BANWELL BYPASS

Environmental Statement

HIF Banwell Bypass and Highways Improvements Project

Environmental Statement Chapter 11 - Noise and Vibration

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		Checker	Young Youn	01/07/22
		Approver	Tom Edwards	01/07/22
		Authoriser	Mark Jenkins	01/07/22

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11 Noise and Vibration

11.1 Introduction

11.1.1 This chapter assesses the potential noise and vibration impacts of the construction and operation of the Scheme. This is based on the methodology set out in the Design Manual for Roads and Bridges (DMRB), LA 111 Noise and Vibration[11.1].

11.1.2 This chapter details the methodology followed for the assessment and summarises the regulatory and policy framework related to noise and vibration and describes the existing environment in the area surrounding the Scheme.

11.1.3 A description of the Scheme can be found in Chapter 2 Scheme Description.

Scheme Overview

11.1.4 The following section provides a brief description and overview of the Banwell Bypass and Highways Improvements Project.

11.1.5 The Scheme comprises the following distinct elements:

a) a bypass of the village of Banwell (referred to as the "Banwell Bypass");

b) a route connecting the A371 at Castle Hill and the A368 at East Street (referred to as the "Southern Link"); and

c) Mitigation and enhancement measures, which broadly consist of the following:

- Environmental mitigation and enhancement measures in connection with the Banwell Bypass and the Southern Link, examples of which include (but are not limited to) flood compensation areas, planting and habitat creation, attenuation basins etc.

- Placemaking improvements within Banwell, comprising mitigation and enhancement measures to the public realm; and

- Traffic mitigation in connection with the Banwell Bypass

and the Southern Link, including Improvements to the wider local road network.

11.1.6 Together, these elements comprise the “Scheme”. Each element as listed is described in more detail below.

Banwell Bypass

11.1.7 The Banwell Bypass would be located within the administrative area of North Somerset. The village of Banwell is located approximately 8km east of Weston-super-Mare. The Banwell Bypass would primarily consist of:

a) signalisation and capacity improvements to the Summer Lane/ Wells Lane junctions on the A371;

b) a 40mph single carriageway Banwell Bypass, connecting the existing A371 (east of Summer Lane) to A368 (west of Towerhead Farm);

c) a 3 metre wide shared use path provided along the majority of the Banwell Bypass providing a link from Weston-super-Mare to Sandford;

d) Banwell West Junction - a three arm roundabout located east of Knightcott Industrial Estate at the western end of Banwell;

e) Wolvershill Road Junction – a traffic signalised junction, providing access for all users to the west, east, and north. Access to the south would be restricted to public transport and walking, cycling and horse-riders, and limited agricultural access only;

f) Banwell River Bridge – an overbridge across Riverside and the River Banwell. There would not be a direct connection between Riverside and the Banwell Bypass;

g) Moor Road to Riverside Link - a side road connection between Riverside and Moor Road; and

h) Banwell East Junction - A three-arm traffic signalised junction, with dedicated turning lanes from the bypass towards the Southern Link.

Southern Link Road

11.1.8 The Southern Link will provide the new primary route south to Winscombe, as Castle Hill and Dark Lane are proposed to be stopped up. The Southern Link would be a 30mph single carriageway, connecting the A368 (East Street) to the A371 at

Castle Hill. The Southern Link would be located within the Mendip Hills AONB. The Southern Link would link into the Banwell Bypass at the Banwell East Junction. A T-junction located along the Southern Link would provide access into the east of Banwell (at East Street).

Mitigation Measures

Environmental mitigation and enhancement measures in connection with the Banwell Bypass and the Southern Link.

11.1.9 The Scheme would include mitigation measures which are provided to offset the impact of the Banwell Bypass proposal. These include (but are not limited to):

a) flood mitigation to ensure that the Banwell Bypass does not increase flood risk for third-party properties;

b) land for essential mitigation, such as ecology and landscape mitigation;

c) sustainable urban drainage systems (e.g. attenuation basins and swales), and additional groundwater mitigation, to prevent adverse water quality impacts (including the Source Protection Zone); and

d) replacement land to mitigate the impact of the scheme on Banwell Football Club.

Placemaking improvements within Banwell

11.1.10 As a result of the Banwell Bypass, there would be a reduction in traffic through Banwell. The reduction in traffic (and resulting reduction in congestion) through the village could result in higher traffic speeds without mitigation.

11.1.11 A reduced 20mph speed limit through Banwell would discourage vehicles from travelling at higher speeds, whilst also discouraging the use of the road as a through route (instead of the Banwell Bypass).

11.1.12 The reduction of traffic through Banwell due to the provision of the Banwell Bypass provides the opportunity to make improvements to the existing road and public spaces within Banwell to enhance the historic and urban setting of the village. These improvements would include, but are not limited to:

a) Alteration to the road and footways including resurfacing, widening, and narrowing (which would encourage drivers to comply with the posted 20mph speed limit);

b) Incorporation of active travel measures;

c) Soft landscaping and ecological improvements; and

d) Street signage improvements.

Improvements to the wider local road network

11.1.13 Improvements to the local road network and junctions including the surrounding villages of Churchill, Sandford and Winscombe are proposed to mitigate increases in traffic as a result of the Banwell Bypass and Southern Link. These mitigation measures would consist of:

a) Lowered speed limits:

- 20mph: A368 through Churchill, A368 through Sandford, A371 through Winscombe.
- 30mph: A368 between Churchill and Sandford Villages.

b) Gateway Features when entering and exiting the villages of Sandford, Churchill and Winscombe;

c) Non-physical traffic calming measures through and between villages (e.g. road markings and speed signage);

d) Capacity improvements to the Churchill Junction (A38/ A371);

e) Provision of new/ improvements to existing pedestrian and cycling crossings;

f) Active travel measures along the A368, with improved footway/ cycleway access from Churchill and Langford to Churchill Academy;

g) Improvements to footways, shared pedestrian, and cycleway; and

h) Soft landscaping, native planting, rewilding, and ecological enhancements.

Context

11.1.14 North Somerset Council's (NSC) Housing Infrastructure Fund (HIF) proposal supports potential housing sites (subject to the emerging Local Plan 2038).

11.1.15 A business case was submitted to Homes England to secure funding for a package of infrastructure improvements in February 2019 and a successful funding announcement was made at the end of October 2019.

11.1.16 The Banwell Bypass would provide a highway connection to enable potential housing sites that may be allocated in the emerging Local Plan and alleviate the anticipated impact of further traffic growth upon the already congested Banwell village.

11.1.17 NSC appointed Alun Griffiths (Contractors) Ltd, with Arup and TACP (the 'AGC Team') as their technical and environmental advisors, to develop a solution including optioneering, design and planning support of the proposed HIF Banwell Bypass and Highways Improvements Project Stage 1 (the "Scheme"). Stage 1 of the project includes: optioneering; preliminary design; Environmental Impact Assessment (EIA); planning permission; Statutory Processes. Stage 2 of the project is the detailed design and construction phase, following planning determination and land acquisition.

