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None

12 Noise and Vibration

12.1 Introduction

12.1.1 This chapter presents the Preliminary Environmental Information in relation to the noise and vibration assessment which follows the *Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration* (Highways England, 2020)1. It details the methodology followed for the assessment and summarises the regulatory and policy framework related to noise and vibration. Following this, the design, mitigation and preliminary significant effects of the project are discussed, along with the limitations of the assessment.

12.1.2 There are interrelationships between the potential effects of noise and other disciplines. Therefore, please refer to the following chapters:

- Chapter 6: Biodiversity
- Chapter 8: Cultural Heritage
- Chapter 10: Landscape and Visual Effects
- Chapter 13: Population and Human Health.

12.1.3 The preliminary assessment has been undertaken to:

- Identify potential noise sensitive receptors (residential and non-residential)
- Identify potential significant effects during the construction and operational phases
- Identify receptors potentially experiencing a significant effect where mitigation may be required to reduce the potential effects of noise change.

12.2 Policy Framework

National policy statement for national networks

12.2.1 The primary policy basis for deciding whether or not to grant a Development Consent Order (DCO) is the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[2], which sets out policies to guide how DCO applications will be decided and how the effects of national networks infrastructure should be considered by the relevant decision maker. The policies for the assessment of noise and vibration include statements that:

12.2.2 *"*Excessive noise can have wide-ranging impacts on the quality of human life and health (e.g. owing to annoyance or sleep disturbance), use and enjoyment of areas of value (such as quiet places) and areas with high landscape quality. The Government's policy is set out in the Noise Policy Statement for England. It promotes good health and good quality of life through effective noise management. Similar considerations apply to vibration, which can also cause damage to buildings…Noise resulting from a proposed development can also have adverse impacts on wildlife and biodiversity." (*NPSNN* paragraphs 5.186 and 5.187)

12.2.3 The *NPSNN* also advises:

[1] Highways England (2020) Design Manual Roads Bridge LA 111 Noise and Vibration, available at: https://www.standardsforhighways.co.uk/prod/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364?inline=true [accessed 21 December 2020]
[2] Department for Transport (2014) National Policy Statement for National Networks, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf [accessed 6 September 2021]

"In determining an application, the Secretary of State should consider whether requirements are needed which specify that the mitigation measures put forward by the applicant are put in place to ensure that the noise levels from the project do not exceed those described in the assessment or any other estimates on which the decision was based." (*NPSNN* paragraph 5.196)

12.2.4 Table 12-1: Relevant *NPSNN* policies for the noise and vibration assessment methodology for the noise and vibration assessment methodology, identifies the *NPSNN* policies relevant to the cultural heritage assessment methodology.

Table 12-1: Relevant NPSNN policies for the noise and vibration assessment methodology

Relevant NPSNN paragraph reference	Requirement of the NPSNN (paraphrase)
5.188	Factors that will determine the likely noise impact include: • Construction noise and the inherent operational noise from the proposed development and its characteristics; • The proximity of the proposed development to noise sensitive premises (including residential properties, schools and hospitals) and noise sensitive areas (including certain parks and open spaces); • The proximity of the proposed development to quiet places and other areas that are particularly valued for their tranquillity, acoustic environment or landscape quality such as National Parks, the Broads or Areas of Outstanding Natural Beauty; and • The proximity of the proposed development to designated sites where noise may have an adverse impact on the special features of interest, protected species or other wildlife.
5.189	Where significant noise impacts are likely to arise from the proposed development, the following should be considered: • Identification of noise sensitive premises and areas • Characteristics of the existing noise environment • Predicted noise change in the short-term and long-term, including day and night • Mitigation options to reduce effects of noise
5.190	The potential noise impact elsewhere that is directly associated with the development, such as changes in road movements elsewhere on the national networks, should be considered as appropriate.
5.191	When assessing operational and construction noise, reference should be made to any relevant British Standards and other guidance.
5.192	The applicant should consult Natural England with regard to assessment of noise on designated nature conservation sites, protected landscapes, protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account.

Relevant NPSNN paragraph reference	Requirement of the NPSNN (paraphrase)
5.193	The development should consider and demonstrate methods for minimising noise wherever possible to mitigate and minimise impacts to receptors. This should include potential noise impacts within the scheme and on the wider network.
5.200	Consideration of Noise Important Areas.

National planning policy framework (NPPF)

12.2.5 The *NPPF* (Ministry of Housing, Communities & Local Government (2021)[3] originally published in March 2012 and most recently updated in July 2021, sets out the government's planning policies for England and provides a framework within which locally prepared plans can be produced. The *NPPF* is *"an important and relevant matter to be considered in decision making for NSIP".*

Local planning policy

12.2.6 The following local planning policies are relevant to the assessment:

- *Cumbria County Council Development Plan* (Cumbria County Council, 2017)[4] Policy DC3
- *Eden District Council Local Plan, 2014-2028* (Eden District County Council, 2018)[5] Policy ENV6 and ENV9
- *County Durham Plan* (Durham County Council, 2019)[6] Policy BENV4, BENV13, GD1 and SC8
- *Richmondshire Local Plan 2012-2028 Core Strategy* (Richmondshire District Council, 2014)[7] Policy CP4

Standards and guidance

12.2.7 In addition to compliance with the *NPSNN* and *NPPF*, this assessment has been compiled in accordance with professional standards and guidance. The standards and guidance which relate to the assessment are:

[3] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf [accessed 19 July 2021]
[4] Cumbria County Council (2017) Cumbria Minerals and Waste Local Plan 2015-2040, available at: https://cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/4298491253.PDF [accessed 21 December 2020]
[5] Eden District County Council (2018) Eden Local Plan 2014-3032, available at: https://www.eden.gov.uk/media/5032/edenlocalplan2014-2032finalwithoutforeword.pdf [accessed 21 December 2020]
[6] County Durham Plan (2019) Durham County Council, available at: https://www.durham.gov.uk/media/34069/County-Durham-Plan-adopted-2020-/pdf/CountyDurhamPlanAdopted2020vDec2020.pdf?m=637424969331400000 [accessed 21 December 2020]
[7] Richmondshire District Council (2014) Local Plan, available at: https://www.richmondshire.gov.uk/media/9616/core-strategy-2012-28.pdf [accessed 21 December 2020]

- *Noise Policy Statement for England (NPSE)* (Department for Environment, Food and Rural Affairs, 2010)[8]
- National Application Annex to *DMRB LA 111*.

12.3 Assessment Methodology

Construction

Construction noise

12.3.1 For the PEI Report, due to the level of information available, a high-level, qualitative appraisal has been completed. For the ES, construction noise will be predicted and assessed quantitatively in accordance with *DMRB LA 111* which draws upon the guidance in BS 5228- 1:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites. Noise' (BS 5228-1)* (British Standard, 2014a)[9]. *BS 5228-1* provides guidance on predicting and measuring construction noise and assessing its impact on the environment.

12.3.2 When assessing the temporary effects of construction noise, the sensitivity of receptors depends on the existing noise levels in the study area. Noise from construction works is expected to be more intrusive in a relatively quiet area with low background noise levels compared to a noisy area with already high background noise levels and where construction noise would not be as easily perceived.

12.3.3 Table 12-2: Construction time period – LOAEL and SOAEL **Error! Reference source not found.** is based on Table 3.12 in DMRB LA 111, which presents the threshold levels based on the ABC method for evaluating the potential significant effects of construction noise based on the existing noise level. The ABC method involves the comparison of the existing, pre-construction ambient noise level with noise level arising from construction works on site alone.

12.3.4 The calculations of construction noise levels will include the following sources:

- Construction plant
- Construction compounds
- Traffic on haul roads

12.3.5 Impacts from construction traffic using the public highway will be assessed separately in the ES.

12.3.6 LOAEL and SOAEL for the assessment, in line with National Policy, were established in accordance with Table 12-2: Construction time period – LOAEL and SOAEL for all noise sensitive receptors .

