] for the obligatory and discretionary provision of noise mitigation measures for dwellings adjacent to new highways. Among the criteria for a property to qualify for insulation in living rooms and bedrooms is that the façade noise level is at least 68dB $L_{A10,18hr}$ and that noise from the altered highway causes the total noise level to increase by at least 1dB.

National policy

National Policy Statement for National Networks

11.3.6 The *National Policy Statement for National Networks* (NPSNN)[2] sets out the Government's vision and policy for the future development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The NPSNN provides guidance for promoters of NSIPs and also provides the basis for examination by the Planning Inspectorate and decision-making by the Secretary of State for Transport.

11.3.7 Paragraph 5.193 of the NPSNN states *"Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise".*

11.3.8 Paragraph 5.200 states *"Applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process".*

11.3.9 Paragraph 5.198 states "*Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:*

- *Engineering: containment of noise generated.*

[1] Parliament of the United Kingdom. (1973). *Land Compensation Act – Part 1, C24*.
[2] Department of Transport (2014) *National Policy Statement for National Networks* [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf (last accessed April 2018).

- *Materials: use of materials that reduce noise (for example low noise road surfacing).*
- *Lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural or purpose-built barriers.*
- *Administration: specifying acceptable noise limits or times of use (for example in the case of railway station PA systems)"*

National Planning Policy Framework 2012

11.3.10 The *National Planning Policy Framework* (NPPF)[3] came into force in March 2012 and replaced the majority of planning policy.

11.3.11 Paragraph 109 of the NPPF states that "*the planning system should contribute to and enhance the natural and local environment by: …preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*."

11.3.12 Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

- *"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions place on them because of changes in nearby land uses since they were established;*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

[3] Department for Communities and Local Government (2012) *National Planning Policy Framework* [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf (last accessed April 2018).

Noise Policy Statement for England

11.3.13 The *Noise Policy Statement for England* (NPSE)[4] came into force in March 2010 and set out the following aims in line with its long-term vision of promoting good health and quality of life through the management of noise.

11.3.14 "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life*
- *Mitigate and minimise adverse impacts on health and quality of life*
- *Where possible, contribute to the improvement of health and quality of life."*

11.3.15 Within the aims stated above there are several key phrases that lead to additional concepts now considered in the assessment of noise impact. These and their definitions are detailed below.

- No Observed Effect Level (NOEL): this is the level below which no effect can be detected.
- Lowest Observed Adverse Effect Level (LOAEL): this is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL): this is the level above which significant adverse effects on health and quality of life can occur.

11.3.16 There are no pre-defined values for these effect levels as it is acknowledged that they will be different for different sources, different receptors and at different times.

11.3.17 The levels used in the assessment are defined in Section 11.4 of this chapter.

Planning Practice Guidance

11.3.18 *Planning Practice Guidance* (PPG)[5] is a government web-based resource which provides guidance on how the policy set out in NPPF may be interpreted in practice for a range of issues. PPG advises that:

[4] Department for Environment, Food and Rural Affairs (2010) *The Noise Policy Statement for England* [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf (last accessed April 2018).
[5] Department for Communities and Local Government (2016) *Planning Practice Guidance* [online] available at: https://www.gov.uk/government/collections/planning-practice-guidance (last accessed April 2018).

11.3.19 "*Local planning authorities' planning making and decision taking should take account of the acoustic environment and in doing so consider:*

- *Whether or not a significant adverse effect is occurring or likely to occur;*
- *Whether or not an adverse effect is occurring or likely to occur; and*
- *Whether or not a good standard of amenity can be achieved.*

11.3.20 *In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during construction wherever applicable) is, or would be above or below the significant observed adverse effect level…"*

11.3.21 Among the specific factors to consider where relevant the guidance states: *"In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur".*

11.3.22 Table 11.1 below summarises the noise exposure hierarchy given in PPG, based on the likely average response.

Table 11.1: Noise exposure hierarchy

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, for example turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	

Perception	Examples of outcomes	Increasing effect level	Action
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, for example avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, for example regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, for example auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Source: *Planning Practice Guidance*

Noise Action Plans

11.3.23 Noise Action Plans, which have been published by the Department for Environment, Food and Rural Affairs (Defra), are required by the *Environmental Noise Directive (Directive 2002/49/EC)*. Specifically, the *Noise Action Plan: Roads (Including Major Roads)*[6] states that the *Environmental Noise Directive* requires the following, on a 5-year cycle:

- *"The determination, through noise mapping, of exposure to environmental noise for major sources of road, rail and aircraft noise and in urban areas (known as agglomerations).*
- *Provision of information to the public on environmental noise and its effects.*
- *Adoption of Action Plans, based upon the noise mapping results, which are designed to manage environmental noise and its effects, including noise reduction if necessary.*
- *Preservation of environmental noise quality where it is good, particularly in urban areas."*

11.3.24 The Action Plan should also *"apply in particular to the most important areas as established by the strategic noise maps".* It was decided that the important areas (with respect to noise from major roads) will be where the 1% of the population that are affected by the highest noise levels from major roads are located according to the results of the strategic noise mapping. There are also a

[6] Department for Environment, Food & Rural Affairs (2014) Noise Action Plan: Roads (Including Major Roads) [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/276237/noise-action-plan-roads-201401.pdf (last accessed April 2018).

number of actions for local authorities to take for these important areas in order to address current noise issues and prevent further noise issues.

Highways England policy

11.3.25 Part of the *Road Investment Strategy* (RIS) for 2015-2020[7] includes noise as a Key Performance Indicator (KPI) for Highways England. The KPI requires mitigation to be installed at 1,150 Important Areas within 5 years. It also describes the factors which have influenced the Highways Agency Investment Plan and states "*All new and improved roads now use low noise road surfaces to help reduce the noise made by vehicles*". The reduction of noise impacts from the strategic road network through the application of quieter surfaces and noise barriers are also given as a benefit of capital renewals projects.

Local policy

South Somerset District Council Local Plan 2006 – 2028

11.3.26 On 5 March 2015, South Somerset District Council adopted the *South Somerset Local Plan (2006 – 2028)*[8]. The Local Plan includes a section on Pollution Control which makes references to the requirements of the NPPF and NPSE.

11.3.27 Policy EQ7 is entitled "Pollution Control" and states the following relating to noise: "*Development that, on its own or cumulatively, would result in air, light, noise, water quality or other environmental pollution or harm to amenity, health or safety will only be permitted if the potential adverse effects would be mitigated to an acceptable level by other environmental controls, or by measures included in the proposals. This may be achieved by the imposition of planning conditions or through a planning obligation."*

Guidance

WHO *Guidelines for Community Noise 1999*

11.3.28 The World Health Organization (WHO) *Guidelines for Community Noise*[9] are intended to guide the long-term management of community noise to help meet the WHO's core objective of *"the attainment by all peoples of the highest possible levels of health"*. They set out various noise guide values for specific

[7] Department for Transport (2015) *Road Investment Strategy: for the 2015/16 – 2019 / 20 Road Period* [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf (last accessed July 2018).
[8] South Somerset District Council (2015) *South Somerset Local Plan 2006 – 2028* [online] available at: https://www.southsomerset.gov.uk/media/707200/south_somerset_local_plan_2006-2028_adoption_version_march_2015.pdf (last accessed March 2018)
[9] World Health Organization (1999) *Guidelines for Community Noise* [online] available at: http://www.who.int/docstore/peh/noise/guidelines2.html (last accessed April 2018).

activities. These values represent the onset of specific effects such as annoyance or sleep disturbance.

11.3.29 For night time noise, WHO gives an indoor guideline value for bedrooms of 30dB L_{Aeq} and 45dB L_{Amax} for single sound events. Allowing for a 15dB reduction through an open window this gives external levels of 45dB L_{Aeq} and 60dB L_{Amax}. However, WHO also states: *"It is estimated that 80-90% of the reported causes of sleep disturbance in noisy environments are for reasons other than noise originating outdoors. For example, sanitary needs; indoor noises from other occupants; worries; illness; and climate."*

WHO *Night Noise Guidelines for Europe 2009*

11.3.30 The WHO *Night Noise Guidelines for Europe 2009*[10] suggested that there is insufficient evidence that the biological effects observed at the level below 40dB $L_{night,outside}$ are harmful to health. The Guidelines suggest, on a precautionary basis, that the population should not be exposed to a night noise guidelines (NNG) value greater than 40dB of $L_{night,outside}$ during the part of the night when most people are in bed. However, the precautionary nature of this target is fully appreciated by the WHO and an interim target of 55dB $L_{night,outside}$ is recommended in the situations where the achievement of NNG is not feasible in the short term.

British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise

11.3.31 BS5228-1[11] provides a methodology for predicting and assessing noise levels generated by fixed and mobile plant used for a range of typical construction operations. The standard includes a database of noise levels at a reference distance of 10m from the source and a simple noise propagation model that can be used to make allowance for effects such as source-receiver distances, ground properties and utilisation time.

BS 5228 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

11.3.32 BS5228-2[12] provides guidance on the effect of vibration and the likelihood it will cause complaint and cosmetic damage to buildings and gives recommendations for methods of vibration control. Vibration levels are predicted in terms of Peak Particle Velocity (PPV).

[10] World Health Organization (2009) Night Noise Guidelines for Europe [online] available at: http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf (last accessed April 2018).
[11] BSI (2009, amended 2014) Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.
[12] BSI (2009, amended 2014) Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

The Design Manual for Roads and Bridges

11.3.33 The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 *Noise and Vibration* (HD213/11)[13] describes a methodology for the assessment of the impacts of noise and vibration for road projects in the UK. It includes a procedure for the calculation of an operational noise study area, a method for the classification of the magnitude of impact, and examples of design and mitigation techniques that may influence noise and vibration impacts.

11.3.34 HD213/11 includes an assessment of nuisance and provides a relationship for noise level against change in people bothered very much, or quite a lot by noise. The relationship differs depending on whether short-term or long-term changes are considered, the former giving rise to greater changes in nuisance. DMRB advises caution in interpretation of results as the surveys underpinning the relationship between noise and nuisance were conducted at locations within 18m of the carriageway edge, at noise exposure levels of 65 – 78dB and noise changes of up to 10dB. It should also be borne in mind that the results represent the change in percentage of people bothered very much, or quite a lot by noise. Therefore, total numbers are in effect a percentage of a percentage as the degree of nuisance felt towards traffic noise varies amongst the population.

Calculation of Road Traffic Noise

11.3.35 Calculation of Road Traffic Noise (CRTN)[14] provides procedures for predicting noise levels for a given flow of road traffic at sensitive receptors. These methodologies are used in the determination of entitlement under the Noise Insulation Regulations and for traffic noise change assessments undertaken in accordance with the DMRB guidance noted above.

IEMA Guidelines for Environmental Noise Impact Assessment

11.3.36 The Institute of Environmental Management and Assessment (IEMA) *Guidelines for Environment Noise Assessment*[15] provide guidance on noise assessment in the Environmental Impact Assessment (EIA) context. The guidelines define key methodologies used within the noise impact assessment process, and provide advice on their limitations. They are relevant to all scales of project. In the context of this assessment the IEMA Guidelines have been used to inform the definition of the sensitivity of receptors and the relation

[13] Highways England (2011) Design Manual for Roads and Bridges Volume 11 Section 2 Part 7 HD213/11 Noise and Vibration.
[14] Department of Transport (1988) Calculation of Road Traffic Noise [online] available at: http://www.devon.gov.uk/core-doc-n3-calculation-of-road-traffic-noise.pdf (last accessed July 2018).
[15] IEMA (2014) Guidelines for Environmental Noise Impact Assessment.

between the magnitude of impact and the significance of effect of noise changes upon those receptors.

11.3.37 The IEMA Guidelines provide a table for the generic relationship between noise impact (magnitude) and noise effect (magnitude and sensitivity) including the evaluation of significance. An extract from that table is reproduced in Table 11.2.

Table 11.2: Extract from IEMA table showing generic relationship between noise impact, effect and significance

Magnitude (nature of impact)	Description of effect (on a specific sensitive receptor)	Significance
Negligible	**No discernible effect on receptor**	**Not significant**
Slight	**Receptor perception = non-intrusive** Noise impact can be heard, but does not cause any change in behaviour or attitude, for example turning up the volume of the television, speaking more loudly, closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	**Less likely to be significant** (greater justification needed based on impact magnitude and receptor sensitivity – to justify a significant effect)  (Greater justification needed – based on based on impact magnitude and receptor sensitivity – to justify a non-significant effect) **More likely to be significant**
Moderate	**Receptor perception = intrusive** Noise impact can be heard and causes small changes in behaviour and / or attitude, for example turning up volume of television; speaking more loudly, closing windows. Potential for non-awakening sleep disturbance. Affects the character of the area such that there is a perceived change in the quality of life.	
Substantial	**Receptor perception = disruptive** Causes a material change in behaviour and / or attitude for example avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty getting to sleep, premature awakening and difficulty getting back to sleep. Quality of life diminished due to change in character of the area.	