Environmental Context

11.1.18 The Scheme crosses the North Somerset Levels which are characterised by flat open landscape of arable land divided by hedgelined ditches and rhynes. These have been inhabited and exploited for thousands of years. Much of the area lies within a designated flood zone.

11.1.19 Banwell lies to the immediate north of the Mendip Hills Area of Outstanding Natural Beauty (AONB). The Southern Link lies within the boundary of the AONB and within a groundwater Source Protection Zone. Whilst the Mendip Hills AONB is not a designated International Dark Sky Reserve (IDSR), it is well known for its dark sky environment.

11.1.20 There are five Scheduled Monuments in the vicinity of the Scheme, the closest of which is a Romano-British villa. There are numerous Grade I, II* and II listed buildings within Banwell and its vicinity. The centre and east of Banwell is designated as a Conservation Area.

11.1.21 The North Somerset and Mendip Bats Special Area of Conservation (SAC), which includes ancient woodland, lies adjacent to the A368 and the eastern junction of the Scheme. The Banwell Ochre Caves and Banwell Caves Sites of Special Scientific Interest (SSSI) are designated for their geology and overlap with the North Somerset and Mendip Bats SAC, providing hibernation sites for Greater Horseshoe bats. The wider area provides habitat for a variety of protected and notable species including dormouse, grass snakes, otter, badger, kingfisher and several species of bat.

11.1.22 The Scheme is dissected by the River Banwell which flows northwards along Riverside. It is classified as a main river and is the source of the River Banwell Estuary.

11.1.23 There is an extensive Public Right of Way (PRoW) network in and around Banwell which includes well-used bridleways. To the east of Banwell, north of the A368 (Towerhead Road) lies a 7.2 MW photovoltaic power station (Banwell Solar Farm).

Scheme objectives

11.1.24 NSC's overall objectives for the Scheme are to deliver, within cost, quality, and programme targets:

a) Improve the local road network to deal with existing congestion issues.

b) Improve and enhance Banwell's public spaces by reducing traffic severance and improving the public realm.

c) Provide the opportunity to increase active and sustainable travel between local villages and Weston-super-Mare.

d) Deliver infrastructure that enables housing development (subject to Local Plan).

e) Ensure the development respects the local area and minimises visual impact upon the surrounding countryside and Mendip Hills Area of Outstanding Natural Beauty (AONB).

f) Innovative and efficient in reducing and offsetting carbon from the design and construction of the infrastructure.

g) Ensure the development provides the opportunity to increase Biodiversity Net Gain by at least 10%.

h) Proactively engage with stakeholders in a way that is both clear and transparent.

11.2 Competent Expert Evidence

11.2.1 Fiona Rogerson is a Senior Consultant in Acoustics at Arup with over 15 years' professional experience working in the field of acoustics. Fiona holds an BEng(Hons) in Electroacoustics from the University of Salford and is a corporate member of the Institute of Acoustics (MIOA).

11.3 Legislative and Policy Framework

Legislation

11.3.1 The following legislation is of relevance to the assessment of noise and vibration.

The Environmental Noise (England) Regulations 2006

11.3.2 The Environmental Noise (England) Regulations 2006[11.2] enact the requirements for noise action planning to promote good health and good quality of life (wellbeing) through the effective management of noise. The Environmental Noise (England) (Amendment) Regulations 2018[11.3] provide for new common noise assessment methods for five-yearly Action Plans.

11.3.3 Regulation 15(1)(a) of The Environmental Noise (England) Regulations 2006 is amended by The Environment (Amendment etc.) (EU Exit) Regulations 2019 (as amended)[11.4] which now state action plans must:

a) aim to prevent and reduce environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health; and

b) aim to preserve environmental noise quality where it is good.

Control of Pollution Act 1974

11.3.4 The Control of Pollution Act 1974 (c.40)[11.5] gives the Local Authority powers to control construction site noise. This may include specific controls to restrict certain activities identified as causing particular problems. Conditions regarding hours of operation will generally be specified and noise and vibration limits at certain locations may be applied in some cases. All requirements must adhere to established guidance and be consistent with best practicable means to control noise and vibration only as far as is necessary to prevent undue disturbance.

Land Compensation Act 1973

11.3.5 Part 1 of the Land Compensation Act 1973 (c.26)[11.6] entitles property or landowners to apply for compensation if the value of their property goes down because of pollution or disturbance from the use of a new or altered road – this includes for reasons of increased noise.

Noise Insulation Regulations 1975

11.3.6 The Noise Insulation Regulations 1975 (NIR)[11.7] define the conditions under which dwellings are eligible for noise insulation to control internal noise levels. The conditions relate to the level of traffic noise at the façade, the increase in noise levels as a result of the highway, and the contribution of the new or altered highway to the noise level received at the façade. In summary, noise insulation qualification criteria require that:

a) the façade noise threshold of 68dB$L_{pA10,18h}$ is met or exceeded

b) there must be a noise increase of at least 1dB(A) compared to the prevailing noise level immediately before the works to construct or improve the highway were begun

c) the noise caused by traffic on new or altered roads makes an effective contribution of at least 1dB(A)

d) the property is 300m or less from the nearest point on the carriageway of a highway to which the Noise Insulation Regulations 1975 apply

National planning policy

11.3.7 The UK government's noise policy is set out in the Noise Policy Statement for England (NPSE)[11.8]. In legislative and policy terms, noise is taken to include vibration.

11.3.8 Government noise policy sets three aims, which are to be met within the context of government policy on sustainable development:

a) To avoid significant adverse impacts on health and quality of life.

b) To mitigate and reduce adverse impacts on health and quality of life.

c) Where possible, contribute to the improvement of health and quality of life.

11.3.9 The same three aims are also reflected in:

a) The National Planning Policy Framework (NPPF)[11.9]; and

b) Planning Practice Guidance – Noise (PPG-Noise)[11.10].

11.3.10 PPG-Noise provides guidance on the application of government noise policy. PPG-Noise sets out in the linked noise exposure hierarchy table that unacceptable adverse effects on health and quality of life due to noise exposure (set at a level higher than

significant adverse impacts on health and quality of life) should be 'prevented'[1].

11.3.11 Thresholds for identifying adverse effect levels in terms of government noise policy are not clearly defined numerically in NPSE, NPPF, or PPG-Noise. The threshold values adopted for this assessment were taken from DMRB LA 111 Noise and vibration and are set out in Section 11.4 Assessment Method.

Local policy

North Somerset Local Plan

11.3.12 The current suite of North Somerset Local Plan documents is up-to-date and has a plan period to 2026. It includes the safeguarding of Banwell Bypass.

11.3.13 The Core Strategy is the main planning document which guides development choices and decisions in North Somerset. Relevant to noise is Core Strategy 3 (CS3) Environmental impacts and flood risk management which '*sets out aspirations for the environmental standards to be met, including those relating to flood risk management and environmental protection'* and includes North Somerset guidance on noise in paragraphs 3.42 and 3.43, as reproduced in Table 11-1.