Table 12-2: Construction time period – LOAEL and SOAEL

Time period	LOAEL	SOAEL
Daytime weekday (07:00-19:00); and Saturdays (07:00-13:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1

[8] Department for Environment, Food and Rural Affairs (2010) Noise Policy Statement for England Explanatory Note, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf [accessed 21 December 2020]

[9] British Standard (2014a) Code of practice for noise and vibration control on construction and open sites. Noise

Evening's weekday (19:00-23:00); Saturdays (13:00-23:00); and Sundays (07:00-23:00)	Baseline noise levels $L_{Aeq, T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1
Night-time (23:00-07:00)	Baseline noise levels $L_{Aeq, T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1

12.3.7 The magnitude of impact of construction noise excluding construction traffic on the public highway is determined using Table 12-3 Construction noise impact magnitudes.

Table 12-3 Construction noise impact magnitudes

Magnitude of impact	Construction noise level
Major	Above or equal to SOAEL +5dB
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

12.3.8 The magnitude of impact from noise of construction traffic on the public highway is determined using Table 12-4: Construction Basic Noise Level (BNL) impact magnitudesTable 12-4. The Basic Noise Level (BNL) is calculated using the principles defined in the *Calculation of Road Traffic Noise (CRTN) 1988 (Department for Transport, 1988)*[10], as required by *DMRB LA 111* and *NPSNN*.

Table 12-4: Construction Basic Noise Level (BNL) impact magnitudes

Magnitude of impact	Increase in BNL of closest public road used for construction traffic (dB)
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

12.3.9 As defined in *DMRB LA 111*, for diversion routes used at night, a major magnitude of impact for construction noise is determined to be the case at any noise sensitive receptor within the diversion route study area.

12.3.10 Construction noise and construction traffic noise is considered a significant effect when it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights; or
- A total number of days exceeding 40 in any six consecutive months.

Construction vibration

12.3.11 Construction vibration will be predicted and assessed in accordance with *DMRB LA 111*, which draws upon the guidance in BS 5228-2:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Vibration' (BS 5228-2)* (British Standard, 2014b)[11] which provides guidance on predicting and measuring

[10] Department for Transport (1988) Calculation of Road Traffic Noise
[11] British Standard (2014b) Code of practice for noise and vibration control on construction and open sites. Vibration

construction vibration and assessing its impact on the environment.

12.3.12 The magnitude of impact at sensitive receptors will be determined in accordance with the threshold summaries in Table 12-5: Construction vibration impact magnitude.

Table 12-5: Construction vibration impact magnitude

Magnitude of impact	Construction vibration level
Major	Above or equal to 10 mm/s Peak Particle Velocity (PPV)
Moderate	Above or equal to SOAEL and below 10 mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

12.3.13 The LOAEL and SOAEL for construction vibration in terms of PPV are established in accordance with Table 12-6: Construction vibration LOAEL and SOAEL.

Table 12-6: Construction vibration LOAEL and SOAEL

Time period	LOAEL	SOAEL
All time periods	0.3 mm/s PPV	1.0 mm/s PPV

12.3.14 Construction vibration is considered a significant effect when it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights; or
- A total number of days exceeding 40 in any six consecutive months.

Operation

Noise model

12.3.15 For the prediction of road traffic noise, *DMRB LA 111 and NPSNN* suggests the use of the methodology described in the technical memorandum *Calculation of Road Traffic Noise (CRTN) 1988*.

12.3.16 The proprietary software, NoiseMap 5 Server Edition, was used to predict traffic noise levels for the opening year (2031) and future year (2046), for both the existing layout (Do-minimum) and project layout (Do-something) as presented for statutory consultation, including alternative alignments. The parameters used in the model are set out in Table 12-7: Modelling parameters.

12.3.17 Noise monitoring will also be used to inform the Project's understanding of the baseline for ES stage.

Table 12-7: Modelling parameters

Parameter	Source	Details
Calculation method	*CRTN* method, as modified by Appendix A *DMRB LA 111*	BNL Calculations CRTN Modifications Speed pivoting process
Calculation engine	NoiseMap 5 Server Edition	CRTN package
Horizontal distances (horizontal alignment)	Engineering team	Civil engineering drawings for each scheme provided by the engineering team

Parameter	Source	Details
Engineering civils (vertical alignment)	Engineering team	Civil engineering drawings for each scheme provided by engineering team
Ground levels (Digital Terrain Model)	OS Mastermap topography	Digital Terrain Model
Building heights	Ordnance Survey (OS)	Provided as part of OS Mastermap dataset
Addresses	AddressBase Premium	Version received in September 2020
Receptor position	Noise model	For receptors with an associated building: 1m from facade and height depending on building height. For outdoor receptors: 1.5m above ground
Absorbent ground	Ordnance Survey (OS)	Soft ground except for areas of hard ground e.g. water, car parks
Road surface type	Engineering team	Highways England roads assumed to have low noise surface. Non-Highways England roads assumed to be hot rolled asphalt. Noise level corrections applied as per DMRB.
Traffic data	Transport planners	Opening year: 2031 Future year: 2046

12.3.18 The purpose of this preliminary assessment is to assess road traffic noise in relation to sensitive properties including dwellings and community facilities. Consideration of noise sensitive non-residential receptors, as described in *DMRB LA 111* is also given as part of the noise assessment including educational establishments, hospitals, places of worship and public rights of way.

12.3.19 The traffic data utilised for the purposes of the PEIR comprises 18-hour annual average weekday traffic (AAWT, 18h) flows for 2031 and 2046, traffic speed, pivoted speed and percentage heavy good vehicles (HGVs).

Assessment scenarios

12.3.20 The assessment considers noise levels with the project (Do-Something) and without the project (Do-minimum) in an opening year (short-term) and a future year (long-term).

12.3.21 The assessment scenarios are defined as:

- Do-minimum – opening year (2031) and future year (2046) plus committed development flows using the existing road layout.
- Do-something - opening year (2031) and future year (2046) plus committed development flows using the project layout as presented for statutory consultation, including alternative alignments.

12.3.22 The traffic model which informs this noise assessment incorporates traffic flows from committed developments.

12.3.23 The inconsistency between the traffic modelling opening year (2031) and the opening year that is used throughout the PEI Report (2029) is due to changes in the original construction programme. This is recognised in the limitations set out in Section 12.4. Both the traffic and noise modelling will be revised, and the final assessment presented in the ES will use an opening year of 2029. Overall, the difference in

effects is considered unlikely to be significant, however this will be reviewed at the ES stage for an assessment opening year of 2029.

12.3.24 During the assessment the following comparisons were made between scenarios in the project opening year and the future year to determine the impact of the project in the short-term and the long-term:

- Do-minimum scenario in the opening year against Do-something scenario in the opening year (short-term Do-something).
- Do-minimum scenario in the opening year against Do-something scenario in the future assessment year (long-term Do-something).

12.3.25 The *DMRB LA 111* methodology requires that night-time noise is also assessed. The $L_{night,outside}$ descriptor is used to represent the noise level at dwellings between the hours of 23:00 and 07:00 as a free-field level. For noise impacts, comparison in the short-term and long-term are considered. Night-time noise levels have been derived using the Transport Research Laboratory (TRL) report '*Converting the UK traffic noise level $L_{A10,18h}$ to EU noise indices for noise mapping'* (Transport Research Laboratory, 2002)[12].

Noise assessment

12.3.26 Noise level change may be determined through the calculation of noise levels at each individual noise sensitive receptor. Where the noise sensitive receptor is a building, the façade used to calculate noise change is chosen as:

- the façade with the greatest magnitude of noise change.
- where the greatest magnitude of noise change is equal on more than one façade, the façade experiencing the greatest magnitude of noise change and highest Do-something noise level.

12.3.27 Regarding absolute noise levels, the effect level categories adopted in *DMRB LA 111* for the daytime and night-time LOAEL and SOAEL are set out for all noise sensitive receptors in Table 12-8: Operational noise LOAELs and SOAELs. The SOAEL and LOAEL defined within *DMRB LA 111* are considered to be appropriate given that the receptors are located near to a road and are already exposed to road traffic noise.