Source: IEMA Guidelines

11.4 Assessment methodology

11.4.1 This section describes the methodology which has been used for the assessment of noise and vibration during construction and operation of the scheme.

11.4.2 The scope of the noise and vibration assessment was presented in Chapter 12 Noise and Vibration of the ***Environmental Impact Assessment (EIA) Scoping Report (Document Reference: HE551507-MMSJV-EGN-000-RP-LP-0014)*** submitted to the Planning Inspectorate in November 2017. The Scoping Opinion is contained within Appendix 4.1 of Volume 6.3. A schedule of

responses detailing how each of the Scoping Opinion comments have been considered as part of this chapter is contained within Appendix 4.2 of Volume 6.3. Operational ground-borne vibration effects are anticipated not to be significant, due to the beneficial effects associated with new carriageway surfacing and have therefore scoped out of this assessment.

11.4.3 The assessment has been undertaken in accordance with the principles set out in Chapter 4 Environmental Assessment Methodology in Volume 6.1 and the methodology follows guidance from the following key documents: NPPF, NPSE, WHO Guidelines, BS5228-1, BS5228-2, DMRB, and CRTN.

11.4.4 The main purpose of this assessment is to identify temporary and permanent noise and vibration impacts associated with the scheme. Part of the assessment process is to identify measures to reduce adverse effects and where practicable, to eliminate significant adverse effects.

11.4.5 Environmental assessment regulations and the NPPF require that the assessment considers the significance of effects on noise sensitive receptors resulting from predicted noise impacts. LOAEL and SOAEL, introduced by NPSE and applied in PPG, have been defined for the scheme, informed by WHO guidance, South Somerset Local Plan, and guidance from BS5228-1 and BS5228-2.

Value of receptors

11.4.6 Noise affects people in different ways. This may include factors such as annoyance and sleep disturbance, enjoyment of spaces, ability to communicate with others, and ability to concentrate at home or at work.

11.4.7 Different receptors would be subject to different sources and at different times and the significance of this is not the same for each receptor (for example, dwellings that are occupied at night and commercial premises which are not occupied at night). As a consequence, it is not appropriate to consider a single criterion when assessing the sensitivity (value) of an existing noise environment.

11.4.8 The majority of receptors that would be affected by noise and vibration impacts arising from the scheme are dwellings. However, there are other types of receptors in the study area such as commercial premises and places of worship. Table 11.3 sets out criteria used in determining the sensitivity of a receptor.

Table 11.3: Sensitivity criteria

Sensitivity	Criteria
High	Receptors where occupants or activities are particularly susceptible to noise. Examples include: residences, quiet outdoor areas used for recreation, conference facilities, auditoria/studios, schools in daytime, hospitals/residential care homes and religious institutions, for example churches or mosques.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance. Examples include: offices, restaurants and sports grounds where spectator noise is not a normal part of the event and where quiet conditions are necessary (for example, golf or tennis).
Low	Receptors where distraction or disturbance from noise in minimal. Examples include residences and other buildings not occupied during working hours, factories and working environments with existing high noise levels and sports grounds where spectator noise is a normal part of the event.

Methodology for assessment of construction impacts

Construction noise

11.4.9 BS5228-1 does not define strict criteria to determine the significance of effects of noise impacts, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are presented.

11.4.10 For the purposes of the noise assessment, indicative noise levels at various distance bands ranging from 10 to 300 metres have been predicted for each of the key construction activities (set out in Section 11.10) in accordance with guidance from BS5228-1. This helps to inform the number of sensitive receptors that will need to be further assessed using BS5228-1 Example Method 2 – The 5dB change method.

11.4.11 Example Method 2 – The 5dB change method (BS5228-1 Annex E Significance of Noise Effects, section E.3.3) has been adopted for the assessment of effects at residential receptors as the approach considers the expected changes in ambient noise levels and better reflects conventional EIA methodologies when compared with the use of fixed or absolute noise limits.

11.4.12 The method states that noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65dB, 55dB and 45dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in a significant effect.

11.4.13 The Standard does not define what is meant by works of a shorter duration but Table E.2 in BS5228-1 (reproduced in Table 11.4) provide examples of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation and specifies a period of 10 or more days of

working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months. This is important because the frequency of occurrence (for example, the number of days) and pattern of occurrence (an event occurring one day per month for twelve months versus twelve events occurring sporadically over a one-month period) affects the disturbance caused.

Table 11.4: Examples of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation

Period	Time	Averaging Time, T	Trigger level dB $L_{Aeq,T}$*
Monday to Friday	07:00 – 08:00	1h	70
	08:00 – 18:00	10h	75
	18:00 – 19:00	1h	70
	19:00 – 22:00	3h	65
	22:00 – 07:00	1h	55
Saturday	07:00 – 08:00	1h	70
	08:00 – 13:00	5h	75
	13:00 – 14:00	1h	70
	14:00 – 22:00	3h	65
	22:00 – 07:00	1h	55
Sunday and public holidays	07:00 – 21:00	1h	65
	21:00 – 07:00	1h	55

* All noise levels are predicted or measured at a point 1 metre in front of the most exposed of any windows and doors in any façade of any eligible dwelling.

11.4.1 Table 11.5 shows the LOAEL and SOAEL adopted for this assessment that are all taken from BS5228-1. The LOAEL values are the lower cut-off values in example method 2 for the daytime and night-time. The daytime SOAEL value is noise insulation trigger level for daytime weekdays converted from 75dB façade level to 72dB free-field level, and the night-time SOAEL value is the WHO Interim Target Level.

Table 11.5: LOAEL and SOAEL thresholds for construction noise at dwellings

Period	Time	Noise level, dB $L_{Aeq,T}$	
		LOAEL	SOAEL
Day-time, weekdays, and Saturday mornings	07:00 – 19:00	65	72
Evening and night-time	19:00 – 07:00	45	55

11.4.2 For the construction noise assessment, plant details from Annex C of *BS5228-1* have been used and are described in Appendix 11.2 Construction activities and plant for noise assessment, Volume 6.3. Annex C of BS 5228-1 includes a database of equivalent continuous noise levels (L_{Aeq} dB) generated by a range of fixed and mobile plant used for typical construction activities, including a set of data for road construction works.

11.4.3 The noise calculations in the assessment do not take into account existing noise barriers or other screening whether natural (for example, an embankment or cutting) or man-made (a building). Noise levels have been predicted over

acoustically absorbent ground to best represent the land between the construction activity and receptors. The assumed percentage on-time of each piece of equipment is also contained within Appendix 11.2 Construction activities and plant for noise assessment, Volume 6.3.

11.4.4 BS5228-1 also provides a method in Section F.2.5.2 to calculate the equivalent continuous sound level for mobile machinery as on haul roads based on the sound power level of the mobile plant, the number of vehicles per hour, the speed, and the distance of the haul road to a receptor. This has been used specifically for the haul road assessment.

11.4.5 Construction work would take place between 07:00 and 18:00 on weekdays, 07:30 and 13:00 on Saturdays, generally with no works being undertaken on Sundays and Bank Holidays. However, it has been advised that there may be exceptions to these hours to accommodate certain works. Where exceptions would be required, these would be agreed in writing with South Somerset District Council ahead of time. Further information is contained within Chapter 2 The Scheme of Volume 6.1.

Construction vibration

11.4.6 Vibration levels can be difficult to predict as there are many variables to take into consideration, such as:

- Ground conditions (hard or soft)
- Distance between a piling source and receiver
- Soil / structure interaction (nature of the connection between the soil and the nearby receiver)
- Energy per blow for piling

11.4.7 BS5228-2 gives a number of factors that determine the acceptability of vibration arising from construction sites.

11.4.8 Vibration nuisance is frequently associated with the assumption that if vibrations can be felt then damage may occur. However, considerably greater levels of vibration are required to cause damage to buildings and structures.

11.4.9 BS7385 provides guidance on the levels of vibration that would be necessary to cause structural damage to different types of buildings. The Standard indicates that transient PPVs of at least 15mm/s would be required to cause even cosmetic structural damage to residential buildings.

11.4.10 In terms of a scale for human receptors, Table 11.6 shows construction vibration impacts based on guidance contained within Table B.1 of BS5228-2.

Table 11.6: Guidance on effects of vibration levels

Vibration level	Effect
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3mm/s	Vibration might be just perceptible in residential environments.
1.0mm/s	It is likely that vibration of this level in residential environments would cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

11.4.11 Construction vibration values have been obtained using empirical formulae in BS5228-2. These incorporate factors to determine the probability of a predicted PPV value being exceeded.

11.4.12 Table 11.7 shows the LOAEL and SOAEL adopted for this assessment which are based on guidance on the effects of vibration given in BS5228-2.

Table 11.7: LOAEL and SOAEL thresholds for construction vibration at dwellings

Threshold	Vibration level (PPV)	BS5228-2 guidance
LOAEL	0.3 mm/s	This is the level at which vibration might be just perceptible in residential environments.
SOAEL	1.0 mm/s	It is likely that vibration of this level in residential environments would cause complaint, but can be tolerated if prior warning and explanation has been given to residents.

Methodology for assessment of operational impacts

11.4.13 The assessment of the operational road traffic noise impacts of the scheme follows the methodology in HD213/11. The objective of the detailed assessment is to understand the impact on the noise climate with and without the scheme and to determine if any significant adverse effects arise.

11.4.14 Noise modelling software (CadnaA) has been used to predict the noise levels at residential properties and other potentially sensitive receptor locations (obtained from the Ordnance Survey address database) in order to determine the potential impacts.

11.4.15 The noise model includes all mitigation that is included in the design whether intended for noise purposes or otherwise including the influence of topography, cuttings and embankments and all noise barriers and low-noise running surfaces.

11.4.16 HD213/11 describes the impacts of road traffic noise in terms of the noise descriptors conventionally used for assessing the impact of road traffic in the UK; this is the statistical noise level $L_{A10,\ 18hr}$ over an 18-hour period between 06:00 and 24:00 (the traffic noise index). CRTN methodology has been followed in the traffic noise calculations, which provide input to the assessment of impact

using HD213/11. For full definitions of noise parameters see Appendix 11.1 Baseline Noise Survey, Volume 6.3.

11.4.17 The level of road traffic noise from the road network has been predicted using traffic data provided in terms of 18-hour Annual Average Weekday Traffic (AAWT) flows between the hours of 06:00 to 24:00, along with average vehicle speed and percentage heavy vehicles.

11.4.18 Calculation of the road traffic noise levels has been carried out for the following scenarios:

- Do Minimum option in the Baseline Year (Opening Year, 2023)
- Do Minimum option in the Design Year (2038)
- Do Something option in the Baseline Year (Opening Year, 2023)
- Do Something option in the Design Year (2038)

11.4.19 In the above scenarios, Do Minimum means traffic growth with committed development only and Do Something means traffic growth with committed development and the proposed scheme.

11.4.20 In accordance with HD213/11 the assessment of road traffic noise impacts requires the following comparisons:

- The short-term change in road traffic upon operation of the project (Do Minimum option in the baseline year vs. Do Something option in the baseline year).
- The long-term change in road traffic noise assuming the scheme is built (Do Minimum option in the baseline year vs. Do Something option in the future assessment year).
- The long-term change in road traffic noise assuming the project is not built (Do Minimum option in the baseline year vs. Do Minimum option in the future assessment year).

11.4.21 For short-term changes in road traffic noise, the smallest change in road traffic noise levels that is considered perceptible is 1dB $L_{A10, 18hr}$. In the long-term, a change of 3dB $L_{A10, 18\ hr}$ in road traffic noise is considered to be the smallest perceptible change. Consequently, different scales are applied for assigning magnitude of impact for short and long-term impacts due to changes in road traffic within HD 213/11. These are presented in Table 11.8 and can be positive or negative.