11.3.14 Further policies are included in the Development Management Policy however most are not relevant to the Scheme. Tranquillity is covered by ES Volume 1 – Chapter 7 - Landscape.

Table 11-1 Local Planning Policy

Policy		Relevant Details of Policy
North Somerset Council Core Strategy Policies		
CS3	Environmental impacts and Flood Risk Management	Includes guidance on noise in paragraphs 3.42 and 3.43:- "The National Planning Policy Framework paragraph 123 and Noise Policy Statement for England (Defra March 2010) set the planning policy context for CS3 sensitive/noise/related developments. Housing, hospitals and schools as well as other uses such as libraries and some other community facilities may be sensitive to an unacceptable degree of noise disturbance. In applying this policy the council will have regard to the scale, nature and type of existing land uses in the surrounding area. The National Planning Policy Framework paragraph 123 and Noise Policy Statement for England (Defra March 2010) set the planning policy context for noise sensitive/related developments. Housing, hospitals and schools as well as other uses such as libraries and some other community facilities may also be sensitive to an unacceptable degree of noise disturbance. In applying this policy the council will have regard to the scale, nature and type of existing land uses in the surrounding area."
Development Management Policies: Site and Policies Plan		
DM10	Landscape	Makes reference to tranquillity which is covered in the Landscape chapter.

Emerging North Somerset Local Plan

11.3.15 A new North Somerset Local Plan is currently being prepared and will cover the period 2023 to 2038. It will include a new spatial strategy for growth.

Standards and Guidance

11.3.16 Details of relevant noise and vibration guidance and standards considered as part of the assessment in this chapter have been provided in ES Volume 3 - Appendix 11.A - Noise and Vibration Guidance and Standards. The key documents referred to in this assessment are:

a) DMRB LA 111 Noise and vibration (2020).

b) Calculation of Road Traffic Noise, HMSO (1988)[11.11].

c) British Standard (BS) 5228-1:2009+A1:2014[11.12] and BS 5228-2:2009+A1:2014[11.13] Code of practice for noise and vibration on construction and open sites.

d) BS 7385-2: 1993 Evaluation and measurement for vibration in buildings – Guide to damage levels from ground borne vibration[11.14].

11.4 Assessment Method

11.4.1 The assessment methodology is outlined in this section.

Study area

11.4.2 The determination of the assessment study area (as shown in ES Volume 2 - Figure 11.1 Noise study area and baseline noise contour map) has been based on the methodology in DMRB LA 111 Noise and vibration (requirements are described below). DMRB LA 111 Noise and vibration allows for the study area to be extended where considered appropriate according to the needs of the assessment and stakeholder expectations, as described below.

Construction

11.4.3 For construction noise and vibration, the study area shall include all Noise Sensitive Receptors (NSR):

a) that are potentially affected by construction noise or vibration; and

b) in areas where there is a reasonable stakeholder expectation that a construction noise or vibration assessment will be undertaken.

Construction noise

11.4.4 DMRB LA 111 Noise and vibration notes that a study area of 300 metres from the closest construction activity is normally sufficient to encompass NSRs, although variations in the study area can be defined for individual projects. BS 5228 (referenced within DMRB LA 111 Noise and vibration) notes that the prediction results should be treated with caution at distances greater than this.

11.4.5 A number of ‘wider network mitigation’ areas (see Chapter 2 and Wider Network Mitigation General Arrangement drawings (Planning Document – Wider Mitigation Drawings) are proposed beyond the immediate Scheme area. Further details can be found in Section 11.8.9 Wider Area Construction Works (Wider Mitigation).

11.4.6 DMRB LA 111 Noise and vibration requires that a diversion route study area be defined where a project requires full carriageway closures during the night (23:00-07:00) to enable construction works to take place. DMRB LA 111 Noise and vibration states that the study area shall include a 25-metre width from the kerb line of the diversion route. This is on the basis that full closures

of major roads at night, causing traffic to be diverted onto local roads, are highly likely to cause disturbance to receptors within 25m of the affected local roads. At present there are no confirmed plans for the full closure of any major roads. Riverside will need to be closed for up to two days during the construction of the River Banwell bridge but this road has a low traffic flow and hence diverted traffic at night is unlikely to cause disturbance. The final connections of the bypass to the existing roads are planned to be undertaken under traffic management or short-term road closures. No diversion routes have been identified at present. However, given that these closures would be likely to be of one to two nights duration, they would not give rise to a significant effect due to the their short-term, temporary, nature and therefore it is scoped out and no study area has been defined for this element.

11.4.7 DMRB LA 111 Noise and vibration specifies that a construction traffic study area shall be defined to include a 50m width from the kerb line of public roads with the potential for an increase in Basic Noise Level (BNL)[2] of 1dB(A) or more as a result of the addition of construction traffic to existing traffic levels. Potential increases in BNL due to construction traffic have been predicted based on the highest predicted construction traffic flows and details are provided in ES Volume 3 - Appendix 11.C - Construction Assessment. No public roads were predicted to experience increases in BNL of 1dB(A) or more and therefore this element is scoped out.

Construction vibration

11.4.8 DMRB LA 111 Noise and vibration notes that a study area of 100m from the closest construction activity with the potential to generate vibration is normally sufficient to encompass vibration sensitive receptors. However, variations in the study area can be defined for individual projects.

Operation

11.4.9 The assessment procedure requires that an operational noise[3] impact study is defined to include:

a) NSRs that are potentially affected by operational noise changes generated by the Scheme, either on the route of the Scheme or other roads not physically changed by the Scheme.

b) NSRs in areas where there is a reasonable stakeholder expectation that noise assessment is undertaken.

11.4.10 For most projects the following areas are suitable, but DMRB LA 111 Noise and vibration notes that the assessor can reduce or

extend this such that it is proportionate to the risk of likely significant effects:

a) The area within 600m of new road links or road links physically changed or bypassed by the Scheme.

b) The area within 50m of other road links with potential to experience a BNL change of more than 1dB(A) in the short term or 3dB(A) in the long term, as a result of the Scheme.

11.4.11 At this stage of the assessment, the study area as described above is considered adequate to assess the potential impacts and effects of the Scheme. The study area is shown on ES Volume 2 - Figure 11.1 - Noise study area and baseline noise contour map.

11.4.12 The Do-Something traffic scenarios do not include any 'wider mitigation' measures but do include Banwell village 20mph speed limit (see Banwell Placemaking Improvements in ES Volume 1 - Chapter 2 – Scheme Description - Section 2.5). Speed reductions below 30mph where the typical percentage of heavy vehicles is 5% or less, could lead to decreases in noise of up to 2dB or increases in noise of less than 1dB dependent on starting speed. Therefore, all of the interventions are likely to have a neutral or, possibly, a beneficial impact in terms of operational noise and so would not significantly worsen the assessment presented in here.