Table 12-8: Operational noise LOAELs and SOAELs

Time Period	LOAEL	SOAEL
Day (06:00 – 24:00)	55dB $L_{A10,18hr}$ (façade) 50dB $L_{Aeq,16hr}$ (free-field)	68dB $L_{A10,18hr}$ (façade) 63dB $L_{Aeq,16hr}$ (free-field)
Night (00:00 – 06:00)	40dB L_{night}, outside (free-field)	55dB L_{night}, outside (free-field)

12.3.28 The magnitude of change caused by the short-term and long-term change in noise levels attributable to the project is evaluated in accordance with Table 12-9: Operational magnitude of change.

Table 12-9: Operational magnitude of change

Magnitude	Short term noise change (dB $L_{A10,18h}$ or L_{night})	Long-term noise change (dB $L_{A10,18h}$ or L_{night})
Major	Greater than or equal to 5.0	Greater than or equal to 10.0
Moderate	3.0 to 4.9	5.0 to 9.9

[12] Transport Research Laboratory (2002) Converting the UK traffic noise level $L_{A10,18h}$ to EU noise indices for noise mapping

Minor	1.0 to 2.9	3.0 to 4.9
Negligible	Less than 1.0	Less than 3.0

12.3.29 The initial assessment of likely significant effects at noise sensitive buildings is defined according to Table 12-10: Operational significance of change.

Table 12-10: Operational significance of change

Significance	Short term magnitude of change
Significant	Major
Significant	Moderate
Not significant	Minor
Not significant	Negligible

12.3.30 Where the magnitude of change in the short-term is negligible, it can be concluded that the operational noise arising from the project will not give rise to a likely significant effect.

12.3.31 For noise sensitive receptors where the magnitude of change in the short-term is minor, moderate or major, Table 12-11: Determining final operational significance on noise sensitive buildings (from *DMRB LA 111*) will be used together with the output of Table 12-8: Operational noise LOAELs and SOAELs to determine final significance. Where the magnitude of change is minor or above in the short-term, other factors including absolute noise level, differing magnitude of change in the long-term, location of receptor, acoustic context and local attitude are then considered to determine the final operational significance.

Table 12-11: Determining final operational significance on noise sensitive buildings (from *DMRB LA 111*)

Local circumstance	Influence on significance judgement
Noise level change (is the magnitude of change close to the minor/moderate boundary?)	1) Noise level changes within 1dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significance effect. Noise level changes within 1dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
Differing magnitude of impact in the long term and/or future year to magnitude of impact in the short term	1) Where the long-term impact is predicted to be greater than the short-term impact, it can be appropriate to conclude that a minor change in the short-term is a likely significant effect. Where the long-term impact is predicted to be less than the short-term it can be appropriate to conclude that a moderate or major change in the short term is not significant. 2) A similar change in the long-term and non-project noise change can indicate that the change is not due to the project and not an indication of a likely significant effect.
Absolute noise level with reference to LOAEL and SOAEL (by design this includes sensitivity of receptor)	1) A noise change where all Do-something absolute noise levels are below SOAEL requires no modification of the initial assessment. 2) Where any Do-something absolute noise levels are above the SOAEL, a noise change in the short-term of 1dB or over results in a likely significant effect.
Location of noise sensitive parts of a receptor	1) If the sensitive parts of a receptor are protected from the noise source, it can be appropriate to conclude a moderate or major

Local circumstance	Influence on significance judgement
	magnitude change in the short-term and/or long-term is not a likely significant effect. 2) An example of this would be where no windows of sensitive rooms face the road, and outdoor spaces are protected from the road by buildings. 3) Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to conclude a minor change in the short-term and/or long-term is a likely significant effect. 4) An example of this would be when a house has many windows of sensitive rooms and outdoor spaces facing the road. 5) It will only be necessary to look in detail at individual receptors in terms of this circumstance where the decision on whether the noise change gives rise to a significant environmental effect is marginal.
Acoustic context	1) If a project changes the acoustic character of an area, it can be appropriate to conclude a minor magnitude of change in the short-term and/or long-term is a likely significant effect.
Likely perception of change by residents	1) If the project results in obvious changes to the landscape or setting or a receptor, it is likely that noise level change will be more acutely perceived by the noise sensitive receptors. In these cases, it can be appropriate to conclude that a minor change in the short-term and/or long-term is a likely significant effect. 2) Conversely, if the project results in no obvious changes for the landscape, particularly if the road is not visible from the receptor, it can be appropriate to conclude that a moderate change in the short-term and/or long-term is not a likely significant effect.

12.3.32 The assessment is based on a design including embedded mitigation (eg low-noise surface, alignment, landscaping bunds, cutting), but excluding essential mitigation (eg barriers, higher-performing or additional low-noise surfacing); therefore, the assessment represents a worst-case scenario. Any necessity for mitigation will be identified following the *DMRB LA 111* assessment for both construction and operational phases at ES stage.

12.3.33 The feasibility of proposed noise mitigation measures will be established through an appraisal process which will take into account engineering and environmental constraints, as well as a cost-benefit assessment which considers the degree of attenuation, cost of the mitigation measure and any other potential impacts arising from additional mitigation.

12.4 Assessment Assumptions and Limitations

12.4.1 At the time of writing there is limited information relating to the methodology to be used during construction of the project. Information relating to construction methods was taken from Chapter 2: The Project. Using this information and professional judgement, assumptions were made for typical road construction methods as reported in *BS 5228-1*. Detailed construction information will be available to inform a quantitative assessment within the final ES.

12.4.2 The proprietary software NoiseMap 5 was used to calculate the results for all residential properties within the relevant study areas.

12.4.3 As discussed in paragraph 12.3.23, the modelled traffic data uses an opening year (2031), however, the results in this PEI Report are based on 2029. This is due to changes in the original construction programme. Therefore, both the traffic and noise modelling will be revised and the final assessment presented in the ES will use an opening year of 2029. It is not anticipated that this would impact the conclusions of this assessment.

12.4.4 A 50mph speed limit will be implemented at Kemplay Bank Roundabout through to Junction 40 of the M6. Updated traffic modelling utilising this new (reduced) speed limit is underway, however the data is not yet available, so it has not been assigned to the modelled traffic data used in this PEI Report. The results shown for this scheme are considered to represent a worst-case scenario and so it is unlikely that the reduced speed would alter the number of significant effects identified. The updated traffic information it will be adopted within the final ES.

12.4.5 It is assumed that the principal A roads and motorways have a low noise surface for both the do-minimum and do-something scenario. All other roads are assumed to be hot rolled asphalt. More detail on road surfacing will be included in the noise model accompanying the ES.

12.5 Study Area

12.5.1 *DMRB LA 111* guidance states that a construction study area of 300m from the closest construction activity with potential to generate noise is normally sufficient to encompass noise sensitive receptors. Similarly, a study area of 100m from the closest construction activities with potential to generate vibration is normally sufficient to encompass vibration sensitive receptors.

12.5.2 At this stage a construction study area has not been defined, due to specific information relating to the construction processes being unknown. When this information is confirmed, the construction study area will follow the *DMRB LA 111* guidance. At this stage, receptors within 300m of the draft DCO boundary have been considered.

12.5.3 Similar to the construction study area, a diversion route study area has not been defined at this stage. However, when details of the diversion route are known, the diversion route study area will be defined as 25m from the kerb line of all diversion routes.

12.5.4 The operational study area is defined as the area within 600m of the centrelines of the new, bypassed or altered roads and 50m of the centrelines of other road links with potential to experience a short-term BNL change of more than 1dB(A) as a result of the project. Based on the results of noise-modelling to date and the subsequently identified locations of likely significant effects, it is anticipated that a study area of 600m will capture all likely significant effects. Where the study area can be refined, this will be done for the ES.

12.5.5 The study areas for this assessment are shown in Figure 12.1: Evolved PRA Study Area, Figure 12.5: Temple Sowerby to Appleby - Evolved PRA Noise levels - Do-minimum opening year, Figure 12.12: Appleby to Brough - Evolved PRA noise levels - Do-minimum opening year, and Figure 12.21: Cross Lanes to Rokeby - Evolved PRA noise levels - Do-minimum opening year and are defined as described in paragraph 12.5.4 covering areas between Penrith and Scotch Corner.