Table 11.8: Classification of magnitude of short and long-term noise impacts due to changes in road traffic noise

Magnitude of impact	Noise Change, $L_{A10, 18hr}$	
	Short-term	Long-term
No change	0	0
Negligible	0.1 to 0.9	0.1 to 2.9
Minor	1 to 2.9	3 to 4.9
Moderate	3 to 4.9	5 to 9.9
Major	5.0+	10.0+

11.4.22 Paragraph 3.36 of HD213/11 states that *"In terms of road traffic noise, a methodology has not yet been developed to assign significance according to both the value of a resource and the magnitude of the impact"*.

11.4.23 For this reason, the magnitude of the road traffic noise impact is reported rather than the significance of the effect. However as the reporting of significant effects is also required, this is considered in the context of the NPPF guidance, associated LOAEL and SOAEL values, and professional judgement, in addition to the magnitude of noise impact.

11.4.24 LOAEL for the daytime is considered to be a free-field level of 50dB $L_{Aeq, 16hr}$ consistent with the threshold for moderate annoyance (from the WHO Guidelines for Community Noise).

11.4.25 LOAEL for the night time is the level at which adverse health effects are observed (such as self-reported sleep disturbance) in the WHO Night Noise Guidelines for Europe which is a value of 40dB $L_{night, outside}$.

11.4.26 Operational noise effects due to the scheme would predominantly result from changes in vehicular traffic noise due to changes to the road network. SOAEL for day-time operational noise is the "specified noise level" from the *Noise Insulation (Amendment) Regulations 1988* and is 68dB $L_{A10,18hr}$. This is the level at which properties may become eligible for mitigation against traffic noise in the form of secondary insulation, subject, among other factors, to a 1dB increase from the new road.

11.4.27 SOAEL for night-time noise is the Interim Target Level of 55dB $L_{night, outside}$ from the WHO Night Noise Guidelines for Europe.

11.4.28 Table 11.9 summarises the LOAEL and SOAEL adopted for this assessment.

Table 11.9: LOAEL and SOAEL thresholds for operational noise at dwellings

Time period	Adverse effect level	Noise level	Criteria / guidance
Day	LOAEL	50dB $L_{Aeq, 16hr}$	WHO Guidelines
Day	SOAEL, façade	68dB $L_{A10, 18 hr}$	Noise Insulation Regulations
Night	LOAEL	40dB $L_{night, outside}$	WHO Guidelines
Night	SOAEL	55dB $L_{night, outside}$	WHO Night Noise Guidelines

Significance criteria

11.4.29 There are no definitive criteria set out in guidance, standards or legislation for the rating of significant adverse effects due to noise.

11.4.30 The NPPF and NPSE aims are to avoid significant adverse effects and mitigate adverse effects. However, simply breaching the LOAEL and SOAEL thresholds do not form adequate significance noise criteria because:

- Receptors may cross the LOAEL or SOAEL thresholds with a negligible impact when initially only just below the threshold whereas it is customary for the increase in noise levels to pass a minimum threshold criterion.
- Where the impact is temporary (as for construction noise) it is necessary to associate a period with this.
- Where the impact is permanent (as for operational noise) it is necessary to consider the magnitude of the impact.
- Professional judgement is applied to ensure that the determination of significance takes all factors into account and is not purely a comparison of noise levels.

11.4.31 Therefore, for the assessment of construction noise from the scheme:

- A significant adverse effect is one for which total noise (pre-construction baseline noise plus construction noise) exceeds the pre-construction baseline noise by 5dB or more, and where SOAEL is exceeded for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.
- An adverse effect is one for which total noise (pre-construction baseline noise plus construction noise) exceeds the pre-construction baseline noise by 5dB or more, and where LOAEL is exceeded.

11.4.32 For the assessment of construction traffic from the scheme:

- A significant adverse effect is one in which noise levels increase by 1dB or more where SOAEL is exceeded
- An adverse effect is one where noise levels increase by 1dB or more.

11.4.33 For the assessment of construction vibration for the scheme:

- A significant adverse effect is one in which SOAEL is exceeded for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.
- An adverse effect is one in which LOAEL is exceeded.

11.4.34 The assessment of significance of operational noise from the scheme depends on many factors as indicated by the IEMA *Guidelines for Environment Noise Assessment* and set out in Table 11.2. These include:

- The impact classification: a negligible impact would not cause any discernible effect on receptors and would not give rise to significant adverse effects. However, as impact magnitude increases from minor to moderate and major, the likelihood of significant adverse effects increases unless there are factors other than noise and vibration that are likely to influence the impact of the noise change
- The level of noise relative to LOAEL and SOAEL: where noise levels exceed SOAEL then a noise impact is more likely to lead to a significant adverse effect. Conversely where noise levels are below LOAEL then a significant adverse effect is less likely.
- Acoustic context: where a scheme changes the acoustic character of an area (for example by the introduction of a completely new road) then a noise impact is more likely to be significant whereas an alignment change is unlikely to change the acoustic character of an area so is less likely to be significant.
- Impact magnitude: the classification bands correspond to large ranges in noise level change. Towards the top end of a classification band a noise impact is more likely to be significant and conversely, towards the bottom end of a band a noise impact is less likely to be significant.

11.4.35 No substantial changes in acoustic character are expected to arise as a result of this scheme: the A303 will continue to be the dominant noise source for receptors that are close to it. Other sources such as local roads, the railway, aircraft and other anthropogenic sources will continue to influence noise levels depending on their relative proximity to receptors compared with the A303.

11.4.36 As no new sources are to be introduced by the scheme, only alignment changes and speed and traffic volumes, a noise impact is considered to be potentially significant if:

- The noise increase is non-negligible (that is 1dB or more in the short term or 3dB or more in the long term (see Table 11.8)) for a receptor exposed to noise above SOAEL, or
- The noise increase in the opening year is moderate or major.

11.4.37 In all cases where a potentially significant adverse effect is indicated, professional judgement is used to determine if a significant adverse effect is likely to arise. This includes consideration of the sources of noise, the causes of change in noise levels, the magnitude of the impact in the opening year, the

classification of the impact in the long-term, and the noise level in the opening year relative to LOAEL and SOAEL.

Consultation

11.4.38 An Environmental Health Officer (EHO) from South Somerset District Council was contacted on 22 March 2018 in order to agree on a methodology, proposed guidance and legislation, and LOAEL and SOAEL values to be used for the assessment. The EHO confirmed that they did not have any comments or amendment suggestions to the proposed methodology.

11.4.39 A representative from Natural England was also contacted on 9 March 2018 to understand if any ecological receptors should be included within the noise and vibration assessment. The representative stated that they were not aware of any receptors of particular sensitivity and biodiversity value that are likely to be affected. On this basis, no assessment for ecological receptors has been carried out.

11.5 Assessment assumptions and limitations

11.5.1 The noise and vibration assessment has been based on the description of the scheme detailed in Section 2.5 of Chapter 2 (Volume 6.1), including the horizontal and vertical limits of deviation. It is assumed that within the vertical and horizontal limits of deviation all mitigation measures would still be provided and function as described in section 11.9 and as such there would be no change to the assessment of significant effects.

11.5.2 The noise model is developed from the 18-hour annual average weekday traffic flow forecasts derived from the traffic model for the scheme, and does not include provision for variations in flow during the day or between seasons. Committed developments with potential to generate traffic have been incorporated into the traffic model, and the cumulative effect of the scheme with these committed developments has therefore been accounted for within this chapter for operational effects. Traffic model assumptions and limitations, including a discussion on committed developments, are detailed within the ***Combined Modelling and Appraisal (ComMA) Report*** **(*document reference: TR010036/APP/7.7*)**.

11.5.3 In addition, the following assumptions and limitations have been identified. The uncertainty associated with each limitation has been reduced as far as possible. The assessment is considered appropriate for the purposes of identifying likely significant adverse noise effects.

Construction noise and vibration

11.5.4 The specific plant to be used during construction is not known at this stage as this would be dependent on the final design, programme, contractor and chosen methodology. A list of construction activities and equipment has been prepared based on other road schemes and in consultation with a team that has provided buildability advice. Construction plant assumptions are contained within Appendix 11.2, Volume 6.3. The construction noise assessment is considered to be a worst-case scenario of potential magnitude of impact because conservative assumptions have been made about the number and type of plant and usage details.

11.5.5 Construction noise levels are generally calculated without accounting for the noise reduction benefit of noise barrier, the actual topography or existing screening between construction works and nearby sensitive receptors. The construction noise assessment has considered the potential noise levels at arbitrary distance bands of 10 metres, 20 metres, 50 metres, 100 metres, 200 metres, and 300 metres in order to inform the selection of specific properties to undertake a more in depth BS5228-1 assessment (the 5dB Change Method). The assessment is therefore conservative.

11.5.6 Where construction noise levels exceed SOAEL, an in-depth BS5228-1 assessment of construction noise has also been carried out to include the noise reduction effect of barriers that shield receptors from construction activity, and in these cases the noise reduction provided by the barrier is 10dB in accordance with BS5528-1.

11.5.7 The full extent of any required piling is not yet known (as this is dependent on both the design of structures and ground conditions). In the absence of a detailed construction methodology the noise assessment has assumed that percussive piling would arise at all locations of structures along the route and would be operating for 70% of the working day for the duration of the structures phase. This is therefore conservative in nature.

11.5.8 Percussive piling has also been assumed for the vibration assessment. BS5228-2 provides guidance on predicting potential vibration levels from different methods of piling based on a number of different variables. Percussive piling has been predicted assuming the following conditions:

- K_p factor of 1.5 (this is a correction applied to account for geological conditions of the local area based on guidance from table E.2 of BS5228-2).
- Hammer energy of 40,000 joules.

11.5.9 It is assumed that the movements in and out of the haul routes (32 in and 32 out) would be unevenly distributed throughout the day. Calculations of the noise for haul roads have used a conservative assumption of 20 vehicles (dump trucks) in 1 hour at a speed of 10 kilometres per hour.

Operational noise

11.5.10 Operational noise has been calculated using the methodology set out in CRTN and implemented in the CadnaA noise modelling software.

11.5.11 Traffic data used for noise predictions has been based upon traffic data supplied from a validated traffic model. For a 1dB change (all other variables being equal) traffic flows need to increase by 25% or decrease by 20%, therefore small errors in forecasting or prediction are unlikely to significantly affect results.

11.5.12 Night-time road traffic noise levels have been calculated from the daytime 18-hour data using Transport Research Laboratory (TRL) Method 3 which is based on empirical relationships between day and night time noise levels.

11.5.13 The definition of residential receptors has been based upon OS Address-point data. Where buildings have been allocated more than one residential unit, these have been incorporated into the calculations. HD213/11 advises on reductions of sound from thin surface courses. For the purposes of this assessment it has been assumed that the A303 has a low noise surface in both the opening year and design year for scenarios both with and without the scheme.

11.5.14 Within the HD213/11 Assessment Summary Tables, the separation between ‘No Change’ and ‘Negligible’ impacts is very low (0.1dB), however, this assessment does not draw a distinction between these categories, and the reporting of adverse or significant effects is unaffected.

11.6 Study area

Construction noise and vibration

11.6.1 The assessment area for temporary noise and vibration impacts during construction is 300 metres from construction activity (seen in Figure 11.1 Construction Noise Study Area, Volume 6.2) due to the nature of the noise sources, the typical distances from source to receptor, and professional experience for the likely area of potential adverse effects from similar highways construction assessments.

Operational noise and vibration

11.6.2 HD213/11 provides the methodology for assessment of road projects within the UK. The methodology, which has been applied for the purposes of this

assessment, requires that the study area is identified as an area within 1 kilometre of the physical works associated with the scheme. Within this study area, road traffic noise calculations are performed at any sensitive receptor within 600 metres of a road where there is a possibility of a change of 1dB $L_{A10,18hr}$ upon scheme opening, or 3dB $L_{A10,18hr}$ in the long term. The operational noise calculation area is shown in Figure 11.2 Operational Noise Study Area, Volume 6.2.

11.6.3 The study area also includes affected routes where there is a change of 1 dB $L_{A10, 18 hr}$ or more in the short term or 3 dB $L_{A10, 18 hr}$ or more in the long term.

11.7 Baseline conditions

Soundscape and existing area

11.7.1 The study area is predominantly rural with no major sources of industrial noise. The A303 is the most significant noise source within the study area while the A359 and B3151 also contribute road traffic noise. The single-track Yeovil to Castle Cary railway line crosses the eastern end of the study area. RNAS Yeovilton is one of the Royal Navy's principal air bases and has frequent helicopter flights.

11.7.2 The study area surrounding the scheme is primarily made up of undeveloped fields scattered with a mixture of residential properties, commercial properties and restaurants, places of worship, and small hotels / guest houses.