Value of Receptor

11.4.13 In addition to residential receptors, DMRB LA 111 *Noise and vibration* identifies a range of non-residential properties as noise sensitive, which should also be considered in the assessment. These include hospitals, healthcare facilities, education facilities, community facilities, designated quiet areas, international and national or statutorily designated sites, and PRoW. Cultural heritage assets which are not included within the preceding descriptions are considered in Chapter 6 Cultural heritage.

11.4.14 DMRB LA 111 *Noise and vibration* does not specifically assign levels of sensitivity to different types of noise sensitive receptor. However, sensitivity has been considered in the assessment based on the use of receptors and the context of the impact (e.g. times of use of the receptor).

Baseline approach

11.4.15 For the purposes of the assessment, as set out in DMRB LA 104, the baseline conditions are assumed to be those prevailing just prior to construction starting for the construction noise

assessment and prior to opening the project to traffic for the operational noise assessment.

Construction

11.4.16 DMRB LA 111 Noise and vibration states that construction baseline shall be determined via one or more of the following methods:

a) Noise measurements, based upon actual survey data.

b) Predicted noise levels (noise model outputs).

c) Existing noise mapping undertaken by public bodies or as part of other developments.

11.4.17 Baseline noise surveys were undertaken between Tuesday 16th November 2021 and Friday 19th November 2021 at selected locations as shown on ES Volume 2 - Figure 11.1 - Noise study area and baseline noise contour map. The locations were agreed with the Environmental Health Officer (EHO) from North Somerset Council via email (see further detail in Section 11.6). Full details of the noise survey are set out in ES Volume 3 - Appendix 11.B - Baseline Noise Survey Report. As reported in the UK government dataset "Domestic transport use by mode: Great Britain, since 1 March 2020"[11.15]. traffic levels for all vehicle types were at around 95% of those recorded in February 2020 prior to the start of restrictions due to the Covid-19 pandemic. A 5% difference in traffic flow is negligible in noise terms. Wherever feasible, traffic counts on local roads were undertaken by the noise survey personnel, concurrent with the noise monitoring.

11.4.18 Following stakeholder consultation, additional short-term noise monitoring is proposed in the villages of Sandford, Winscombe and Churchill. However, it is not required in order to provide a robust assessment of the potential changes in noise as a result of traffic changes through the villages as reported in this chapter. The results of this monitoring will be included in an addendum to the Environmental Statement.

11.4.19 Baseline noise conditions for the construction assessment are based primarily on the noise survey results, augmented by modelled baseline noise levels where necessary.

11.4.20 It is assumed that baseline noise levels would not change significantly between the time when the baseline surveys were undertaken and just prior to the start of construction works for the Scheme.

11.4.21 As per DMRB LA 111, construction vibration has been assumed to be absent in the baseline scenario for the purpose of construction vibration assessment.

Operation

11.4.22 DMRB LA 111 Noise and vibration states that the operational baseline shall be determined from the Do-Minimum noise levels in each assessment year and that noise monitoring should be used to inform baseline noise modelling results and to provide data for public consultation purposes.

11.4.23 Baseline noise levels have been predicted at each noise sensitive receptor using a detailed noise model calculating in accordance with Calculation of Road Traffic Noise (CRTN) and DMRB.

11.4.24 Baseline noise levels for the construction and operational noise assessments have been determined by modelling of the Do-Minimum noise levels for the opening year (2024). For the operational assessment, the noise levels for the future year (2039) have also been predicted taking into account any expected traffic changes as a result of other committed development or infrastructure that would occur without the Scheme in operation by 2039. Only sensitive receptors that would be in existence prior to the opening year of the Scheme are included in the assessment in the future year.

Magnitude of Impacts

Construction noise

11.4.25 The noise assessment from the construction of the Scheme has been based on DMRB LA 111 Noise and vibration which makes reference to BS 5228–1:2009+A1:2014 (BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Noise, 2014). This standard provides information on the prevention and control of construction noise and includes a procedure for predicting construction noise. Calculations of noise levels at selected representative receptors have been based on information supplied by the project engineering team and typical noise levels for construction plant (taken from BS 5228). Calculations have assumed that the ground cover between the noise source and the receptor is predominantly soft, however, at this stage no account has been taken of topography or screening (e.g. where the works would be in cutting or sensitive receptors are screened by other buildings) hence presenting a likely worst-case scenario. Predicted construction noise levels include a 3dB façade reflection correction.

11.4.26 Construction noise levels have been predicted as the logarithmic average noise level over the daytime assessment period as an

$L_{Aeq,T}$[4,5]. The predictions are based on the following range of activities, considered to represent the likely worst-case activities, which are likely to continue for more than the significance time period thresholds (see paragraph 11.4.48):

a) site preparation and clearance;

b) utilities (water, electricity, gas and communications diversions);

c) earthworks (topsoil strips, cuttings and fills);

d) structures (culverts, retaining walls, abutment walls, foundations, etc);

e) road construction (sub-base - representing noisiest road construction activities); and

f) landscaping.

11.4.27 For each activity the likely variation in the working area for the period assessed has been taken into account.

11.4.28 Construction traffic travelling on haul routes across the Scheme has also been included within the assessment.

Construction Vibration

11.4.29 Groundborne vibration during the construction of the Scheme may potentially arise due to the use of compaction plant or rock-breaking machinery. Impact piling is also expected to be used for the construction of culverts. Impacts at sensitive receptors would be dependent on their proximity to the works, the intensity with which the equipment is operated and the intervening ground conditions.

11.4.30 BS 5228–2:2009+A1:2014 (BS 5228-2:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites – Vibration) provides a methodology for predicting typical levels of vibration from certain types of construction activities, based on case study data and empirical models. This and data from similar road construction projects have been used, where appropriate, to consider the likelihood that vibration from the works may exceed the thresholds for perception and disturbance.

Operational Noise

11.4.31 Traffic noise level calculations were carried out according to DMRB LA 111 which makes reference to the CRTN methodology. Noise levels were calculated across a grid of receptor positions over the study area to produce contours of noise level exposure. Additional calculations were also

conducted at all noise sensitive receptors throughout the study area. In line with the methodology of DMRB LA 111, the façade with the predicted greatest magnitude of change was selected for the impact assessment. However, where another façade was shown to experience an impact of 1dB or more over SOAEL, this has also been assessed and the final significance has been determined by looking at each of these impacts.

11.4.32 The traffic data used in the model were those forecasted under the Do-Something and Do-Minimum scenarios in the opening year and those in the future assessment year (long-term). In this case taken as 2024 for opening year, and 2039 for the future assessment year.

11.4.33 For the purposes of this assessment, the $L_{A10,18h}$ results are converted to the corresponding L_{Aeq} (see Glossary) scale for daytime noise (07:00 to 23:00), i.e. $L_{Aeq,16h}$. This provides a direct comparison with the quantitative L_{Aeq} criteria described later for assessing significance with respect to the government's noise policy (NPSE).