12.6 Baseline Conditions

12.6.1 A desk-based review of the surrounding area along the existing route corridor, the draft DCO boundary for the project and the alternative alignments, has been undertaken. The acoustic environment is primarily characterised by road traffic noise throughout the project study area. Additional noise sources include occasional aeroplane noise near to Warcop and trains passing by.

12.6.2 In addition to residential buildings, there are many other sensitive receptor types within relatively close proximity of the existing A66, such as the North Pennines AONB (refer to Chapter 10: Landscape and Visual Effects), North Pennine Moors Special Protection Area and Special Area of Conservation (SAC), the River Eden SAC (refer to Chapter 6: Biodiversity), several Scheduled Monuments (refer to Chapter 8: Cultural Heritage), public rights of way (PRoW), community facilities and schools (refer to Chapter 13: Population and Human Health). These receptors have been considered in line with *DMRB LA 111*.

Route wide

12.6.3 Within the route corridor the main settlement areas are: Penrith, Temple Sowerby, Kirkby Thore, Crackenthorpe, Appleby-in-Westmorland, Warcop, Brough, Bowes, Barnard Castle, West Layton, Scotch Corner and Middleton Tyas.

12.6.4 Noise Important Areas (NIA) are locations in England where the top 1% of the population that are affected by the highest noise levels are located, according to the results of the strategic noise mapping undertaken by Defra, under the terms of the Environmental Noise (England) Regulations 2006. NIAs will be assessed as sensitive receptors or groups of receptors in their own right in the ES.

12.6.5 The following NIAs have been identified adjacent to the existing route corridor which are the responsibility of Highways England (Defra, 2019b) (see Figure 12.1: Evolved PRA Study Area):

- Defra Important Area, 10283, Highways England
- Defra Important Area, 10284, Highways England
- Defra Important Area, 10285, Highways England
- Defra Important Area, 6763, Highways England
- Defra Important Area, 12113, Highways England
- Defra Important Area, 10128, Highways England
- Defra Important Area, 10438, Highways England
- Defra Important Area, 13930, Highways England
- Defra Important Area, 10230, Highways England
- Defra Important Area, 10437, Highways England.

12.6.6 The following NIAs have been identified which are the responsibility of Cumbria County Council:

- Defra Important Area, 10285, Cumbria County Council
- Defra Important Area, 10286, Cumbria County Council.

12.6.7 No designated areas of tranquillity are located within the study area (Campaign to Protect Rural England, 2007)[13].

12.6.8 For schemes with alternatives, the description of the baseline also accounts for 600m

[13] Campaign to Protect Rural England (2007), Tranquillity Map: England, Available at: https://www.cpre.org.uk/resources/tranquility-map-england/ [accessed 27 August 2021]

from alternative scheme boundaries.

M6 Junction 40 to Kemplay Bank

12.6.9 This scheme is located to the south of the town of Penrith within the Eden District Council. Land to the east, south and west is predominantly rural with a number of commercial and residential receptors located near the A66. The majority of receptors are located to the north within the town of Penrith. Closest residential receptors are located near to Clifford Road.

12.6.10 There are a number of main roads in the area surrounding this scheme. These include; M6, A66, A529, A686 and A6.

12.6.11 There are four Noise Important Areas (NIAs) located within 600m of this scheme NIA 10284, 10283, 10285 and 6763.

Penrith to Temple Sowerby

12.6.12 This scheme is located to the east of the town of Penrith within the Eden District Council. It extends for approximately 5km through a largely rural area. There are a number of residential, commercial and community receptors located near the A66.

12.6.13 The A66 is the main road in the vicinity of this scheme area with a number of local roads which are accessed from the A66.

12.6.14 There are no NIAs located within 600m of this scheme.

Temple Sowerby to Appleby

12.6.15 This scheme begins to the west of the Roman Road and then bypasses south of the village of Kirkby Thore within the Eden District Council. It extends for approximately 7.5km through a predominantly rural area with the exception of the village of Kirkby Thore and the village of Crackenthorpe. Appleby-in-Westmorland is located to the south east of the end of the scheme.

12.6.16 The A66 is the main road in the vicinity of this scheme area with a number of local roads which are accessed from the A66. There is also a British Gypsum site to the north of Kirkby Thore.

12.6.17 There is one NIA located within 600m of this scheme; NIA 12113.

12.6.18 Within this scheme, the baseline described in the paragraphs above includes the corridors for the following alternatives as described in Chapter 2: The Project:

- Blue Route (Evolved Preferred Route)
- Orange (Online Alternative Route)
- Red (Offline Alternative Route).

Appleby to Brough

12.6.19 The scheme is located within the Eden District Council. The area immediately surrounding this section is rural. It extends for approximately 8km. There are a number of scattered residential, commercial and community receptors located near the A66. The villages of Warcop and Brough are located within the study area.

12.6.20 There is one NIA located within 600m of this scheme; NIA 10128.

12.6.21 Within this scheme, the baseline described in the paragraphs above includes the corridors for the alternative routes. The route is broken down into three sections. Two of the sections have alternative routes (Blue in the central section and Orange in the

Eastern section), which can combine in any combination to create four alternative routes, as described in Chapter 2: The Project:

- Black-Black-Black (evolved version of the Preferred Route announced in spring 2020)
- Black-Blue-Black
- Black-Black-Orange
- Black-Blue-Orange.

Bowes Bypass

12.6.22 This scheme is located to the north of the village of Bowes in the Eden District Council. The surrounding area is predominantly rural with a number of scattered residential and community receptors. The scheme extends for approximately 3km.

12.6.23 There are no NIAs located within 600m of this scheme.

Cross Lanes to Rokeby

12.6.24 This scheme is located within the Durham County Council. The surrounding area is predominantly rural with a number of scattered residential and community receptors. The scheme extends for 3km.

12.6.25 There are no NIAs located within 600m of this scheme.

12.6.26 Within this scheme, the baseline described in the paragraphs above includes the corridors for the alternative routes. There are two junctions that have alternative location and layouts, Cross Lanes and Rokeby. Each junction has two options, which can combine in any combination, providing four alternatives, as described in Chapter 2: The Project:

- Black-Black (evolved version of the Preferred Route announced in spring 2020)
- Blue-Black (Cross Lanes alternative junction and Black evolved Preferred Route)
- Black-Red (Black evolved Preferred Route and Rokeby alternative junction)
- Blue-Red (Cross Lanes alternative junction and Rokeby alternative junction)

12.6.27 It should be noted that the Black + Black alternative (evolved PRA) was ruled out due to the effect it would have on local traffic movements (see the *Route Development Report* (Highways England, 2021)[14] for further information). The remaining three combinations were then converted into three separate route alignments and are described as such in the consultation brochure[15] and Route Development Report. The descriptions in this PEI Report have not been updated because the assessments already completed were based on the consideration of each junction alternative in isolation.

Stephen Bank to Carkin Moor

12.6.28 This scheme is located within Richmondshire Council and extends for approximately 6.5km. The area immediately surrounding this section is predominantly rural. There are a number of scattered residential and community receptors located near the A66 and also West Leyton.

[14] Highways England (2021) Route Development Report, available as part of the consultation material on http://www.highwaysengland.co.uk/A66-NTP
[15] The consultation brochure and Construction Method Statement are available as part of the statutory consultation material at http://www.highwaysengland.co.uk/A66-NTP

12.6.29 There is one NIA located within 600m of this scheme – NIA 10437.

A1(M) Junction 53 Scotch Corner

12.6.30 This scheme is located to the west of Middleton Tyas within the Richmondshire Council area. There are a number of commercial and residential community located receptors near Scotch Corner.

12.6.31 There are no NIAs located within 600m of this scheme.

12.7 Potential Impacts

Construction

12.7.1 The construction being undertaken for the project includes the widening of the original carriageway in places, with new improved underpasses or over bridges being installed. In some instances, where there are added complexities to the project alignment, a new alignment will be sought to benefit the road user and stakeholders.