11.7.3 There are there are 529 residential receptors and 55 non-residential receptors located within the study area used in this assessment.

Baseline noise measurements

11.7.4 A series of long-term (LT) and short-term (ST) measurements were undertaken along the scheme between 28 February and 15 March 2018 to establish baseline conditions and which can also be used to inform the construction noise assessment.

11.7.5 The priority for undertaking measurements was given to areas representative of sensitive receptors considered likely to be affected by the scheme based on their proximity to the works. In total there were measurements undertaken at 4 LT locations and seven ST locations.

11.7.6 Full results and graphical data can be found in Appendix 11.1 Baseline Noise Survey, Volume 6.3. This also includes details of equipment used, weather conditions, and a map showing all ST and LT monitoring locations (Figure 1.1 contained within Appendix 11.1 Baseline Noise Survey, Volume 6.3).

11.7.7 Table 11.10 summarises the LT data collected for each of the measurement positions, for weekdays only, during school term time (for representative traffic) and during appropriate weather conditions (noting that there was insufficient data due to snow and instrumentation failures at LT3, and that measurements at LT4 were not undertaken due to safety and access reasons). All levels have been rounded to the nearest whole number.

Table 11.10: Summary of LT noise monitoring results

Position and location	$L_{A10, 18hr}$ dB	$L_{Aeq, 12hr}$ dB (daytime)	$L_{Aeq, 4hr}$ dB (evening)	$L_{Aeq, 8hr}$ / L_{night} dB (night-time)
LT1 – NE of Wayne's Bar and Grill	77	76	72	70
LT2 – northern boundary of West Camel Methodist Church	80	77	75	74
LT5 – Hazel Park caravan site	63	62	58	56

11.7.8 ST measurements were conducted on Wednesday, 28 February, Thursday, 1 March, Wednesday, 14 March, and Thursday, 15 March 2018. For all the short-term measurements, statistical indices (L_{Aeq}, L_{AMax} and L_{A10}) were obtained over contiguous 15 minute intervals (unless otherwise stated). Table 11.11 shows the range of statistical indices at each ST position. All levels have been rounded to the nearest whole number. Figure 1.1 within Appendix 11.1 Baseline Noise Survey, Volume 6.3 shows the location of all measurement positions.

Table 11.11: Summary of ST noise monitoring results

Position and location	**Dates**	**Day or night**	**Range of L_{Aeq} dB**	**Range of L_{Amax} dB**	**Range of L_{A10} dB**
ST1 –opposite westbound slip road to Podimore	28 February, 1 March*, 14 March, 15 March	Daytime	67-80	83-97+	70-80
	28 February	Night time	62-73	82-90	57-78
ST3 – end of the vehicle turning circle opposite Wayne's Bar and Grill	28 February^, 1 March*, 14 March, 15 March	Daytime	70-78	79-87	72-82
ST4 – between the existing A303 and road to Downhead	28 February, 1 March*, 14 March, 15 March	Daytime	70-74	80-84	74-78
ST5 – between West Camel Methodist Church and Plowage Lane	28 February, 1 March*, 14 March, 15 March	Daytime	73-78	86-89	76-81
ST6 – between the existing A303 and Gason Lane	28 February, 1 March*, 14 March, 15 March	Daytime	69-77	79-88	72-81
ST7 – boundary of the Ridge Copse wooded area	28 February, 1 March*, 14 March, 15 March	Daytime	73-76	85-90	77-80
ST8 – field north of the layby area between the Hazelgrove Roundabout and the A303 road bridge over the A359	28 February, 1 March*, 14 March, 15 March	Daytime	68-71	76-81	71-73
* indicates snow during measurement, and therefore may impact traffic during the day. Road traffic during snow is assumed to be lower than usual and therefore under represent the normal noise climate. ^ indicates a 12-minute measurement instead of a 15 minute measurement					

Position and location	Dates	Day or night	Range of L_{Aeq} dB	Range of L_{Amax} dB	Range of L_{A10} dB
[+] L_{Amax} 110 dB was removed and considered to be an outlier					

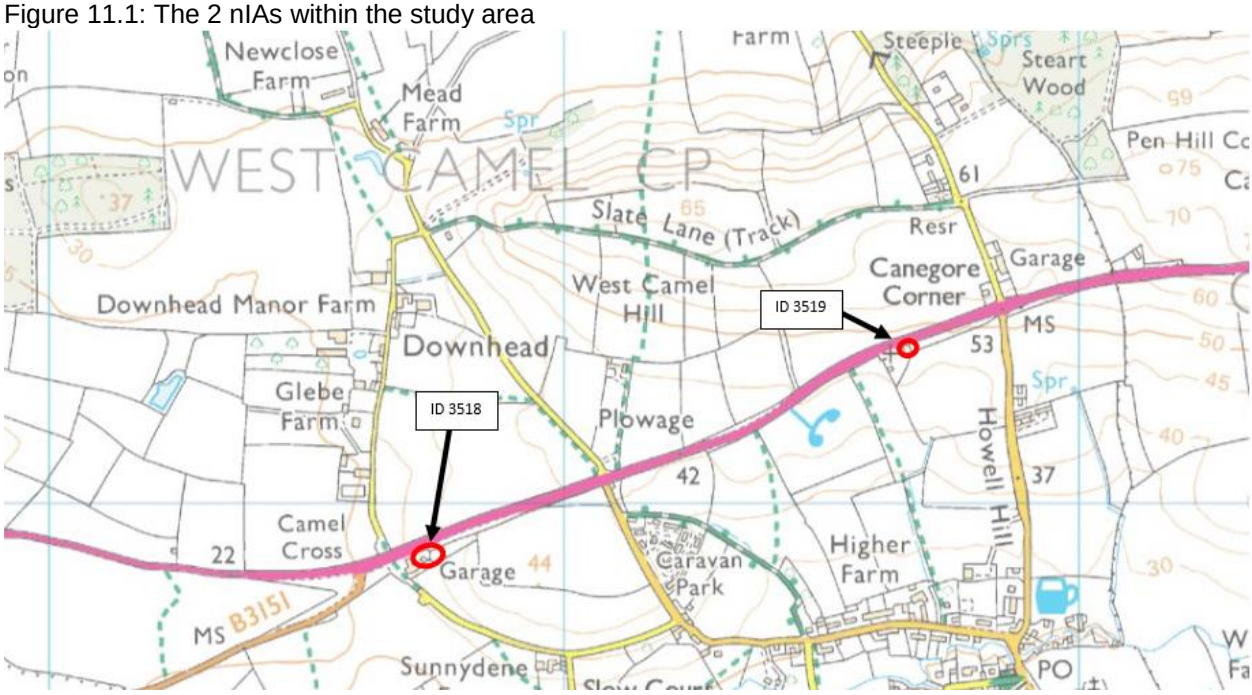
Noise Important Areas

11.7.9 Table 11.12 summarises the 2 noise Important Areas (nIA) within the study area and Figure 11.1 in this chapter show these highlighted in red. The nIAs are also shown on the Environmental Constraints Plan contained in Figure 2.2 of Volume 6.3.

Table 11.12: Summary of road nIAs

nIA by ID	Location	Approximate length	Responsible authority	Approximate number of dwellings
3518	A303 westbound side, east of junction with B3151	56m	Highways England	1
3519	A303 westbound side, approximately 200m west of Howell Hill	34m	Highways England	2

Figure 11.1: The 2 nIAs within the study area



Source: Contains Ordnance Survey data © Crown copyright and database right 2014

11.8 Potential impacts

11.8.1 The scheme has the potential to give rise to both temporary and permanent noise and vibration impacts in the daytime and night-time.

11.8.2 Potential temporary impacts arising from the construction phase include:

- Noise and vibration arising from construction of the scheme and associated new structures

- Noise and vibration from construction traffic using the existing surrounding roads and haul roads
- Noise and vibration due to the use of site compounds
- Changes in traffic (and subsequent noise) on local roads due to construction activity and road closures.

11.8.3 The construction activities that have the potential to cause impacts include:

- Linear road works, including the following:
  - Enabling works – tree / hedgerow clearance and site clearance
  - Earthworks – including topsoil stripping, bulk earthworks, resoiling, roadbox and capping
  - Drainage works for pavement drainage, ducting and chambers
  - Roadworks – road pavement construction / asphalting and road marking works
- Structures – construction of new structures (from west to east): Downhead Junction Overbridge, Steart Hill Overbridge, Traits Lane Underbridge, and Hazlegrove Junction Underbridge
- Temporary haul roads
- Construction compounds – site clearance and general construction, compound operation (24 hours per day), and batching plant compound
- Night time works at pinch points (defined in Chapter 2 of Volume 6.1) – resurfacing and roadbox and capping

11.8.4 During operation, the scheme would broadly follow the existing road corridor. However, there is potential for changes to traffic flows and road alignment to result in noise changes at noise sensitive receptors, particularly from increased traffic on the scheme road and surrounding roads and speed changes.

11.8.5 Potential permanent impacts arising from the operation of the scheme include:

- Changes in road traffic noise resulting from the newly aligned carriageway
- Changes in road traffic using the new junctions
- Changes in road traffic on the existing roads

11.9 Design, mitigation and enhancement measures

Design

11.9.1 The mitigation within the design includes consideration of horizontal alignment, use of cuttings and embankments, noise barriers and low-noise running surfaces. Four barriers would be included along the alignment of the A303, 1 located at a property known as The Spinney, 1 located at Steart Hill and 2 located near Camel Hill. A total of 7 bunds would be provided along the

scheme. Two bunds would be located towards the western end of the scheme, where the B3151 joins the A303 near Hawk House, another would be located to the east of Downhead junction, a false cutting would be provided between Howell Hill and Traits Lane, and 3 false cuttings would be provided at Hazlegrove Junction. A thin surface course would be applied to new carriageways associated with the scheme. A full description of these design measures is provided in Section 2.5 of Chapter 2 The Scheme of Volume 6.1, and all mitigation measures are included on the Environmental Masterplan (Figure 2.8, Volume 6.2).

Mitigation

Construction

11.9.2 Normal workings hours would be 07:00 and 18:00 on weekdays, 07:30 and 13:00 on Saturdays, generally with no works being undertaken on Sundays and Bank Holidays. This would be agreed by the Contractor in advance with the South Somerset District Council's EHO(s) and incorporated into the Construction Environment Management Plan (CEMP) for the scheme. Further information is contained within Chapter 2 The Scheme, Volume 6.1.

11.9.3 As discussed in paragraph 11.3.3, the Contractor will approach South Somerset District Council prior to construction works commencing in order to obtain approval through the Section 61 process for the methods to be used and the steps proposed to minimise noise resulting from construction works.

11.9.4 Incorporated mitigation related to construction noise and vibration would be set out within the CEMP. This would identify the series of measures to reduce the environmental effects during the construction period and covers environmental and safety aspects affecting the interests of the residents, businesses, road users, and the general public in the vicinity of the works. At this stage an **Outline Environmental Management Plan (OEMP) (*document reference TR010036/APP/6.7*)** has been produced.

11.9.5 Temporary barriers will be used as a form of mitigation for residential receptors where there would be significant construction noise effects. The detailed assessment (within Appendix 11.3 Construction Assessment of 10 Properties, Volume 6.3) has been prepared showing the resultant noise levels both with and without barrier mitigation (that shields the receptor from the construction works, therefore reducing the resultant noise levels from works by 10dB) in order to show where significant construction effects are eliminated with the provision of this mitigation.

11.9.6 Noise mitigation measures other than temporary barriers would include the following:

- Select quieter plant than has been used in the assessment (worst-case scenario).
- Ensure equipment is maintained, in good working order, and is used in accordance with the manufacturer's instructions.
- Fit equipment with silencers or mufflers.
- Set time restrictions on certain noisy activities (such as topsoil strip and bulk earthworks as seen in Table 11.13).
- Manage deliveries to prevent queuing of site traffic.
- Do not leave plant running unnecessarily.
- Careful orientation of plant with directional features.
- Materials to be lowered instead of dropped from height.
- Use of adjustable or directional audible vehicle-reversing alarms or use of alternative warning systems (for example, white noise alarms).
- Train and advise members of the construction team during toolbox talk briefings on quiet working methods.
- Positioning of generators at least 20 metres from the nearest receptor.