Operational night-time noise

11.4.34 The LA 111 methodology requires that night-time noise is also assessed. The L_{night} descriptor is used to represent the noise level at dwellings between the hours of 23:00 and 07:00. A procedure known as 'Method 3' from the Transport Research Laboratory (TRL) report PR/SE/451/02[11.16] was used for predicting L_{night} noise levels. Method 3 uses daily traffic flow data for converting predicted 18-hour daytime noise levels (LA10,18h) to night-time noise levels. This method was considered appropriate as there was nothing atypical in the proportionate traffic flow volumes for this route between daytime and night-time[6].

11.4.35 The assessment of impact magnitude for night-time noise follows the same method as that for daytime.

Assessment of Significance

Approach to assessment of effects – all sources and receptors

11.4.36 The method for identifying likely significant effects of noise and vibration from construction and operation of the Scheme, as required by the EIA Regulations, is aligned with DMRB LA 111 Noise and vibration and government noise policy.

11.4.37 It follows from government noise policy NPSE, and PPG-Noise

that thresholds should be set to define the onset of the following levels of effect:

a) Significant Observed Adverse Effect Levels (SOAEL) to identify the onset of significant impacts on health and quality of life.

a) Lowest Observed Adverse Effect Levels (LOAEL) to identify the onset of adverse impact on health and quality of life.

Significant adverse effects on health and quality of life

11.4.38 Where the calculated noise or vibration exceeds the relevant SOAEL threshold – criteria defined in Table 11-2, Table 11-5 and Table 11-8, then this is assessed as a likely significant adverse effect at each receptor[7]. Above the SOAEL threshold, such noise levels are perceived as 'present and disruptive' according to the assessment framework referred to in PPG-Noise. The NPSE states that these effects should be avoided.

Adverse effects on health and quality of life

11.4.39 The assessment also identifies likely adverse effects where the calculated noise or vibration is less than the SOAEL but greater than the relevant LOAEL. Between these thresholds, such noise levels are perceived as 'present and intrusive' according to the assessment framework referred to in PPG-Noise. The NPSE states that these effects should be mitigated and reduced to a minimum.

11.4.40 These effects may be identified in this assessment as likely significant adverse effects. This describes effects at lower noise exposures that are an adverse impact on health and quality of life and are assessed as 'significant' in the EIA, but which are 'not significant' in terms of government noise policy (paragraph 11.4.37).

11.4.41 In this case, the basis for determining a likely significant effect is primarily the change in noise caused by the Scheme, with consideration of other factors such as the existing level of noise exposure.

11.4.42 The DMRB LA 111 criteria used to assess the significance of effects (adverse and beneficial) are described in the following section.

Assessment criteria

11.4.43 The assessment uses criteria as set out in DMRB LA 111 that

respond to the requirements of:

a) government policy set out in NPSE, NPPF, and PPG-Noise;

b) relevant regulations, guidance, and standards; and

c) best practice as set by previous relevant projects.

Construction noise assessment criteria

11.4.44 Potential adverse effect thresholds in government policy terms have been established based upon DMRB LA 111 Noise and vibration which refers to the ABC Method described in BS5228-1:2009+A1:2014. These thresholds, described in Table 11-2, have been used to establish assessment criteria for construction noise levels. The numerical thresholds for the ABC method are defined in Table 11-3.

11.4.45 These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment. Note that although BS5228-1 only sets out these thresholds as an example for residential receptors, DMRB LA 111 requires them to be used for all types of receptor.

Table 11-2 LOAEL and SOAEL thresholds for construction noise at all receptors in terms of government policy (from DMRB LA 111 Noise and vibration)

Time Period	LOAEL	SOAEL
Day (07:00-19:00 weekday and 07:00-13:00 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1
Night (23:00-07:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1
Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1

11.4.46 The threshold of potential adverse effect described in Table E.1 of BS5228-1 according to the ABC method is reproduced in Table 11-3.

Table 11-3 Threshold of potential significant effect at dwellings according to ABC method (from Table E.1, BS 5228–1:2009 + A1:2014)

Assessment category and threshold value period	Threshold value, dB(A)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Other:	55	60	65

Assessment category and threshold value period	Threshold value, dB(A)		
	Category A	Category B	Category C
Weekday evenings (19:00 – 23:00) Saturdays (13:00 – 23:00) Sundays (07:00 – 23:00)			
Category A: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are less than these values Category B: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are the same as Category A values Category C: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are higher than Category A values.			

11.4.47 Using the DMRB LA 111 methodology, the construction noise impact level is determined from Table 11-4.

Table 11-4 Magnitude of impact and construction noise descriptions (from DMRB LA 111 Noise and vibration)

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

11.4.48 From DMRB LA 111 Noise and vibration, construction noise is taken as a significant effect for all NSRs where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding either of the following:

a) ten or more days or nights in any 15 consecutive days or nights, and

b) a total number of days exceeding 40 in any six consecutive months.

Construction vibration assessment criteria

11.4.49 DMRB LA 111 Noise and vibration, which refers to BS 5228-2:2009+A1:2014, states that Peak Particle Velocity (PPV) vibration levels are considered to be an appropriate vibration parameter to be used when considering construction vibration, and the standard provides guidance upon the 'instantaneous' human response to vibration in buildings in terms of overall vibration velocity levels (Table 11-5)8. These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment.

11.4.50 Table 11-5 LOAEL and SOAEL thresholds of likely effects of vibration for building occupants (from DMRB LA 111 Noise and

vibration, derived from BS 5228-2:2009+A1:2014)

Time period	LOAEL	SOAEL	Notes
All time periods	0.3mm/s PPV	1.0mm/s PPV	LOAEL is set at the lowest level at which vibration may be perceptible in residential environments.

11.4.51 Using the DMRB LA 111 Noise and vibration methodology, the construction vibration impact level is determined from Table 11-6.

Table 11-6 Magnitude of impact and vibration level (from DMRB LA 111 Noise and vibration)

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

11.4.52 Construction vibration is taken as a significant effect for all vibration sensitive receptors where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding either of the following:

a) Ten or more days or nights in any 15 consecutive days or nights.

b) A total number of days exceeding 40 in any six consecutive months.

11.4.53 Risk of damage to buildings from groundborne vibration is assessed using the criteria in Table 11-7. The criteria are derived from BS 5228-2:2009+A1:2014, and BS 7385, Part 2. This ensures there is no risk of the lowest damage category ('cosmetic') being exceeded, as defined in BS ISO 4866[11.17]. However, effects in terms of even cosmetic damage to buildings would occur only for vibration exposures much higher than the lowest perceptible levels.