12.7.2 The following information relating to the project has been based on Chapter 2; The Project, section 2.7:

- Excavation works will be required to form the desired road alignments. Therefore, haul routes will also be required to move the material and allow access to these sites.
- A number of construction compounds and site access points will be required as described in Chapter 2; however, the final size and location of these compounds will depend on site requirements.

12.7.3 A full construction programme detailing specific construction activities, phasing and duration of activities was not available at the time of this assessment as the draft Construction Method Statement (CMS)[20] had not been completed. Nor is a plant list or information relating to the location of construction activities. When this information is known, a full noise and vibration construction assessment will be undertaken within the ES, using the guidance set out in *DMRB LA 111*. Potential types of construction noise and vibration impacts, based on information available and professional judgement, are described in Section 12.9. The CMS for consultation provides an indication of how the construction might be implemented to inform consultees. It will continue to be developed and will inform the assessment presented within the ES.

Operation

12.7.4 The potential impacts associated with the project are likely due to the noise emissions associated with the new roads and changes in traffic flows in the wider road network. Operational impacts are assessed and discussed in Section 12.9.

12.8 Design, Mitigation and Enhancement Measures

Construction

12.8.1 The potential impacts of construction activities will be minimised by the use of 'best practicable means' (BPM) of noise and vibration control during all construction activities. Mitigation measures will be recommended within the final ES when the details of the construction programme are known.

12.8.2 A detailed traffic management plan will be implemented throughout the construction programme to minimise the disruption caused by the construction traffic flows, to

ensure the traffic on the A66 can be maintained; and additional interfaces will likely be implemented if night-time working is required.

12.8.3 It is recognised that the adoption of diversion routes has the potential to cause adverse impacts to nearby receptors, depending on the traffic volume and speed. The following methods could be implemented to reduce these impacts:

- A choice of diversion routes to reduce the pressure on the local road infrastructure, where practicable. Opportunities for this may be limited.
- A suitable speed limit will be applied to minimise potential adverse impacts
- Varying times of construction traffic to prevent vehicles disturbing properties at the same time each day.

Operation

12.8.4 The alignment and design of the project (horizontal and vertical) has been and will continue to be considered as part of the design factors to avoid or minimise noise impacts.

12.8.5 To ensure that any other additional mitigation is practicable and sustainable, the provision of further mitigation will be subject to the following considerations:

- Stakeholder engagement and consultation responses
- Engineering practicability
- Consideration of noise benefit compared to cost of the mitigation
- Other environmental effects potentially caused by mitigation (particularly landscape and visual effects).
- Policy compliance

12.8.6 Noise mitigation will be considered at receptors where a significant effect has been predicted, in line with the above tests. All mitigation will be considered and designed in line with achieving Aim 3 as set out in the England National Application Annex to *DMRB LA 111* which states that the scheme should contribute to improvement to health and quality of life through the effective management and control of noise, where possible.

12.8.7 Mitigation of operational road traffic noise may include (but not be limited to) screening (i.e. noise barriers and/or earth bunds) or higher-performing or additional low-noise surfacing or a combination of these. Examples of design and mitigation techniques that may influence noise and vibration impacts are described below:

- Environmental barriers. These can be in the form of earth mounding or acoustic fencing of various types, or a combination of the two. Environmental barriers are not effective in reducing groundborne vibration and may be only partially effective against airborne vibration. The use of reflective and absorptive barriers could also be considered.
- Low-noise surfaces. The principal benefit of low-noise surfaces is the reduction in mid and higher frequency noise generated by tyres at speeds in excess of 75km/h. They are less effective in reducing noise at low speeds where engine noise, particularly from heavy vehicles is more dominant and may not be viable for some sections of the route such as those at higher altitudes due to the impact on durability of climatic/meteorological conditions.

12.8.8 Some potential barrier locations have been identified and included in the map book available on http://www.highwaysengland.co.uk/A66-NTP. This drawing is for indicative purposes only and barrier locations are not exhaustive and have not been taken into account in the assessment. It is anticipated that barrier locations will

develop during the ES modelling process.

12.8.9 Properties eligible under the Noise Insulation Regulations that are likely to exceed the criteria (after all mitigation options have been considered) and likely to qualify for noise insulation under the Noise Insulation Regulations will be identified and discussed as part of the ES.

12.9 Assessment of the Likely Significant Effects

Construction

12.9.1 The construction of the project has the potential to result in temporary noise and vibration impacts at the closest receptors to the development. The potential for significant adverse effects is primarily dependent on what distance the receptors are from the construction works. Therefore, it has been assumed that receptors closest to the project are most likely to experience significant adverse effects during the construction phase.

12.9.2 A full construction assessment of likely significant effects cannot be undertaken at this stage. However, the main activities during the construction stage which have the potential to generate significant effects include:

- Demolition
- Foundation excavations
- Piling, abutments and bases
- Structure and beams
- Construction compound
- Borrow pit
- Site/vegetation clearance
- Road and embankment earthworks
- Drainage
- Roadworks (removal and laying surface).

12.9.3 Much of the excavated material will be retained and used on site, however, in some instances there is a need for additional materials depending on the new road alignment and topography. Where this occurs, the impacts of such activities will be assessed and mitigated and minimised where practicable (e.g. use neighbouring schemes to reduce off-site haul distance).

12.9.4 The works which are most likely to result in the largest noise impacts are those longer-term activities like earthworks. However, the potential for significant effects during the construction phase is likely to be limited to a particular activity or stage within the construction programme. With the exception of works taking place within construction compounds, it is unlikely that each of the main activities detailed above will be undertaken at the same time at the same location. Instead, the works are likely to be mobile in nature and the distance between the receptors and the noise sources will vary depending on the task. Therefore, any potential significant effects during the construction period are likely to be temporary and their duration will depend on the individual activity.

12.9.5 As discussed in paragraph 12.8.1, BPM will be implemented to minimise the potential for significant adverse effects during the construction period, both during day and night-time periods.

12.9.6 A summary of the receptors that could be temporarily affected during some construction activities is provided below:

- Receptors near or within Penrith - Clifford Road, Pategill Road, Carleton Hall Road and Carleton Hall Gardens
- Receptors near or within Brougham - Tollbar Cottage, Lightwater, Whinfell Park, High Barn and Whinfell House
- Receptors near or within Kirkby Thore - Spittals Farm, Halefield Farm and Bungalow, Main Street, Cross Street, Dunfell View, Townhead Garth, Sanderson Croft and Sleastonhow
- Receptors near or within Long Marten - Powis House, Dunelm and Roman Vale
- Roger Head Farm, Crackenthorpe
- Castlerigg House and Rising Sun, Crofts End
- Receptors near or within Appleby-in-Westmoreland -The Sands, Bongate and Roman Road, Burbank House and Coupland Beck
- Dyke Nook, Sandford
- Receptors near or within Warcop - Hall Park, Meadowbank Farm, Eastfield Farm, Low Broomrigg, Thunderstones and Broomrigg House
- Receptors near or close to Brough - Lady Anne Drive and Pembroke Close, Westview and Foxtower View
- Receptors near or within Bowes including Stainmore Road, West End Farm and Stone Bridge Farm
- Receptors near or within Boldron - Bowes Cross Farm and Pennine View, Six Chimney's, Kilmond Cottage and Cross Keys farm
- Receptors at Cross Lanes including The Cottage, Cross Lanes Farm, Ivy Cottage, Smithy Cottage, Street Side Farm and Birk House
- Receptors near to Rokeby including Keepers Cottage, Tutta Beck Cottages and Farm, The Old Rectory, Ewebank Farm, Tack Room Cottage, and The Grove
- Receptors near to Greta Bridge - Thorpe Farm and Cottage
- Receptors on Roman Road – Mooreside Barn, Greenbrough Barn, Greenbrough House, Newsham Grange Cottages and Grove House
- Receptors near to Dalton - Browson Bank, East Browson, East Dalton Field and Dairy Cottage
- Receptors near or within West Layton and East Layton
- Receptors near or at Gilling West – Gatherley Moor Farm, Granary Cottage, Sedbury Home Farm, Sedbury Lodge and the Vintage Hotel

12.9.7 Where significant effects, due to the linear nature of the scheme and the transient nature of construction activities, it is anticipated that these would not occur for the full duration of construction phase of the project.