11.9.7 The effects of potential noise and vibration on local communities can be mitigated by effective communication. Good public relations are invaluable in securing public acceptance of construction noise. People are more tolerant of noise if they understand the reason for it, the likely duration, start and stop dates, and that everything is being done to minimise noise levels. Letter box drops explaining this would be considered. A dedicated site contact for the public and a complaints handling procedure would both be put in place. Further information would be contained within the Community Relations Strategy (see Annex B.6 of the ***OEMP**, **document reference TR010036/APP/6.7***).

11.9.8 Where vibration levels have been predicted to exceed SOAEL (PPV 1.0mm/s) the Contractor would:

- Use alternative piling methods and/or plant if practicable
- Keep occupiers informed of the likely times and duration of works through letterbox drops.
- Monitor the vibration level at the nearest receptors (or at an equivalent offset distance) to enable the vibration level at receptors to be determined.
- Carry out a condition survey at nearby structures to ensure they can undergo works without permanent damage and to ensure any current damage to buildings is accounted for ahead of time.

11.10 Assessment of likely significant effects

Potential construction noise effects

11.10.1 The level of noise experienced by sensitive receptors would vary according to the following factors:

- Sound power levels of the plant
- Periods of operation of the plant
- Number of plant items used at the same time
- Distances from source to receiver
- Phasing of construction works
- Presence of screening by barriers
- Topographical features, such as ground type and building heights

11.10.2 Details of the plant for this assessment are defined in Appendix 11.2 Construction activities and plant for noise assessment, Volume 6.3. All other factors are defined in Section 11.5 Assumptions and Limitations of this chapter.

11.10.3 The predicted noise levels for each of the construction activities are shown in the Tables 11.13, 11.16, 11.18. 11.19, 11.20, and 11.21 below. Noise levels are shown as free-field predictions.

11.10.4 The calculations show exceedances of the daytime SOAEL only (as bold numbers within the tables) as a majority of the works will take place during daytime hours. Known night-time works are assessed separately.

Linear road works

11.10.5 The noise levels expected to be in excess of the SOAEL threshold construction noise level (free-field 72dB $L_{Aeq, 16h}$) for linear road works are highlighted by a bold typeface in Table 11.13. However, it should be noted that some receptors near the A303 are already subject to ambient noise levels in excess of the SOAEL (see Table 11.10 and Table 11.11 for a summary of the baseline noise conditions, with full results shown in Appendix 11.1 Baseline Noise Survey, Volume 6.3).

Table 11.13: Predicted construction noise levels – linear road works

Phase	Activity	$L_{Aeq, 16h}$ dB at various distances from the works						Approximate distance (m) to be at or above daytime SOAEL
		10m	20m	50m	100m	200m	300m	
Enabling works	Tree/hedgerow clearance	**84**	**78**	68	61	53	49	37
	Site clearance	**85**	**79**	70	62	55	50	42
Earthworks	Topsoil strip	**91**	**85**	**75**	68	60	56	70
	Bulk earthworks	**90**	**84**	**74**	67	59	55	65

Phase	Activity	$L_{Aeq, 16h}$ dB at various distances from the works 10m	20m	50m	100m	200m	300m	Approximate distance (m) to be at or above daytime SOAEL
	Resoil	**86**	**80**	70	63	55	51	44
	Roadbox and capping	**85**	**79**	70	62	55	50	43
Drainage	Pavement drainage, ducting and chambers	**84**	**78**	69	61	54	49	37
Roadworks	Road pavement construction/asphalting	**90**	**84**	**75**	67	60	55	67
	Road markings	**82**	**76**	67	59	52	47	31

11.10.6 Table 11.14 shows the number of residential (and therefore high sensitivity) receptors within each distance band from the scheme road. There are 10 receptors that are potentially subject to significant adverse effects due to their distance from the works. Figure 11.2 and Figure 11.3 below show the locations of these 10 receptors. These receptors are assessed in paragraph 11.10.23 using Method 2 – 5 dB Change Method from BS5228-1 by determining which linear works are within the approximate SOAEL distance threshold.

Table 11.14: Estimated number of residential receptors – linear road works

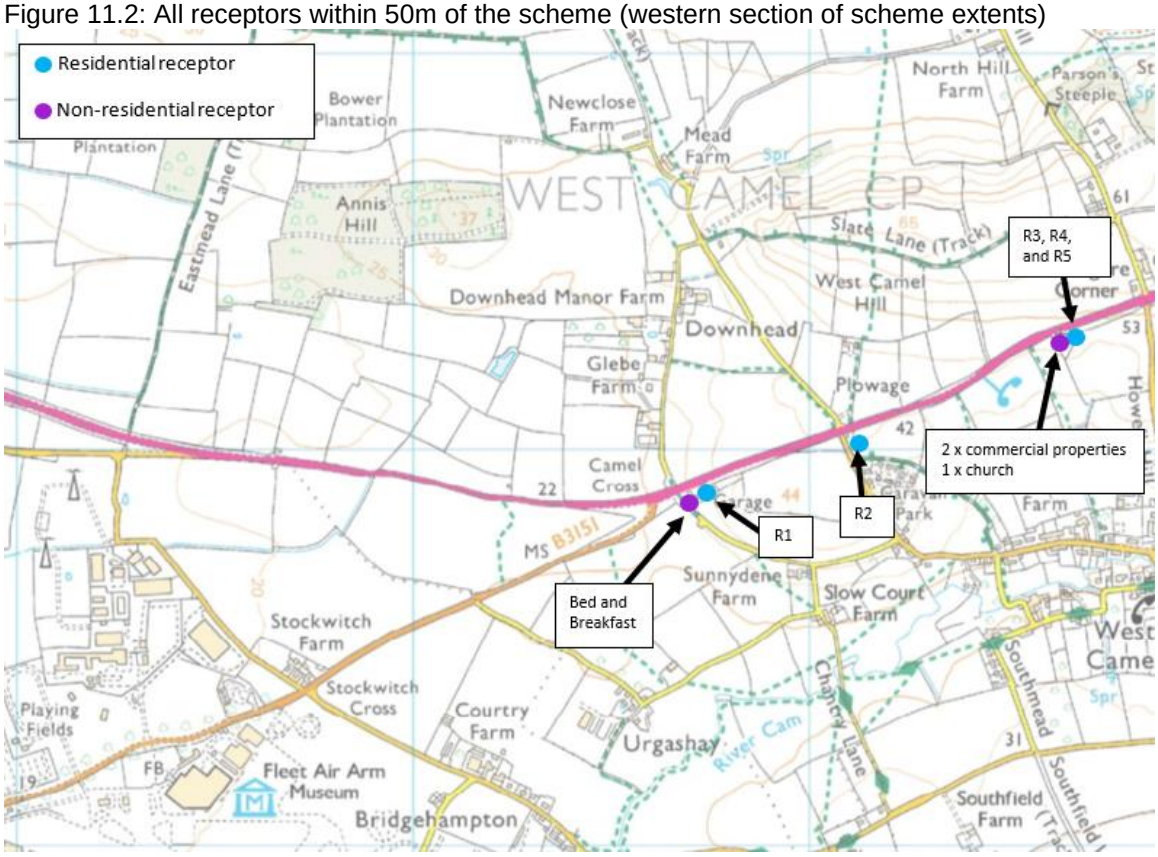
Linear works	Residential receptors at various distances from the works 0-10m	10-20m	20-50m	50-100m	100-200m	200-300m
Number of receptors	2	2	6	7	103	39

11.10.7 Table 11.15 shows the number of other (non-residential) receptors within each distance band from the scheme road. There are 7 receptors that are within 50 metres of the works. Figure 11.2 and Figure 11.3 below show the locations of these 7 receptors.

Table 11.15: Estimated number of other (non-residential receptors) – linear road works

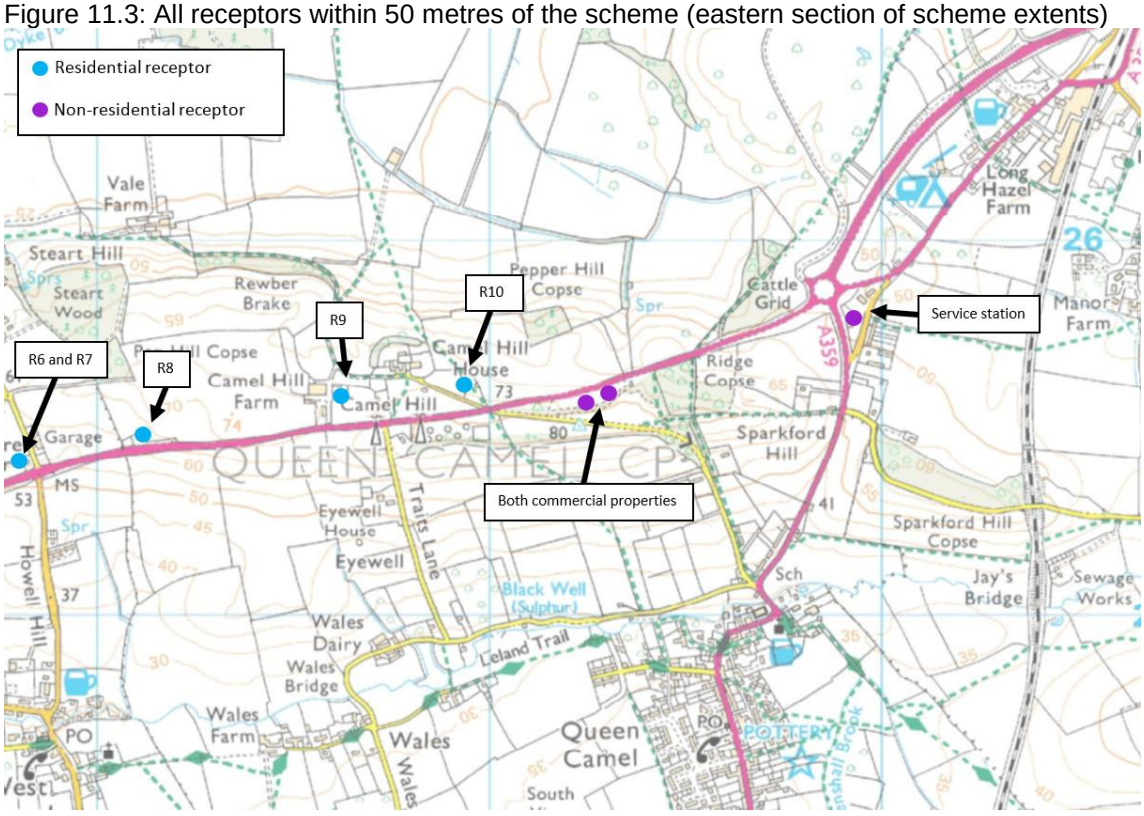
Linear works	Other (non-residential) receptors at various distances from the works 0-10m	10-20m	20-50m	50-100m	100-200m	200-300m
Number of receptors	3	2	2	4	1	2

Figure 11.2: All receptors within 50m of the scheme (western section of scheme extents)



Source: Contains Ordnance Survey data © Crown copyright and database right 2014

Figure 11.3: All receptors within 50 metres of the scheme (eastern section of scheme extents)



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Structures

11.10.8 There are 4 new structures proposed within the scheme. The noise levels expected to be in excess of the SOAEL threshold construction noise level (free-field 72dB $L_{Aeq, 16h}$) for the new structures are highlighted by a bold typeface in Table 11.16.

Table 11.16: Predicted construction noise levels – structures

Activity	$L_{Aeq, 16h}$ dB at various distances from the works					
	10m	20m	50m	100m	200m	300m
Overbridges at Downhead & Steart Hill; Underbridges at Hazlegrove and Traits Lane	**89**	**83**	**73**	66	58	54

11.10.9 Table 11.17 shows the number of residential receptors within each distance band from each of the proposed structures.

Table 11.17: Estimated number of residential receptors – structures

	Residential receptors at various distances from the works					
	0-10m	10-20m	20-50m	50-100m	100-200m	200-300m
Hazlegrove Junction Underbridge	0	0	0	0	0	1
Traits Lane Underbridge	0	0	0	0	5	3
Steart Hill Overbridge	0	0	0	0	1	2
Downhead Junction Overbridge	0	0	0	1	2	42

11.10.10 Construction noise levels are above SOAEL up to 60 metres from the works. There are no residential receptors within 60 metres of the works (the 1 property shown in Table 11.17 between 50-100m is between 70 and 80m of the Downhead Junction Overbridge). There are therefore no significant adverse noise effects due to the construction of structures.

Temporary haul routes

11.10.11 The temporary works requirements for the scheme include 2 off-line haul routes. The proposed northern haul route is between Steart Hill and Camel Hill. The proposed southern haul route is between Plowage Lane and Howell Hill. Both of these routes have nearby sensitive receptors as can be seen in Figure 2.9 Temporary Works Area, Volume 6.2.