Table 11-7 Vibration impact criteria for buildings (conservative criteria below which there is no risk of cosmetic damage)

Category of building	Peak particle velocity[i] (mm/s)	
	Transient[ii] vibration	Continuous[iii] vibration
Potentially vulnerable building	6	3
Structurally sound buildings	12	6

Notes:
[i] At the building foundation
[ii] Transient relative to building response e.g. from percussive piling
[iii] Continuous relative to building response e.g. from vibratory piling, vibrating rollers

Operational noise assessment criteria

11.4.54 Adverse effect levels have been set in in accordance with DMRB LA 111 Noise and vibration which references government noise policy (including NPPF, NPSE, and PPG-Noise). The thresholds also relate to the guidance from the World Health Organization (WHO) Guidelines for Community Noise[11.18], WHO Night Noise Guidelines for Europe[11.19], WHO Environmental Noise Guidelines[11.20], the Noise Insulation Regulations 1975, and best practice from other projects. These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment as shown in Table 11-8. DMRB LA 111 gives the daytime LOAEL and SOAEL thresholds in terms of a façade level[9] $L_{A10,18hour}$ parameter. As the L_{Aeq} is a more widely used parameter in literature and to be consistent with the night-time thresholds which are free-field L_{Aeq} values, the approximately equivalent free-field L_{Aeq} daytime values are also presented and are subsequently used throughout this chapter.

11.4.55 The $L_{Aeq,16h}$ has been calculated by subtracting 2dB from the $L_{A10,18h}$ values (method from TAG Unit A3 Environmental Impact Appraisal). There are other methods of conversion but this simple method retains a consistent relationship with the $L_{A10,18h}$ values thus ensuring that the LA 111 thresholds and NIR thresholds are consistently applied. Including the façade to free-field correction of 2.5dB and an additional 0.5dB to allowed for rounding, leads to an overall difference of 5dB between $L_{A10,18h,façade}$ levels and $L_{Aeq,16h\ free\text{-}field}$ levels in Table 11-8.

Table 11-8 Operational noise LOAELs and SOAELs for all receptors (from LA 111)

Time period	LOAEL	SOAEL
Day	55dB$L_{A10,18h}$ (façade) 50dB$L_{Aeq,16h}$ (free-field)	68dB$L_{A10,18h}$ (façade) 63dB$L_{Aeq,16h}$ (free-field)
Night	40dB $L_{night,outside}$ (free-field)	55dB $L_{night,outside}$ (free-field)

11.4.56 The magnitude of the impact and effect caused by short-term and long-term change in noise levels attributable to the Scheme is evaluated in accordance with Table 11-9 and Table 11-10 respectively.

Table 11-9 Magnitude of noise impact in the short term (from DMRB LA 111 Noise and vibration)

Noise change [dB(A)]	Magnitude of impact in the short term
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0 +	Major

Table 11-10 Magnitude of noise impact in the long term (from DMRB LA 111 Noise and vibration)

Noise change [dB(A)]	Magnitude of impact in the long term
0	No change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10.0 +	Major

11.4.57 The initial assessment of likely significant effect on noise sensitive buildings is determined using Table 11-11.

Table 11-11 Initial assessment of operational noise significance (from DMRB LA 111 Noise and vibration)

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

11.4.58 DMRB LA 111 Noise and vibration goes on to say that for NSRs where the magnitude of change in the short term is minor, moderate or major at noise sensitive buildings, Table 11-12 shall be used, together with the output of Table 11-11 to determine final significance.

Table 11-12 Determining final operational significance on noise sensitive buildings (from DMRB LA 111 Noise and vibration)

Assessment factor	Local circumstance	Influence on significance judgement
1	Noise level change (is the magnitude of change close to the minor to moderate boundary?)	1) Noise level changes within 1 dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significant effect. Noise level changes within 1 dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
2	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.
3	Absolute noise level with reference to LOAEL and SOAEL (by design this includes	1) A noise change where all do-something absolute noise levels are below SOAEL requires no modification of the initial assessment.

Assessment factor	Local circumstance	Influence on significance judgement
	sensitivity of receptor)	2) Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0dB (decibel) or over results in a likely significant effect.
4	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 magnitude change in the short term and/or long term is not a likely significant effect. 2) 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. 3) It is only 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.
5	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.
6	Likely perception of change by residents	1) If the project results in obvious changes to the landscape or setting of a receptor, it is likely that noise level changes will be more acutely perceived by the NSRs. 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.

11.4.59 For residential receptors where noise impacts occur in areas below the LOAEL, there would be no noise effect in government policy terms. However, there could be noise effects in EIA terms

for certain cases in very quiet, rural settings. This aligns with the requirement in DMRB LA 111 to consider 'changes to the landscape or setting', as referred to in the final row of Table 11-12. The absence of man-made sound is a factor (amongst other aspects of the setting) in assessing areas as having a particularly tranquil character. It is considered that there are no NSRs which have a particularly tranquil character within the study area, therefore where noise levels are predicted to be below the LOAEL, no significant noise effects occur.

11.4.60 Tranquillity is assessed as part of Chapter 7 Landscape

Cumulative effects assessment

11.4.61 The assessment of cumulative effects of this chapter topic both in-combination with other technical assessments on specific receptors and with other relevant developments have been assessed and are reported in the Cumulative Effects chapter, ES Volume 1 - Chapter 15 - Cumulative Effects.

11.5 Assessment Assumptions and Limitations

Construction

11.5.1 A detailed construction method and programme have been provided to assist with this assessment. The assessment has been undertaken by splitting the programme up into seven separate stages of works, for additional clarity. These are as follows: 'Site Clearance', 'Utilities', 'Earthworks', 'Structures', 'Road Construction', 'Landscaping', and 'Night-time works'. The programme has been subdivided into several sections delineated by chainage markers, and in many cases these works have been further divided into specific phases of works. The present approach adopted has been to provide predictions of the likely worst-case impacts from construction activities for each stage, and where appropriate, specific phases of works. The construction assessment receptor locations have been selected to represent groups of receptors along the Scheme and are shown in ES Volume 2 - Figure 11.1 - Noise study area and baseline noise contour map.

11.5.2 Predictions have been made by placing construction plant at the closest likely distance to each of the noise sensitive receptors, during each stage and associated phases of works. The works are, in general, undertaken by a team or gang of construction workers. Where multiple teams/gangs are proposed for specific works, then these have been spaced out in order to provide a more realistic operational condition, rather than having all plant associated with each team situated at the closest point to the receptor location. Where these cases arise, it has been assumed that they work in an area of 100m along the trace of the Scheme each day.

Operation

11.5.3 Road traffic flows and speeds were provided for the noise assessment by the project team. The details of the assumptions and limitations on traffic data on local road network can be found in Strategic Model Forecasting Report (Planning Document - Traffic Assessment).

11.5.4 Ordnance Survey (OS) MasterMap© Highways Network has been used to generate the road centre lines for modelling.

11.5.5 The Scheme and all existing roads other than the M5, are assumed to have conventional hot rolled asphalt surfaces with a texture depth of 1.5mm. The M5 has been assumed to have a low noise surface with a -3.5dB correction.