Operation

Route wide Magnitude of Change

In total, 6,188 residential and 435 non-residential receptors have been identified within the study area and included in this assessment. Table 12-12: Short-term Do-something magnitude of change (in accordance with *DMRB LA 111*) and Table 12-13: Long-term Do-something magnitude of change (in accordance with *DMRB LA 111*) relate to the full study area as defined in paragraph 12.5.4 which includes the affected road network. The residential and non-residential receptors potentially affected by the schemes with options are presented in the scheme-by-scheme section. As per paragraph 12.3.18, other sensitive receptors include educational establishments, hospitals, places of worship and public rights of way.

Noise levels represent an scenario including embedded mitigation (eg low-noise

surface, alignment, landscaping bunds, cutting), but excluding essential mitigation (eg barriers, higher-performing or additional low-noise surfacing); and therefore are worst-case. Mitigation will be identified and discussed in detail as part of the ES.

12.9.8 Table 12-12: Short-term Do-something magnitude of change (in accordance with *DMRB LA 111*) presents the predicted noise changes in terms of magnitude of change bands for the short-term (opening year) Do-something assessment.

Table 12-12: Short-term Do-something magnitude of change (in accordance with *DMRB LA 111*)

Change in noise level (dB $L_{A10,18hr}$ – daytime) (dB $L_{night, outside}$ – night-time)		Magnitude	Daytime		Night-time	
			Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level	<1.0	Negligible	1809	148	3313	182
	1.0 – 2.9	Minor	2259	87	814	54
	3.0 – 4.9	Moderate	570	23	503	21
	>5.0	Major	288	13	255	11
No change	0.0	No change	3	0	41	5
Decrease in noise level	<1	Negligible	280	12	302	12
	1.0 – 2.9	Minor	570	132	573	132
	3.0 – 4.9	Moderate	179	5	192	4
	>5.0	Major	230	15	195	14

12.9.9 Table 12-13: Long-term Do-something magnitude of change (in accordance with *DMRB LA 111*) presents the predicted noise changes in terms of magnitude of change bands for the long-term (future operational year) Do-something assessment.

Table 12-13: Long-term Do-something magnitude of change (in accordance with *DMRB LA 111*)

Change in noise level (dB $L_{A10,18hr}$ – daytime) (dB $L_{night, outside}$ – night-time)		Magnitude	Daytime		Night-time	
			Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level	<3.0	Negligible	4164	229	4269	240
	3.0 – 4.9	Minor	605	22	580	25
	5.0 – 9.9	Moderate	317	23	240	12
	>10.0	Major	50	1	41	0
No change	0.0	No change	21	2	27	2
Decrease in noise level	<3	Negligible	653	140	694	138
	3.0 – 5.9	Minor	183	6	168	5
	5.0 – 9.9	Moderate	133	7	130	9

Change in noise level (dB $L_{A10,18hr}$ – daytime) (dB $L_{night, outside}$ – night-time)		Magnitude	Daytime		Night-time	
			Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
	>10.0	Major	62	7	39	4

12.9.10 The likely significant effects for residential and non-residential receptors are described below. It should be noted that these numbers represent a scenario which includes only embedded mitigation but not essential mitigation. As part of the ES mitigation options will be identified and all residual effects will be reported.

Route wide Likely Significant Effects

12.9.11 The route wide section has been assessed with respect to the entire study area as discussed in paragraph 12.5.4, which includes the wider network.

12.9.12 Table 12-14: Summary of route wide significant effects provides a summary of the receptors predicted to be subject to a significant effect for each of the schemes.

Table 12-14: Summary of route wide significant effects

Scheme	Residential Significant Effects		Non-Residential Significant Effects	
	Adverse	Beneficial	Adverse	Beneficial
Route wide	979	530	37	79

12.9.13 Figure 12.2: Evolved PRA noise levels – Do-minimum opening year to Figure 12.4: Evolved PRA – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.14 There are 979 residential receptors predicted to experience significant adverse effects from the scheme, primarily near or within Penrith, Whinfell, Kirby Thore, Appleby-in-Westmoreland, Warcop, Brough, Bowes, Barnard Castle, Cotherstone, Ronaldkirk, Rokeby, West Layton, Gilling West, Richmond and Scotch Corner.

12.9.15 There are 530 residential receptors predicted to experience significant beneficial effects from the scheme, primarily near to the existing A66 at Kirkby Thore, Whinfell, Crackenthorpe, Warcop, Barnard Castle, Ravensworth, Rokeby, Washton Green, Richmond and Middleton Tyas.

12.9.16 There are 37 non-residential receptors predicted to experience significant adverse effects from the scheme in or near to Penrith, Brougham, Kirby Thore, Warcop, Ronaldkirk, Cotherstone, Barnard Castle, Bowes, Rokeby, Gilling West, Richmond and Scotch Corner.

12.9.17 There are 79 non-residential receptors predicted to experience significant beneficial effects from the scheme located in Kirkby Thore, Bolton, Crackenthorpe, Barnard Castle, Rokeby, Ravensworth and Richmond.

Scheme by scheme Likely Significant Effects

12.9.18 For this section, with the exception of Cross Lanes to Rokeby, each of the schemes has been assessed based on the 600m study area (including in respect of alternative alignments) only. Due to changes in traffic flows on affected roads, the scheme by scheme assessment for Cross Lanes to Rokeby includes receptors on the wider network due to the potential (as identified at previous stages in project development) for significant effects near and within Barnard Castle.

12.9.19 Noise contours have been produced and are provided in Figures 12.2: Evolved PRA noise levels – Do-minimum opening year to 12.29: Cross Lanes to Rokeby – Blue + Red alternative – Long term noise change.

12.9.20 Table 12-15: Summary of significant effects provides a summary of the receptors predicted to be subject to a significant effect for each of the schemes.

Table 12-15: Summary of significant effects

Scheme		Residential Significant Effects		Non-Residential Significant Effects	
		Adverse	Beneficial	Adverse	Beneficial
M6 Junction 40 to Kemplay Bank		117	0	0	0
Penrith to Temple Sowerby		12	4	0	1
Temple Sowerby to Appleby	Blue alternative	256	124	4	8
	Red alternative	260	120	9	3
	Orange alternative	20	61	3	4
Appleby to Brough	Black-Black-Black	58	5	5	0
	Black-Blue-Black	42	5	2	0
	Black-Black-Orange	75	9	5	1
	Black-Blue-Orange	42	9	2	1
Bowes Bypass		9	0	1	0
Cross Lanes to Rokeby	Black + Black	225	216	12	64
	Black + Red	14	39	1	4
	Blue + Black	195	219	8	65
	Blue + Red	16	32	1	4
Stephen Bank to Carkin Moor		26	8	1	0
A1(M) Junction 53 Scotch Corner		12	0	1	0

M6 Junction 40 to Penrith Kemplay Bank

12.9.21 Figure 12.2: Evolved PRA noise levels – Do-minimum opening year to Figure 12.4: Evolved PRA noise levels – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.22 There are 117 residential receptors associated with this scheme predicted to experience significant adverse effects from the scheme. The majority of these receptors are located to the north of the existing A66 at Clifford Road, Pategill Park and Carleton Avenue.

12.9.23 No non-residential receptors are predicted to experience significant adverse or beneficial effects from the scheme.

12.9.24 There are four NIAs located in close proximity to this scheme; NIA 6763, 10284,

10283 and 10285. The residents within each of these NIAs are predicted to experience an increase in noise levels from the scheme.

Penrith to Temple Sowerby

12.9.25 Figure 12.2 Evolved PRA noise levels – Do-minimum opening year to Figure 12.4: Evolved PRA noise levels – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.26 From the scheme, there are 12 residential receptors associated with this scheme predicted to experience significant adverse effects and four residential receptors predicted to experience significant beneficial effects. The majority of these receptors are located near to the existing A66.