11.10.12 Advice from the buildability team is that the maximum proposed number of dump trucks per day is 32. However, this is throughout the entire 7 kilometres length of the scheme.

11.10.13 Table 11.18 shows the predicted noise levels for the potential haul routes.

Table 11.18: Predicted construction noise levels – haul routes

Activity	$L_{Aeq, 16h}$ dB at various distances from the works					
	10m	20m	50m	100m	200m	300m
Haul Road	67	64	60	57	54	52

11.10.14 In all cases the noise level is below the construction noise SOAEL so the haul routes would not have a significant impact on nearby sensitive receptors.

Site compounds

11.10.15 Temporary site compounds would be established to support the construction operations and would comprise mobile, temporary office units, welfare facilities, storage areas for construction material, maintenance areas and parking areas (for the workforce). See section 2.5 of Chapter 2 The Scheme, Volume 6.1, for further information.

11.10.16 It is expected that the site clearance and compound construction at the 4 compound locations would take place during the day-time only. However, when compounds are fully operational they would be expected to have a 24-hour generator running. Therefore, the tables below show noise levels for both day and night representing a worst-case scenario.

11.10.17 The noise levels expected to be in excess of the SOAEL threshold construction noise level (free-field 72dB $L_{Aeq, 16hr}$ for daytime and 55dB $L_{Aeq, 8hr}$ for night-time) for the site compounds are shown in bold in Table 11.19 and Table 11.20.

Table 11.19: Predicted construction noise levels – compounds day time

Activity	$L_{Aeq, 16h}$ dB at various distances from the works					
	10m	20m	50m	100m	200m	300m
Site clearance	**87**	**81**	71	64	56	52
Compound construction	**85**	**79**	70	62	55	50
Compound operation	**72**	66	56	49	41	37
Batching plant compound operation	**85**	**79**	70	62	55	50

11.10.18 Site clearance and construction of the compound would not lead to significant adverse effects provided that the compound is at least 50 metres from the nearest noise sensitive receptor or that clearance and construction is completed within 10 of 15 consecutive days or for a total number of days not exceeding 40 in any 6 consecutive months. There are 3 residential receptors within 50 metres of the main compound, structures compound, and Hazlegrove Roundabout compound and noise barriers will be required (as stated in section 11.9 of this chapter) to control noise at these receptors if the delivery partner expects works operations to exceed 10 days within 15 consecutive days or a total of 40 days in any 6 consecutive months. There are no residential receptors within 50 metres of the batching plant compound.

11.10.19 At night the only noise source from the compound would be the 24-hour generator which would result in significant night-time noise levels where receptors are 10 metres or less from the compound.

Table 11.20: Predicted construction noise levels – compounds night time

Activity	$L_{Aeq, 16h}$ dB at various distances from the works					
	10m	20m	50m	100m	200m	300m
Compound operation (generator only)	**61**	55	46	38	31	26

11.10.20 All receptors are more than 10 metres from the compounds and therefore no significant adverse noise effects arise.

Night-time works

11.10.21 The noise levels expected to be in excess of the SOAEL threshold construction noise level (55dB $L_{Aeq, 16h}$) night time works at pinch points (defined within Chapter 2, Volume 6.1) are highlighted by a bold typeface in Table 11.21 below.

Table 11.21: Predicted construction noise levels – night-time works at pinch points

Activity	$L_{Aeq, 8h}$ dB at various distances from the works						Approximate distance (m) to be at or above night time SOAEL
	10m	20m	50m	100m	200m	300m	
Resurfacing	**81**	**75**	**66**	**58**	51	46	138
Roadbox and capping	**84**	**78**	**69**	**61**	54	49	187

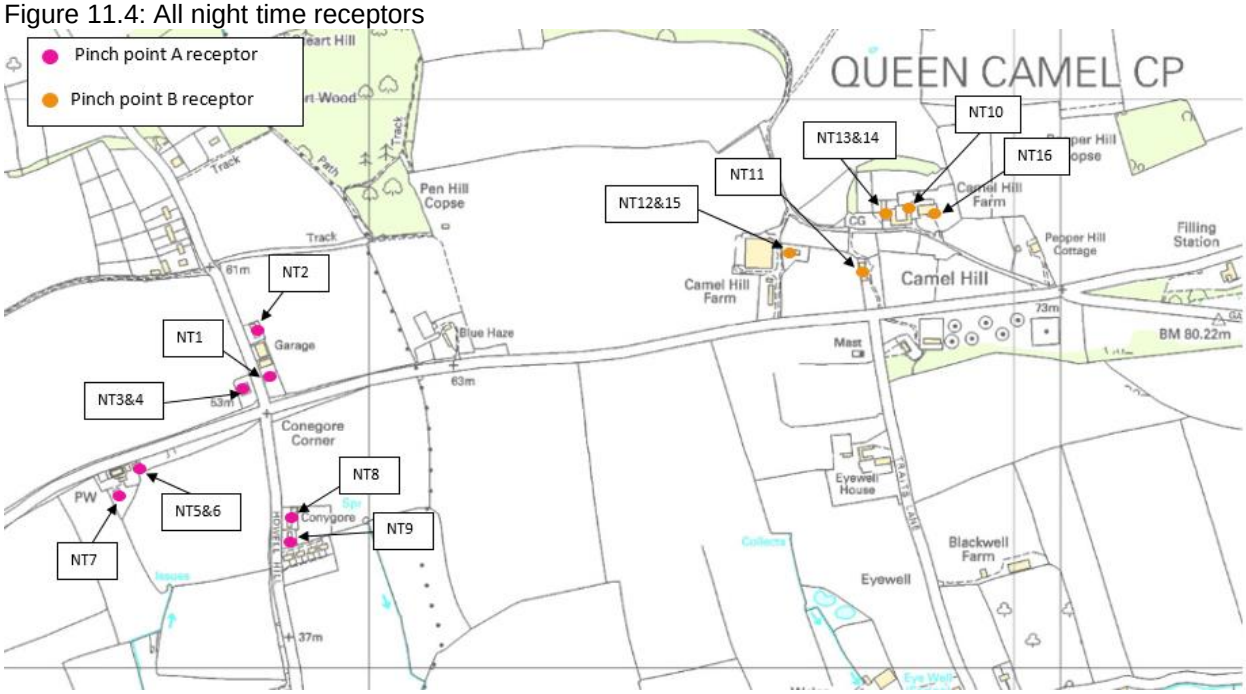
11.10.22 Table 11.22 shows the approximate number of residential receptors within each distance band from each of the proposed pinch point works based on preliminary information given about night-time pinch point locations.

Table 11.22: Estimated number of residential receptors – night-time works at pinch points

	Residential receptors at various distances from the works					
	0-10m	10-20m	20-50m	50-100m	100-200m	200-300m
Pinch point A	0	0	2	3	12	4
Pinch point B	0	0	1	2	4	2

11.10.23 Specifically for pinch point A there are 8 residential within 138 metres of resurfacing works and 9 residential receptors within 187 metres of roadbox and capping works (including the 8 from resurfacing works). Specifically for pinch point B there are 5 residential within 138 metres of resurfacing works and 7 residential receptors within 187 metres of roadbox and capping works (including the 5 from resurfacing works). All receptors can be seen in Figure 11.4 below. A detailed assessment for these 16 receptors is given in Appendix 11.3, Volume 6.3 and summarised below in paragraph 11.10.25.

Figure 11.4: All night time receptors



Source: Contains Ordnance Survey data © Crown copyright and database right 2014

Assessment of 10 nearest receptors (daytime works)

11.10.24 Appendix 11.3 Construction Assessment of Residential Properties, Volume 6.3 contains the individual tables that assess each of the nearest residential receptors using Method 2 – 5 dB Change from BS5228-1 in order to inform mitigation. Table 11.23 below summaries the findings in terms of the potential significant effects from construction activities for receptors (with the required barrier mitigation in place). Significant effects will only occur if works in the vicinity of the receptor extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months. Where there is the potential for significant effects as identified in Table 11.23, additional mitigation measures (stipulated in paragraph 11.9.6 and 11.9.7) would be employed. With these measures in place, effects would be reduced and are not considered to be significant.

Table 11.23: Activities resulting in potentially significant effects due to daytime construction

Receptor	Activity
R1	Earthworks – topsoil strip and bulk earthworks Roadworks – road pavement construction/asphalting
R2	Enabling works – tree/hedgerow clearance, site clearance Earthworks – topsoil strip, bulk earthworks, resoil, roadbox and capping Roadworks – road pavement construction / asphalting
R3	Earthworks – topsoil strip and bulk earthworks Roadworks – road pavement construction / asphalting
R4	Enabling works – tree/hedgerow clearance, site clearance Earthworks – topsoil strip, bulk earthworks, resoil, roadbox and capping Roadworks – road pavement construction / asphalting
R5	Enabling works – tree/hedgerow clearance, site clearance Earthworks – topsoil strip, bulk earthworks, resoil, roadbox and capping Roadworks – road pavement construction / asphalting

Receptor	Activity
R6	Earthworks – topsoil strip, bulk earthworks, and resoil Roadworks – road pavement construction/asphalting Site compound – site clearance and compound construction
R7	Earthworks – topsoil strip, bulk earthworks, and resoil Roadworks – road pavement construction / asphalting Site compound – site clearance and compound construction
R8	Earthworks – topsoil strip and bulk earthworks Roadworks – road pavement construction / asphalting
R9	Earthworks – topsoil strip and bulk earthworks Roadworks – road pavement construction / asphalting
R10	Enabling works – site clearance Earthworks – topsoil strip, bulk earthworks, resoil, roadbox and capping Roadworks – road pavement construction / asphalting Site compound – site clearance and compound construction

Assessment of nearest receptors (night time works)

11.10.25 Appendix 11.3 Construction Assessment of Residential Properties, Volume 6.3 contains the individual tables that assess each of the nearest residential receptors using Method 2 – 5 dB Change from BS5228-1 in order to inform mitigation.

11.10.26 There would be no significant adverse noise effects due to night time noise provided construction activity does not exceed 10 or more days of working in 15 consecutive days or 40 days of working in 6 months. It is currently envisaged that there would be some night-time works, likely to comprise 4 full weekend closures only (see Table 2.6 Chapter 2, Volume 6.1) and therefore no significant adverse effects would arise.

Construction traffic

11.10.27 Construction traffic details for the roads surrounding the scheme are not currently available. It is likely that local and major roads leading to site compounds and access points will be subject to construction traffic.

11.10.28 Access into the site compounds (for members of staff and site visitors) would be positioned to accommodate the anticipated traffic volume and to ensure public road safety is not compromised.

11.10.29 It is estimated as a worst case volume that construction related vehicles per day would be 100, with the average being around 20 to 40 per day (dispersed on different roads).

11.10.30 The number of goods vehicles and additional traffic movements (for members of staff and site visitors) would need to increase by more than 25% to produce a 1dB $L_{A10,\ 18hr}$ increase in noise level.

11.10.31 Traffic data supplied for the Do Minimum Baseline Year (Opening Year) (for the operational noise model) shows that roads surrounding the existing

A303 range from about 58 vehicles per hour to 793 vehicles per hour (closer to the A303 junctions). On this low volume road (58 vehicles per hour, for example) there would need to be an additional 160 vehicles throughout the course of the construction working day in order to increase the volume by 25%.

11.10.32 Therefore, applying the worst-case information detailed above, the number of goods vehicles and additional traffic movements would not lead to significant adverse effects.

Traffic changes due to diversions and road closures

11.10.33 For online construction work, single lane traffic would be maintained through much of the works. According to HD213/11, a restriction of road traffic speed is often implemented for reasons of safety allowing construction works to occur adjacent to flowing traffic, and such decreases in traffic speed can lead to temporary reductions in noise levels for nearby receptors.

11.10.34 Clause 3.17 of HD213/11 states that certain projects may require use of temporary diversion routes and receptors located in proximity to such routes may experience increased levels of noise and vibration. The worst-case duration of road closures has been given in Chapter 2 of Volume 6.1 but the nature of the temporary diversions for the scheme (for example, the expected traffic flows distributed on surrounding roads) is not known and therefore potential impacts cannot be readily determined.

11.10.35 In the case of diversion of traffic from local roads with relatively low flows then it is not considered likely that significant effects will arise since, as noted in paragraph 11.10.30, traffic would need to increase by more than 25% to produce a 1dB $L_{A10, 18hr}$ increase in noise level.