11.6 Consultation

11.6.1 A meeting was held with the EHO from North Somerset Council on 8 October 2021. The proposed monitoring locations and survey methodology were presented and provisionally agreed. This was followed up by written agreement via email on 16 November 2022. The EHO commented that he expected to see some improvements to the noise environment (during the operational phase) in areas such as the centre of Banwell as well as mitigation for the impacts due to the Scheme.

11.6.2 The issue of mitigation during the construction phase was discussed and it was agreed that this should be controlled via the Construction Environmental Management Plan (CEMP) and Section 61 applications.[10]

11.6.3 The EHO also requested a summary of the noise impacts for each route alignment considered and the justification for the choice of the proposed route. A link to the Options Appraisal report, which contains this information, was forwarded to the EHO by email on 13 October 2021.

11.6.4 Following stakeholder requests, additional short-term noise monitoring is proposed in the villages of Sandford, Winscombe and Churchill.

11.7 Baseline Conditions

11.7.1 Baseline noise conditions for the construction noise assessment have been determined from the noise survey as set out in Section 0 or from noise modelling where more suitable. Full details of the noise survey are presented in ES Volume 3 - Appendix 11.B - Baseline Noise Survey Report. It is expected that noise levels would not change substantially between the survey date and the start of construction. Most of the construction noise receptors have been identified as the most sensitive 'Category A', based on the noise survey and noise modelling showing existing noise levels to be below 65dB $L_{Aeq,day}$ (with the exception of receptor 1 which has been identified as 'Category B', with existing noise levels being between 65dB $L_{Aeq,day}$ and 70dB $L_{Aeq,day}$) and hence any changes in environmental noise levels between now and the start of construction would not change the construction noise assessment as reported.

11.7.2 Baseline noise conditions for the operational noise assessment have been determined through detailed modelling of road traffic noise, without the Scheme (Do-Minimum) in the opening year 2024.

11.7.3 ES Volume 2 - Figure 11.1 - Noise study area and baseline noise contour map shows the predicted traffic noise level contours for the operational baseline year (i.e. Do-Minimum 2024). Noise Important Areas (NIA) are shown to identify dwellings in areas of relatively high noise exposure recognised by Department for Environment, Food and Rural Affairs (Defra)[11.30].

11.7.4 Any additional traffic on the highway network associated with committed developments expected to be built out by 2024 is included in the traffic forecasts used for the assessment.

Future baseline

11.7.5 The Do-Minimum future year scenario (2039) represents the future baseline taking into account any expected traffic changes as a result of other committed development or infrastructure that would occur without the Scheme in operation by 2039. Only sensitive receptors that would be in existence prior to the opening year of the Scheme are included in the assessment in the future year.

11.8 Predicted Environmental Effects

Construction Noise

11.8.1 Construction noise effects have been calculated based upon reasonable worst-case assumptions taking into account the main construction activities expected and the likely durations and on-times of individual plant items, as has been provided. These details are set out in section 11.5 and ES Volume 3 - Appendix 11.C - Construction Assessment.

11.8.2 Given the level of detailed information provided, it has been possible to extract the likeliest worst-case activities for each of the construction stages considered for this assessment, which are most likely to give rise to significant effects:

a) Site clearance

b) Utilities

c) Earthworks

d) Structures

e) Road construction

f) Landscaping

g) Piling for stabilisation and ground consolidation

h) Night-time works

11.8.3 The majority of these activities are assumed to be linear (i.e. taking place along the proposed scheme) e.g. site clearance, utilities (drainage), earthworks, road construction and landscaping. The piling for stabilisation and ground consolidation works between chainage 1500-2650 have also been considered and included within the utilities works. The activities associated with the structures stage, which mainly centre around the Riverside Bridge and a few other specific locations, (see General Arrangement drawing BNWLBP-ARP-HGN-X_BB_Z-DR-CH-000001 to 000005) affect only some of the receptors.

11.8.4 Other activities which are likely to be required but are not assessed quantitatively are:

a) Boundary fencing

b) VRS installation

c) Kerbing

11.8.5 Table 11-13 sets out the predicted likely significant construction

noise effects. These predictions are based on noise levels from typical construction plant and equipment from BS 5228 and are without the benefit of specific mitigation e.g. in the form of noise barriers. The noise levels include noise from movements along the haul route.

Table 11-13 Summary of preliminary significant construction noise effects

Receptor	Impact	Phases that cause impact (when combined with haul road)	Number of sensitive receptors impacted
(1) Properties lying south of Ch 0+000	Major	Tree and vegetation clearance (10 days) Earthworks (42 days) Earthworks for surfacing (14 days)	7
	Moderate	Water mains (20 days) HV-LV diversions (10 days) Landscaping (15 days)	8
(2) SE corner of Summer Park Homes	Moderate	Tree and vegetation clearance (10 days)	11
(3) NW corner of Banwell village	Major	Tree and vegetation clearance (10 days) Earthworks (42 days) Earthworks for surfacing (14 days)	4
	Moderate	Water mains (20 days) HV-LV diversions (10 days)	30
(4) Stonebridge Farm	Major	Tree, vegetation and site clearance (18 days) Structures (10 days)	3
	Moderate	Water mains (25 days) Earthworks (62 days) Landscaping (14 days)	3
(5) Court Farm	Moderate	Tree, vegetation and site clearance (18 days)	2

Receptor	Impact	Phases that cause impact (when combined with haul road)	Number of sensitive receptors impacted
(6) Cook's Lane	Moderate	Utility diversions (40 days) Water main diversions (10 days) Earthworks (40 days) Piling for ground stabilisation/consolidation (19 days)	3
(7) Riverside	Major	Earthworks (40 days) Structures (10 days) Piling for ground stabilisation/consolidation (18 days)	2
	Moderate	Utility diversions (40 days) Water main diversions (10 days) Drainage (46 days) Surfacing (27 days)	1
(10) Towerbrook Farm	Moderate	Utility diversions (40 days) Water main diversions (10 days) Drainage (46 days) Earthworks (40 days) Surfacing (27 days)	8
(11) Castle Hill / Park Lane	Major	Drain diversions (15 days) Surfacing and V-ditches (23 days) Earthworks (Two separate 10 days)	28
	Moderate	V-ditches (12 days) V-ditches and road drainage (16 days)	15
Note: The significant adverse effect on some receptors near to the Banwell River crossing area would not change if the piling works duration is for more than 10 days, i.e. it is already assumed to be a significant effect for this duration and would remain significant if it took longer. However, given the nature of these particular works, it is not considered likely that the period of piling would be extended beyond this duration.			

Receptor	Impact	Phases that cause impact (when combined with haul road)	Number of sensitive receptors impacted
The noise level from the structures activity (that include piling) is lower than the noise level from the earthworks activity which has a longer duration (40 days) at these receptors.			