12.9.27 There are no non-residential receptors predicted experience significant adverse effects and one non-residential receptor predicted to experience a significant beneficial effect (Brougham Institute at Whinfell) from the scheme.

12.9.28 There are no NIAs located in close proximity to this scheme.

Temple Sowerby to Appleby

12.9.29 The results for this scheme are discussed using the following categories:

- Blue alternative (Evolved PRA);
- Red alternative
- Orange alternative

Blue alternative (Evolved PRA)

12.9.30 Figure 12.5: Temple Sowerby to Appleby – Evolved PRA noise levels – Do-minimum opening year to Figure 12.7: Temple Sowerby to Appleby – Blue Alternative - Long term noise change represent the results of the Do-minimum and Do-something noise modelling.

12.9.31 There are 256 residential receptors associated with this scheme predicted to experience significant adverse effects from the scheme. The majority of these significant adverse effects are predicted within the community of Kirkby Thore. There are other receptors scattered to the north of Crackenthorpe who are also predicted to experience significant adverse effects.

12.9.32 There are 124 residential receptors predicted to experience significant beneficial effects from the scheme. The majority of these receptors are located near to the existing A66. Significant beneficial effects are primarily located on the existing A66 and Main Street leading to Kirkby Thore and at Crackenthorpe.

12.9.33 There are four non-residential receptors (including Kirkby Thore Primary School), near to Kirkby Thore, predicted to experience significant adverse effects from the scheme.

12.9.34 There are also eight non-residential receptors predicted to experience significant beneficial effects from the scheme, near to Kirkby Thore and Crackenthorpe.

12.9.35 There is one NIA located in close proximity to this scheme; NIA 12113. The residents within this NIA are predicted to experience a decrease in noise levels from the scheme.

Red alternative

12.9.36 Figure 12.5: Temple Sowerby to Appleby – Evolved PRA noise levels – Do-minimum opening year, Figure 12.8: Temple Sowerby to Appleby – Red Alternative – Do-something future year and Figure 12.9: Temple Sowerby to Appleby – Red Alternative

- Long term noise change represent the results of the Do-minimum and Do-something noise modelling.

12.9.37 There are 260 residential receptors predicted to experience significant adverse effects from the scheme, primarily within the community of Kirkby Thore. Additional receptors are also located in Broad Lea.

12.9.38 There are 120 residential receptors predicted to experience significant beneficial effects from the scheme, primarily near to the Main Street or Cross Street in Kirkby Thore and throughout Crackenthorpe.

12.9.39 There are nine non-residential receptors predicted to experience significant adverse effects from the scheme in or near to Kirkby Thore.

12.9.40 There are three non-residential receptors predicted to experience significant beneficial effects from the scheme located in Kirkby Thore and Crackenthorpe.

12.9.41 There is one NIA located in close proximity to this scheme; NIA 12113. The residents within this NIA are predicted to experience a decrease in noise levels from the scheme.

Orange alternative

12.9.42 Figure 12.5 Temple Sowerby to Appleby – Evolved PRA noise levels – Do-minimum opening year, Figure 12.10: Temple Sowerby to Appleby – Orange Alternative – Do-something future year and Figure 12.11: Temple Sowerby to Appleby – Orange Alternative - Long term noise change represent the results of the Do-minimum and Do-something noise modelling.

12.9.43 There are 20 residential receptors predicted to experience significant adverse effects from the scheme, which will be primarily experienced by residents to the north of the section of the existing A66 which goes through Kirkby Thore and the section which bypasses Crackenthorpe.

12.9.44 There are 61 residential receptors predicted to experience significant beneficial effects from the scheme, around the by-passed A66 and at Crackenthorpe.

12.9.45 There are three non-residential receptors predicted to experience significant adverse effects from the scheme in Kirkby Thore.

12.9.46 There are four non-residential receptors predicted to experience significant beneficial effects from the scheme in Kirkby Thore and Crackenthorpe.

12.9.47 There is one NIA located in close proximity to this scheme; NIA 12113. There are a number of residents within close proximity to this NIA. Residents located to the north of the existing A66 are predicted to experience a decrease in noise levels from the scheme, whereas, residential that are located to the south of the existing A66 are likely to experience an increase in noise levels from the scheme.

Appleby to Brough

12.9.48 The results for this scheme will be discussed using the following categories:

- Black-Black-Black (Evolved PRA)
- Black-Blue-Black
- Black-Black-Orange
- Black-Blue-Orange.

Black-Black-Black (Evolved PRA)

12.9.49 Figure 12.12: Appleby to Brough – Evolved PRA noise levels – Do-minimum opening year to Figure 12.14: Appleby to Brough – Black-Black-Black route – Long term noise

change represent the results of the Do-minimum and Do-something noise modelling.

12.9.50 There are 58 residential receptors close to the Evolved PRA predicted to experience significant adverse effects from the scheme, the majority being near to the existing A66, at Warcop and at Brough.

12.9.51 There are five residential receptors predicted to experience significant beneficial effects from the scheme, primarily located in Wheat Sheaf Bridge and Turks Head.

12.9.52 There are five non-residential receptors predicted to experience significant adverse effects from the scheme, near to Warcop.

12.9.53 No non-residential receptors are predicted to experience significant beneficial effects from the scheme.

12.9.54 There is one NIA located in close proximity to this scheme; NIA 10128. The residents within the NIA are predicted to experience a decrease in noise from the scheme.

Black-Blue-Black

12.9.55 Figure 12.12: Appleby to Brough – Evolved PRA noise levels – Do-minimum opening year, Figure 12.15: Appleby to Brough – Black-Blue-Black alternative noise levels – Do-something future year and Figure 12.16: Appleby to Brough – Black-Blue-Black alternative noise levels – Long term noise change represent the results of the Do-minimum and Do-something noise modelling.

12.9.56 There are 42 residential receptors predicted to experience significant adverse effects from the scheme, within Brough and along the existing A66.

12.9.57 There are five residential receptors predicted to experience significant beneficial effects from the scheme in Wheat Sheaf Bridge, Turks Head and around West View.

12.9.58 There are two non-residential receptors predicted to experience significant adverse effects from the scheme. These are located at Ketland Moor and Dyke Nook (Sandford).

12.9.59 No non-residential receptors are predicted to experience significant beneficial effects from the scheme.

12.9.60 There is one NIA located in close proximity to this scheme; NIA 10128. The residents within this NIA are predicted to experience a decrease in noise from the scheme.

Black-Black-Orange

12.9.61 Figure 12.12: Appleby to Brough – Evolved PRA noise levels – Do-minimum opening year, Figure 12.17: Appleby to Brough – Black-Black-Orange alternative noise levels – Do-something future year and Figure 12.18: Appleby to Brough – Black-Black-Orange alternative noise levels – Long term noise change represent the results of the Do-minimum and Do-something noise modelling.

12.9.62 There are 75 residential receptors within Warcop and near to Brough predicted to experience significant adverse effects from the scheme.

12.9.63 There are nine residential receptors predicted to experience significant beneficial effects from the scheme. These receptors are located at Wheat Sheaf Bridge, Turks Head and around West View.

12.9.64 There are five non-residential receptors predicted to experience significant adverse effects from the scheme (located at Ketland Moor, Dyke Nook (Sandford) and at Warcop).

12.9.65 There is one non-residential receptor predicted to experience a significant beneficial

effect from the scheme (located at West View).

12.9.66 There is one NIA located in close proximity to this scheme; NIA 10128. The residents within this NIA are predicted to experience a decrease in noise from the scheme.

Black-Blue-Orange

12.9.67 Figure 12.12 Appleby to Brough – Evolved PRA noise levels – Do-minimum opening year, Figure 12.19: Appleby to Brough – Black-Blue-Orange alternative noise levels – Do-something future year and Figure 12.20: Appleby to Brough – Black-Blue-Orange alternative noise levels – Long term noise change represent the results of the Do-minimum and Do-something noise modelling.

12.9.68 There are 42 residential receptors predicted to experience significant adverse effects from the scheme, primarily along the existing A66, at Warcop and Brough.