11.10.36 There is a further possibility that traffic may divert from the A303 on to local roads in order to avoid congestion. The likelihood of this occurring would vary during the course of the day – it being more likely during peak periods and less likely during off-peak periods. As traffic noise is assessed using weekday traffic flows averaged over an 18-hour period (06:00 – 24:00) then it is not likely that this would be significant in terms of this assessment. Notwithstanding this, there will be a duty on the Contractor to minimise such occurrences as the location and duration of temporary diversion routes would form part of the Section 61 discussions the Contractor would undertake with South Somerset District Council.

Potential construction vibration effects

11.10.37 In this assessment, LOAEL for vibration is 0.3mm/s based on the level that might be perceptible in residential environments and SOAEL is a vibration level of 1.0mm/s based on the level that would cause complaint (although even this level can be tolerated if prior warning and explanation has been given to residents).

11.10.38 Vibration levels that have been predicted to be in excess of the SOAEL threshold are shown in bold in Table 11.25. Table 11.26 shows the number of residential receptors within each distance band from each of the proposed structures.

Table 11.25: Predicted construction vibration levels – structures

Activity	PPV (mm/s) at various distances from the works			
	10m	20m	50m	100m
Overbridges at Downhead & Steart Hill; Underbridges at Hazlegrove and Traits Lane	**15**	**6.1**	**1.9**	0.75

Note: Distance bands above 100 metres have not been calculated as the BS5228-2 formula allows distances to be calculated up to 111 metres.

Table 11.26: Estimated number of residential receptors – structures

	Residential receptors at various distances from the works			
	0-10m	10-20m	20-50m	50-100m
Hazlegrove Junction Underbridge	0	0	0	0
Traits Lane Underbridge	0	0	0	0
Steart Hill Overbridge	0	0	0	0
Downhead Junction Overbridge	0	0	0	1

11.10.39 The SOAEL of 1.0mm/s would not be exceeded at distances greater than 81 metres. There is one property within 81m of the Downhead Junction Overbridge, which is R2. No significant adverse effects due to vibration will arise providing piling takes place for no more than 10 days of working in 15 consecutive days or 40 days of working in 6 months.

11.10.40 For other works, the TRL has published the results of a series of measurements of vibration levels at distances from a range of construction works[16]. The ground conditions in the area of the source and receiver position and of the intervening ground are not specified in the report, however, it is considered to be sufficiently robust for the purposes of this assessment. The data from Figure 3 in the TRL document are reproduced in Table 11.27 below.

[16] Transport Research Laboratory. (1986) Ground vibration caused by civil engineering works (Research Report 53).

Table 11.27: Estimated PPVs at distances between construction plant and vibration measurement positions

Construction plant	Distance between construction site and vibration measurement position in (m)	PPV at measurement position (mm/s)
General construction traffic including haul routes	1	0.60
	2	0.24
	4	0.14
	6	0.10
	≥8	<0.10
Heavy lorry on poor road surface	1	2.20
	2	0.80
	4	0.24
	6	0.16
	8	0.10
	≥10	<0.10

11.10.41 Based on the separation distances between the proposed works and the receptors the estimated vibration levels would not result in vibration levels at the receptors that would exceed SOAEL and therefore no significant adverse effects due to construction vibration arise.

Potential operational noise effects

Road traffic noise

11.10.42 DMRB HD213/11 sets out a range of comparisons that should be made to assess the impact of changes in road traffic noise. These comparisons include:

- Do-Minimum scenario in the baseline year against Do-Minimum in the future assessment year (long-term change without the scheme)
- Do-Minimum scenario in the baseline year against Do-Something in the baseline year (short-term change with the scheme)
- Do-Minimum scenario in the baseline year against Do-Something in the future assessment year (long-term change with the scheme)

11.10.43 Contour maps of the $L_{A10,18h}$ index illustrate noise levels for these scenarios and noise difference contours illustrate noise changes as follows:

- Figure 11.3, Volume 6.2 shows the noise level contours in the Do-Minimum scenario in the baseline year
- Figure 11.4, Volume 6.2 shows the noise level contours in the Do-Minimum scenario in the future assessment year
- Figure 11.5, Volume 6.2 shows the noise level contours in the Do-Something scenario in the baseline year
- Figure 11.6, Volume 6.2 shows the noise level contours in the Do-Something scenario in the future assessment year

- Figure 11.7, Volume 6.2 shows the noise level increase between the Do-Something scenario in the baseline year and Do-Minimum scenario in the baseline year (short-term change with the scheme) in which a positive value shows a noise increase and a negative value shows a noise decrease
- Figure 11.8, Volume 6.2 shows the noise level increase between the Do-Something scenario in the future assessment year and Do-Minimum scenario in the baseline year (long-term change with the scheme) in which a positive value shows a noise increase and a negative value shows a noise decrease.

11.10.44 All of these comparisons are made for the daytime (comparing the $L_{10,18h}$ index in the two scenarios) and are reported for the number of receptors within the study area that are subject to no change or negligible, minor, moderate or major changes that may be either increases or decreases. The receptors include both residential receptors (dwellings) and non-residential (such as commercial premises, schools and community facilities).

11.10.45 For the changes over the long-term DMRB also requires comparisons to be made for the night-time, but only when $L_{night,outside}$ is greater than 55dB in any scenario.

11.10.46 Table 11.28 compares the noise levels in the long-term for the Do-Minimum scenario in the baseline year against Do-Minimum in the future assessment year. The noise changes are a combination of both increases in traffic volume and speed changes. It shows that all but one residential receptor would be subject to either no noise change or only negligible noise changes and the one exception is a minor noise decrease (daytime and night-time) and is due to a speed change on the A359 near Sawmills Cottage.

Table 11.28: Long-term change in noise levels, Do Minimum 2023 – Do Minimum 2038

Change in noise level			Day time Number of dwellings	Number of other sensitive receptors	Night-time Number of dwellings
Increase in noise level, $L_{A10, 18h}$	Negligible	0.1-2.9	486	45	42
	Minor	3.0-4.9	0	0	0
	Moderate	5.0-9.9	0	0	0
	Major	10.0+	0	0	0
No change		0	14	0	5
Decrease in noise level, $L_{A10, 18h}$	Negligible	0.1-2.9	28	10	0
	Minor	3.0-4.9	1	0	1
	Moderate	5.0-9.9	0	0	0
	Major	10.0+	0	0	0

11.10.47 Table 11.29 compares the noise levels in the short-term for the Do-Minimum scenario in the baseline year against Do-Something in the baseline

year. As these are changes over the short-term, the night-time noise levels are not compared.

11.10.48 Table 11.29 shows that 107 residential receptors would be subject to a minor noise increase, 10 receptors would be subject to a moderate noise increase and one receptor would be subject to a major noise increase. The minor noise increases are for receptors located along the A303 and in Sparkford, West Camel and Queen Camel, and are due to increases in traffic on the A303 and the surrounding local roads. The moderate noise increases are for receptors on Downhead Road and Steart Hill, to the north of the A303 and are due to changes to the vertical and horizontal alignment of the A303 and changes in traffic flow. The single receptor subject to a major noise increase is 'The Spinney' located on Plowage Lane. This major increase is due to changes to the vertical and horizontal alignment of the A303 and changes in traffic flow. All other residential receptors would be subject to either negligible noise increases, no change, or to noise decreases that could be negligible, minor, moderate or major.

Table 11.29: Short-term change in noise levels, Do Minimum 2023 – Do Something 2023

Change in noise level			Day time Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10, 18h}$	Negligible	0.1-0.9	224	18
	Minor	1.0-2.9	107	12
	Moderate	3.0-4.9	10	0
	Major	5.0+	1	0
No change		0	24	1
Decrease in noise level, $L_{A10, 18h}$	Negligible	0.1-0.9	98	10
	Minor	1.0-2.9	18	5
	Moderate	3.0-4.9	44	1
	Major	5.0+	3	8

11.10.49 Table 11.30 compares the noise levels in the long-term for the Do-Minimum scenario in the baseline year against Do-Something in the future assessment year. As these are changes over the long-term, the night-time noise levels are also compared. The table shows that 24 residential receptors (on Downhead Road, Steart Hill and Howel Hill, West Camel, on Blackwell Road and Traits Lane, Queen Camel, and on High Street, Sparkford) would be subject to a minor noise increase in the daytime. One residential receptor will be subject to a moderate noise increase in the daytime. This property is 'The Spinney', Plowage Lane, West Camel. All other residential receptors would be subject to either negligible noise increases, no change, or to noise decreases that could be negligible, minor or moderate. At night all residential receptors would be subject to either negligible noise increases, no change, or to noise decreases that could be negligible, minor or moderate.

Table 11.30: Long-term change in noise levels, Do Minimum 2023 – Do Something 2038

Change in noise level			Day time Number of dwellings	Number of other sensitive receptors	Night-time Number of dwellings
Increase in noise level, $L_{A10, 18h}$	Negligible	0.1-2.9	435	37	46
	Minor	3.0-4.9	24	2	0
	Moderate	5.0-9.9	1	0	0
	Major	10.0+	0	0	0
No change		0	0	2	0
Decrease in noise level, $L_{A10, 18h}$	Negligible	0.1-2.9	64	5	3
	Minor	3.0-4.9	3	2	2
	Moderate	5.0-9.9	1	6	0
	Major	10.0+	1	1	0

11.10.50 The assessment of permanent traffic nuisance impacts set out in HD213/11 compares (1) the Do-Minimum scenario in the baseline year against the Do-Minimum scenario in the future assessment year and (2) the Do-Minimum scenario in the baseline year against the Do-Something scenario in the future assessment year. These comparisons therefore compare the Do-Minimum scenario in the baseline year with 2 possible scenarios that are calculated for the future assessment year.

11.10.51 Table 11.31 shows the change in airborne noise nuisance for residential receptors within the study area. The table shows that the change in nuisance level for the Do-Minimum scenario (comparison (1) in paragraph 11.10.33) is less than 10% for all receptors. However, for the Do-Something scenario (comparison (2)) there are 175 receptors where the nuisance increases by 10 to 20%, 124 where nuisance increases by 20 to 30% and 11 receptors where nuisance increases by 30 to 40%.

Table 11.31: Summary of nuisance calculations for road traffic noise

Change in nuisance level		Do-Minimum Number of dwellings	Do-Something Number of dwellings
Increase in nuisance level	<10%	471	148
	10<20%	0	175
	20<30%	0	124
	30<40%	0	11
	>40%	0	0
No change	0%	39	3
Decrease in nuisance level	<10%	19	64
	10<20%	0	3
	20<30%	0	1
	30<40%	0	0
	>40%	0	0

Road traffic vibration

11.10.52 Paragraph A6.21 of HD213/11 states that the relationship between the percentage of people bothered by largely airborne vibration is similar to that for noise nuisance except that the percentage of people bothered by vibration is lower at all exposure levels. Table 11.32 shows the change in vibration nuisance calculated for receptors at exposure levels above 58dB $L_{A10,18h}$ as HD213/11 notes that, on average, traffic induced vibration is expected to affect a very small percentage of people at exposure levels below this level and that therefore, zero per cent should be assumed in these cases.

11.10.53 Table 11.32 shows the change in nuisance level is less than 10% for all receptors for the Do-Minimum scenario but that that for the Do Something scenario 35 receptors have an increase in vibration nuisance between 10 and 20%, 59 receptors have an increase between 20 and 30% and 2 receptors have an increase between 30 and 40%.

Table 11.32: Summary of nuisance calculations for road traffic induced airborne vibration

Change in nuisance level		Do-Minimum Number of dwellings	Do-Something Number of dwellings
Increase in nuisance level	<10%	153	45
	10<20%	0	35
	20<30%	0	59
	30<40%	0	2
	>40%	0	0
No change	0%	0	0
Decrease in nuisance level	<10%	5	20
	10<20%	0	3
	20<30%	0	1
	30<40%	0	0
	>40%	0	0

Noise Important Areas

11.10.54 Over the long-term, even without the scheme in place, noise levels would be expected to increase within nIAs due to a gradual increase in traffic volumes over the 15-year assessment period.

11.10.55 All nIAs within the study area are shown for the long-term in Table 11.33 (for the Do-Minimum scenario for the future assessment year) and Table 11.34 (for the Do-Something scenario for the future assessment year). Table 11.33 shows that without the scheme there would be an increase in noise for receptors in each nIA, albeit negligible, and Table 11.34 shows that with the scheme there would be a minor decrease in noise for receptors in each nIA.

Table 11.33: Numbers of dwellings experiencing noise changes for DM Opening Year vs DM Design Year

nIA by ID number	Total number of dwellings	Noise level decrease			Noise level increase		
		-10 to -5dB (moderate)	-5 to -3dB (minor)	-3 to 0dB (negligible)	0 to +3dB (negligible)	+3 to +5dB (minor)	+5 to +10dB (moderate)
3518	1	0	0	0	1	0	0
3519	2	0	0	0	2	0	0

Table 11.34: Numbers of dwellings experiencing noise changes for DM Opening Year vs DS Design Year

nIA by ID number	Total number of dwellings	Noise level decrease			Noise level increase		
		-10 to -5dB (moderate)	-5 to -3dB (minor)	-3 to 0dB (negligible)	0 to +3dB (negligible)	+3 to +5dB (minor)	+5 to +10dB (moderate)
3518	1	1	0	0	0	0	0
3519	2	0	2	0	0	0	0

Affected routes

11.10.56 An affected route while within the study area is outside the calculation area and uses the basic noise level (BNL). In this context the BNL is the CRTN calculated noise level at a reference distance of 10 metres from the nearside carriageway edge obtained from the traffic flow, speed of the traffic, composition of the traffic (percentage of heavy goods vehicles), gradient of the road, and the road surface. HD213/11 indicates that the BNL and number of receptors for affected routes should be reported. Table 11.36 shows that there is 1 receptor on an unnamed road which is due to a decrease in flow from Do Minimum to Do Something in both the Baseline Year (Opening Year) and Design Year, and 14 receptors on the A359 Cary Road which is due to speed band change between DMOY and all other scenarios. These receptors are within 50 metres of the centre line of each of the affected routes that adjoin the calculation area. All receptors are residential; there are no non-residential receptors on the affected roads.

Table 11.36: Affected road network

Road	DMOY	DSOY	DMDY	DSDY	Number of residential receptors
Unnamed road between Bridgehampton Road and Lambrook Lane	56.6	54.8	59.8	57.6	1
A359 Cary Road	70.8	66.9	67.0	67.6	14

LOAEL and SOAEL

11.10.57 Table 11.37 shows the number of residential receptors exposed to noise above the SOAEL, between the LOAEL and the SOAEL and below the LOAEL for the baseline year for both the daytime and the night-time and for both the Do-Minimum and Do-Something scenarios. The difference column shows the short-term change in the number of dwellings exposed to these adverse effect levels.

Table 11.37: Short-term adverse effect level summary

Noise level	Number of dwellings in day-time			Number of dwellings at night		
	DM 2023	DS 2023	Difference	DM 2023	DS 2023	Difference
Above SOAEL	26	30	4	42	43	1
Between LOAEL and SOAEL	218	179	-39	327	357	30
Below LOAEL	285	320	35	160	129	-31

11.10.58 In the short-term daytime, the scheme would increase the total number of receptors exposed to noise levels above the SOAEL by 4 and would increase the total number of receptors exposed to noise that is below the LOAEL by 35. At night, the scheme would increase the total number of receptors exposed to noise levels above the SOAEL by 1 and would decrease the total number of receptors exposed to noise below the LOAEL by 31.

11.10.59 Table 11.38 shows the number of residential receptors exposed to noise above the SOAEL, between the LOAEL and the SOAEL and below the LOAEL for the future assessment year for both the daytime and the night-time and for both the Do-Minimum and Do-Something scenarios. The difference column shows the long-term change in the number of dwellings exposed to these adverse effect levels.

Table 11.38: Long-term adverse effect level summary

Noise level	Number of dwellings in day-time			Number of dwellings at night		
	DM 2023	DS 2038	Difference	DM 2023	DS 2038	Difference
Above SOAEL	26	35	9	42	56	14
Between LOAEL and SOAEL	218	180	-38	327	398	71
Below LOAEL	285	314	29	160	75	-85

11.10.60 In the long-term, during the daytime, the scheme would increase the total number of receptors exposed to noise levels above the SOAEL by 9 and would increase the total number of receptors exposed to noise that is below the LOAEL by 29. At night, the scheme would increase the total number of receptors exposed to noise levels above the SOAEL by 14 and would decrease the total number of receptors exposed to noise below the LOAEL by 85.

Operational noise significance

11.10.61 Paragraph 11.4.36 set out criteria for receptors that are potentially subject to significant operational noise effects. Of the 30 receptors identified in Table 11.37 as being above SOAEL, in the opening year, 23 receptors will be subject to non-negligible impact in the daytime or night-time. These are all on Sparkford Road, High Street and Hanyton Close, Sparkford and all are subject to noise from the existing A303 and local roads. The maximum noise increase in the opening year for receptors exposed to noise above SOAEL is 1.3dB and the modal increase for receptors exposed to noise above SOAEL is 1.0dB. These increases are towards the bottom end of the minor increase classification band (1.0 to 2.9dB). For all 23 receptors the noise increase in the long-term is classified as negligible and there are no major changes in acoustic character. Therefore, the noise impact for these 23 receptors is considered to be not significant.

11.10.62 There are 11 receptors subject to moderate or major noise increases in the opening year as shown in Table 11.29. Additional information about each of these is given in Table 11.39, showing the short-term impact magnitude in the daytime and at night as both a level change and HD 213/11 classification. The table also shows the daytime Do Something level ($L_{Aeq,16h}$ façade) and how this level compares with LOAEL (50dB free-field, and shown as positive if LOAEL is exceeded), whether the noise effect is considered significant and a justification for this, taking all factors into account. The table shows impact classifications as min for minor, mod for moderate and maj for major.

11.10.63 In all cases the noise level change is primarily due to the alignment change of the A303 together with changes in road speed and traffic volume on the A303. Therefore, no change in the acoustic context is expected.

11.10.64 In all cases except The Spinney, the noise impact classification in the long-term is minor (3 to 4.9dB). The noise impact classification for The Spinney in the long-term is classified as moderate as the noise increase is 7.5dB in the daytime and 6.9dB at night.

Table 11.39: Professional judgement of potentially significant adverse effects

Receptor	Impact Day [dB]	Impact Night [dB	DS level [dB]	LOAEL exceedance [dB]	Justification for significance conclusion	Significant
2 Steart Hill, West Camel, Yeovil, BA22 7RF	3.6 mod	3.4 mod	51.1	-1.4	Lower end of moderate band for day and night and level is below LOAEL	No
4 Steart Hill, West Camel, Yeovil, BA22 7RF	3.2 mod	2.9 min	49.6	-2.9	Lower end of moderate band daytime and in minor band at night. Level is below LOAEL	No
5 Steart Hill, West Camel, Yeovil, BA22 7RF	3.4 mod	3.2 mod	49.9	-2.6	Lower end of moderate band for day and night and level is below LOAEL	No
6 Steart Hill, West Camel, Yeovil, BA22 7RF	3.4 mod	3.2 mod	49.2	-3.3	Lower end of moderate band for day and night and level is below LOAEL	No
Annis Hill Farm, Downhead Road, West Camel, Yeovil, BA22 7RG	3.0 mod	2.8 min	55.6	3.1	Level is above LOAEL even though daytime impact is only just within the moderate band and night-time impact is minor	Yes
Glebe Farm, Downhead Road, West Camel, Yeovil, BA22 7RG	3.6 mod	3.3 mod	50.7	-1.8	Lower end of moderate band for day and night and level is below LOAEL	No
Hendersons Cottage, Downhead Road, West Camel, Yeovil, BA22 7RG	3.4 mod	3.2 mod	50.4	-2.1	Lower end of moderate band for day and night and level is below LOAEL	No
Parsons Steeple, Steart Hill, West Camel, Yeovil, BA22 7RF	3.0 mod	2.8 min	47.6	-4.9	Level is almost 5dB below LOAEL and daytime impact only just within the moderate band and night-time impact is minor	No
Steeple Cottage, Steart Hill, West Camel, Yeovil, BA22 7RF	3.3 mod	3.0 mod	48.7	-3.8	Lower end of moderate band for day and night only just within moderate bandl. Level is below LOAEL	No
The Spinney, Plowage Lane, West Camel, Yeovil, BA22 7RH	6.6 maj	6.0 maj	60.6	8.1	Major impact day and night and level is above LOAEL	Yes
Upover, Downhead	3.1 mod	2.9 min	50.8	-3.7	Lower end of moderate band daytime and in minor	No

Receptor	Impact Day [dB]	Impact Night [dB	DS level [dB]	LOAEL exceedance [dB]	Justification for significance conclusion	Significant
Road, West Camel, Yeovil, BA22 7RG					band at night. Level is below LOAEL	

11.10.65 Table 11.38 shows that with the exception of The Spinney and Annis Hill Farm, the impact at all receptors is considered to be not significant. In all cases but The Spinney and Annis Hill Farm, the daytime level with the scheme in the opening year is below LOAEL. The A303 may be heard but is not expected to cause any change in behaviour or attitude and no quality of life reduction is expected.

11.10.66 The noise level at Annis Hill Farm is 3.1dB above LOAEL in the opening year of the scheme in the daytime and 6.9dB above LOAEL at night. When combined with a short-term increase of 3.0dB in the daytime, this is considered to be significant even though the increase at night is 2.8dB and therefore in the minor classification band. Two noise bunds, each 2 metres high would be provided where the B3151 joins the A303 near Hawk House. The bunds would follow the alignment of the A303 on the north side of the carriageway for approximately 380 metres. Compensation in the form of secondary glazing and acoustic trickle vents will be offered to ensure these increases can be offset.

11.10.67 The noise level at The Spinney is 8.1dB above LOAEL in the opening year of the scheme in the daytime and 11.5dB above LOAEL at night. When combined with an increase in the short-term of 6.6dB in the daytime and 6.0dB at night, this is considered to be significant. The scheme incorporates a 2 metre high acoustic barrier, approximately 150 metres long located to the north of the scheme. Compensation in the form of secondary glazing and acoustic trickle vents will be offered to ensure these increases can be offset.

11.10.68 Figure 11.5 below shows the location of the two significantly-affected receptors.

Figure 11.5. Significantly-affected receptors

Source: Contains Ordnance Survey data © Crown copyright and database right 2014

11.11 Monitoring

11.11.1 Whilst the operational noise assessment has identified 2 significant adverse effects, both of these receptors will be offered compensation in the form of secondary glazing to offset adverse effects. No other significant effects for the operational scheme have been identified. As a result, no additional monitoring is required.

11.12 Conclusions

11.12.1 This assessment has considered the temporary and permanent noise and vibration impacts using standard methodologies and assessment criteria and is informed by NPPF and NPSE.

11.12.2 The assessment of construction noise shows:

- Linear road works would produce potentially significant adverse effects at 10 receptors if the works in the vicinity of the receptor extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Mitigation measures described in paragraph 11.9.6 must be employed to eliminate significant effects.

- Overbridge and underbridge construction would not produce significant adverse effects as there are no nearby sensitive receptors.
- Temporary haul routes would not produce significant adverse effects.
- Construction of site compounds have the potential to produce significant adverse effects at 3 receptors if they extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months. Mitigation measures described in paragraph 11.9.6 must be employed to eliminate significant effects.
- Operation of site compounds would not produce significant adverse effects in the daytime or night time.

11.12.3 The assessment of construction vibration shows:

- Piling would produce a significant adverse effect at 1 receptor if the piling occurring within 81 metres of the receptor exceeds a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.
- Other construction activity would not produce significant adverse effects.

11.12.4 With the construction works duration limits as set out above, no significant adverse effects will arise due to construction noise or vibration and the scheme therefore meets the aims of NPSE and NPPF.

11.12.5 The Contractor will be required to approach South Somerset District Council prior to construction works commencing in order to obtain approval through the Section 61 process. During this process any assumptions used in calculating construction impacts in this assessment will be refined and mitigation identified that will ensure there will be no residual significant impacts.

11.12.6 The operational noise assessment shows that:

- There are 2 significant adverse effects that have been identified. Additional compensation in the form of secondary glazing must be offered to the owners of these properties.
- All other receptors may be subject to minor or moderate increases in the short-term and minor increases in the long-term but none of these are considered to be significant due to a combination of the magnitude of the increase, the noise level with the scheme and because little change is expected in the acoustic character of the area.

- With the compensation in the form of secondary glazing at The Spinney and Annis Hill Farm, the scheme will meet the operational noise aims of the NPSE and NPPF.

11.12.7 The evidence provided in the ES supports the accordance statement provided in the ***Case for the Scheme* (*document reference TR010036/APP/7.1*)**.