12.9.69 There are nine residential receptors predicted to experience significant beneficial effects from the scheme, located west of Brough and along the existing A66 at Wheat Sheaf Bridge, Turks Head and around West View.

12.9.70 There are two non-residential receptors predicted to experience significant adverse effects from the scheme (located at Ketland Moor, Dyke Nook (Sandford) and at Warcop).

12.9.71 There is one non-residential receptor predicted to experience a significant beneficial effect at West View from the scheme.

12.9.72 There is one NIA located in close proximity to this scheme; NIA 10128. The residents within this NIA are predicted to experience a decrease in noise from the scheme.

Bowes Bypass

12.9.73 Figure 12.2: Evolved PRA noise levels – Do-minimum opening year to Figure 12.4: Evolved PRA noise levels – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.74 There are nine residential receptors predicted to experience significant adverse effects from the scheme. The majority of these receptors predicted to experience adverse effects are located near to the existing A66. No residential receptors are predicted to experience significant beneficial effects.

12.9.75 There is one non-residential receptor, at Low Broats, predicted to experience a significant adverse effect from the scheme.

12.9.76 There are no NIAs located in close proximity to this scheme.

Cross Lanes to Rokeby

12.9.77 The results for this scheme will be discussed using the following categories:

- Black Cross Lanes – Black Rokeby (Black + Black (Evolved PRA))
- Black Cross Lanes – Red Rokeby (Black + Red)
- Blue Cross Lanes – Black Rokeby (Blue + Black)
- Blue Cross Lanes – Red Rokeby (Blue + Red)

12.9.78 As previously discussed, for this scheme, the wider network has been included as part of the assessment of this scheme. Therefore, receptors within 600m of the scheme and the wider network, which is predicted to experience a change, have been included.

Black + Black (Evolved PRA)

12.9.79 Figure 12.21: Cross Lanes to Rokeby – Evolved PRA noise levels – Do-minimum

opening year to Figure 12.23: Cross Lanes to Rokeby – Black + Black alternative – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.80 There are 225 residential receptors associated with this scheme predicted to experience significant adverse effects from the scheme. The majority of these receptors are located within or near to Romaldkirk, Cotherstone, Lartington, Startforth (south of Barnard Castle), Rokeby and along the existing A66.

12.9.81 There are 216 residential receptors predicted to experience significant beneficial effects from the scheme. The majority of these receptors are located near or within Barnard Castle. Within Barnard Castle a number of receptors are located near or on the following roads: New Gate, A67, B6278 and Abbey Lane. Receptors predicated to experience significant beneficial effects are also located at Rokeby.

12.9.82 There are 12 non-residential receptors predicted to experience significant adverse effects from the scheme, located near or within Romaldkirk, Cotherstone, Startforth and Cross Lanes.

12.9.83 There are 64 non-residential receptors are predicted to experience beneficial effects from the scheme, primarily within Barnard Castle. Within Barnard Castle a number of receptors are located near or on the following roads: Newgate, A67 and B6278. Additionally, there is a small number of receptors located at Rokeby which are likely to experience significant beneficial effects from the scheme.

12.9.84 There are no NIAs located in close proximity to this scheme

Black + Red

12.9.85 Figure 12.21: Cross Lanes to Rokeby – Evolved PRA noise levels – Do-minimum opening year, Figure 12.24: Cross Lanes to Rokeby – Black + Red alternative noise levels – Do-something future year and Figure 12.25: Cross Lanes to Rokeby – Black + Red alternative – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.86 There are 14 residential receptors associated with this scheme predicted to experience significant adverse effects from the scheme. The majority of these receptors are located near to the existing A66 and on the B6277 leading to Barnard Castle.

12.9.87 There are 39 residential receptors predicted to experience significant beneficial effects from the scheme. The majority of these receptors are located near or within Startforth, Abbey Lane (south of Barnard Castle) and at Rokeby.

12.9.88 There is one non-residential receptors predicted to experience significant adverse effects from the scheme, located at Cross Lanes.

12.9.89 There are four non-residential receptors predicted to experience beneficial effects from the scheme, primarily at Rokeby and on Abbey Lane (south of Barnard Castle).

12.9.90 There are no NIAs located in close proximity to this scheme.

Blue + Black

12.9.91 Figure 12.21: Cross Lanes to Rokeby – Evolved PRA noise levels – Do-minimum opening year, Figure 12.26: Cross Lanes to Rokeby – Blue + Black alternative noise levels – Do-something future and Figure 12.27: Cross Lanes to Rokeby – Blue + Black alternative – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.92 There are 195 residential receptors associated with this scheme predicted to

experience significant adverse effects from the scheme. The majority of these receptors are located north of Barnard Castle in Ronald Kirk, Cotherstone and Larington. Additional receptors are located on B6277 leading into Barnard Castle and along the existing A66.

12.9.93 There are 219 residential receptors predicted to experience significant beneficial effects from the scheme. The majority of these receptors are located near or within Barnard Castle (including New Gate, Market Place, Bowes Road and Abbey Lane) and at Rokeby.

12.9.94 There are eight non-residential receptors predicted to experience significant adverse effects from the scheme, located along the existing A66, at Cotherstone and along the B6277 to Barnard Castle.

12.9.95 There are 65 non-residential receptors predicted to experience beneficial effects from the scheme, primarily within Barnard Castle. Within Barnard Castle a number of receptors are located near or on the following roads: Newgate, Market Place and B6278. A small number of non-residential receptors are also located at Rokeby.

12.9.96 There are no NIAs located in close proximity to this scheme.

Blue + Red

12.9.97 Figure 12.21: Cross Lanes to Rokeby – Evolved PRA noise levels – Do-minimum opening year, Figure 12.28: Cross Lanes to Rokeby – Blue + Red alternative noise levels – Do-something future and Figure 12.29: Cross Lanes to Rokeby – Blue + Red alternative – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.98 There are 16 residential receptors associated with this scheme predicted to experience significant adverse effects from the scheme. These receptors are located near to the existing A66 at Cross Lanes and Rokeby.

12.9.99 There are 32 residential receptors predicted to experience significant beneficial effects from the scheme. The majority of these receptors are located near or within Startforth and at Rokeby.

12.9.100 There is one non-residential receptor predicted to experience significant adverse effects from the scheme, located at Cross Lanes.

12.9.101 There are four non-residential receptors predicted to experience beneficial effects from the scheme, primarily at Rokeby and on Abbey Lane (south of Barnard Castle).

12.9.102 There are no NIAs located in close proximity to this scheme.

Stephen Bank to Carkin Moor

12.9.103 Figure 12.2: Evolved PRA noise levels – Do-minimum opening year to Figure 12.4: Evolved PRA noise levels – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.104 There are 26 residential receptors associated with this scheme predicted to experience significant adverse effects from the scheme. The majority of these receptors are located near to the existing A66 and at West Layton.

12.9.105 There are eight residential receptors predicted to experience significant beneficial effects from the scheme. These are located near to the existing A66 at Fox Grove and Fox Well.

12.9.106 There is one non-residential receptor predicted to experience significant adverse effects from the scheme, at Dunsa Manor. No non-residential receptors are predicted

to experience significant beneficial effects.

12.9.107 There is one NIA located in close proximity to this scheme; NIA 10437. The residents within this NIA are predicted to experience a decrease in noise levels from the scheme.

A1(M) J53 Scotch Corner

12.9.108 Figure 12.2: Evolved PRA noise levels – Do-minimum opening year to Figure 12.4: Evolved PRA noise levels – Long term noise change represents the results of the Do-minimum and Do-something noise modelling.

12.9.109 There are 12 residential receptors associated with this scheme predicted to experience significant beneficial effects from the scheme. The majority of these receptors are located to the east of the roundabout at Middleton Tyas.

12.9.110 There is one non-residential receptor, at Scotch Corner Roundabout, predicted to experience significant adverse effects from the scheme. There are no non-residential receptors predicted to experience significant beneficial effects.

12.9.111 There is no NIA located in close proximity to this scheme.

12.10 Monitoring

12.10.1 All monitoring strategies will be defined and discussed within the ES when the final details of significant effects are identified.