11.8.6 In summary, based on the preliminary assessment of 11 locations, as shown in ES Volume 2 - Figure 11.1 - Noise study area and baseline noise contour map, representative of residential areas situated closest to substantial road construction works, a total of nine are direct effects above the SOAEL. Of these, five are predicted to experience major impacts (Receptors 1, 3, 4, 7 and 11) during one or more construction activities, with a further four locations (Receptors 2, 5, 6 and 10) predicted to experience moderate impacts. In total, these receptors represent predicted major impacts at 44 sensitive receptors and predicted moderate impacts at a further 81 sensitive receptors. The predominant work phases resulting in these impacts are associated with Site Clearance (tree/shrub & vegetation removal), Utilities (water and electricity supply diversions), Earthworks (cut and fill) and Road Construction (base and blacktop surfacing) stages. It is likely that durations of these works would exceed ten days in 15 consecutive days or 40 days in any consecutive six months period, and therefore temporary direct likely significant adverse effects are predicted at these 125 receptors.

11.8.7 The above impacts all relate to noise levels predicted to exceed the SOAEL threshold. There would be further negligible or minor impacts affecting properties between the LOAEL and SOAEL which are assessed as not significant effects predicted noise levels would not exceed the SOAEL threshold.

11.8.8 Night-time working may be required to complete the tie-ins. Noise levels from these works would be negligible or minor impacts, which are assessed as not significant effects as the durations of these works would be very short and would not exceed ten days in 15 consecutive days or 40 days in any consecutive six months period.

Wider Area Construction Works (Wider Mitigation)

11.8.9 This section discusses the predicted noise levels arising from the ‘offline’ construction works within the wider network area, associated with the proposed traffic calming and pedestrian/cyclist accessibility improvement measures proposed

in the villages of Banwell, Sandford, Churchill and Langford. These measures are spread out across various designated areas in each village where road/pavement infrastructure and furniture improvements are proposed, and in many cases will result in associated construction works operating very close to existing NSRs, albeit for a relatively short duration in all cases.

11.8.10 These 'offline' areas are designated as two specific types of areas within the 'Wider Area' scheme development programme, these being 'Wider Network Mitigation' and 'Place Making Provision' measures. These have been clearly identified in the first column within Table 11-14 where a construction noise prediction has been assessed.

11.8.11 Table 11-14 presents the predicted noise impacts that would arise from these various construction work activities. They will all be of relatively short duration, each specific area lasting no longer than 60 days in total, and where the reported 'worst case' noise impact is unlikely to last for more than 20 days in most cases, particularly where the ongoing works travails in a linear fashion past the closest NSR locations. All noise calculations undertaken are in accordance with the procedures set out in paragraph 11.4.25.

11.8.12 The proposed new link road between Moor Lane and Riverside has also been assessed in this section, as an 'offline' feature of the Banwell Bypass scheme, situated just to the north of the Banwell River crossing. The construction calculations have been based upon the exact same construction processes that have been used for the main scheme alignment.

11.8.13 From the various work processes proposed, only those that are likely to continue for a duration more than 10 consecutive days in any 15-day period are considered (see section 11.5). These would account for the most prolonged period of 'reasonable worst-case' noise levels, of all the proposed 'offline' construction works situated mainly within the local communities of Banwell, Sanford, Churchill and Langford. These construction works will be comprised of the following construction processes:

a) Proposed footway/cycleway widening

b) Footway widening measures

c) Carriageway narrowing/footway widening

d) Traffic calming measures

e) Junction improvements

Table 11-14 Wider Network Measures (WNM), Place Making (PM) and Mead Road/Riverside Link – 'Worst Case' noise levels at the closest NSRs.

(WNM, PM, Moor Road Link Road)	Receptor	Impact	Work area locations and Total expected durations	Approximate Number of sensitive receptors impacted
WNM	(1) Towerhead Road.	Major	Catworthy Lane to Mead Lane (New 3m wide shared footpath/cycle path - 45 days)	5
WNM	(2) Greenhill Road & Sandford Primary School	Major	Greenhill Road Bus Stop and Footpath (15 days)	5
WNM	(3) Daniells Farm	Major	Greenhill Road to Churchill Green Footpath (New 3m wide shared footpath/cycle path/bridleway - 40 days)	1
WNM	(4) Brookside	Moderate	Greenhill Road to Churchill Green Footpath (New 3m wide shared footpath/cycle path/bridleway - 40 days)	1
WNM	(5) Newlaye & Rose Cottage -	Major	Churchill Gate Junction (Junction improvements - 20 days)	2
WNM	(6) Pitchbury & Park View	Major	Church Lane to Ladymead Footpath AX14/36/30 (Existing footpath improvements/widening - 25 days)	2
WNM	(7) Ladymead Lane	Major	Ladymead Lane to Church Lane Footpath AX14/34/10 (Existing footpath improvements/widening - 25 days)	7
WNM	(8) Flowerdown Road	Major	A371 / Banwell Junction (Junction improvements - 20 days)	4

(WNM, PM, Moor Road Link Road)	Receptor	Impact	Work area locations and Total expected durations	Approximate Number of sensitive receptors impacted
PM	(9) Banwell, close to Primary School	Major	West Street Car Park, nr School Close (Placemaking works - 45 days)	11 (inc Banwell Primary School)
Moor Road to Riverside	(10) * Withyhurst - South of Moor Road	Major	Earthworks – worst case phase	1

* Property already assessed as 'Major Adverse' for Banwell Bypass construction works activities

11.8.14 In summary, based on the preliminary assessment of all of the proposed Wider Network Measures, Placemaking Measures and Moor Road/Riverside link road works, and taking account of representative residential areas and other noise sensitive areas situated closest to construction works, a total of ten are direct effects above the SOAEL. Of these, nine are predicted to experience major impacts (Receptors 1, 2, 3, 5, 6, 7, 8, 9 and 10) during these construction activities, with a further one location (Receptor 4) predicted to experience a moderate impact. In total, these receptors represent predicted major impacts at 38 sensitive receptors and a predicted moderate impact at 1 sensitive receptor. It is likely that durations of these works would exceed ten days in 15 consecutive days, and therefore temporary direct likely significant adverse effects are predicted at these 39 receptors. It should be noted that none of the construction works for both the Wider Network Measures and Placemaking Measures are expected to last for longer than 60 days in total.

11.8.15 The above impacts all relate to noise levels predicted to exceed the SOAEL threshold. There would be further negligible or minor impacts affecting properties between the LOAEL and SOAEL which are assessed as not significant effects as predicted noise levels would not exceed the SOAEL threshold.

11.8.16 It is presently not expected that any of these works would require Night-time working.

11.8.17 No consideration has been given to potential areas where temporary mitigation measures i.e. vertical screens and hoardings, could be used in order to provide beneficial noise reductions at the closest and 'worst' affected NSRs. Potential

noise mitigation measures would be considered as part of the CEMP.

Construction Vibration – Banwell Bypass

11.8.18 Groundborne vibration during the construction of the Scheme is expected in certain localised locations along the route, due to the use of compaction plant during the earthworks and pavement works, and precast concrete driven piling activities during the construction of the box culverts. These activities have been assessed quantitively below.

11.8.19 The potential vibration effects of the compaction and driven piling activities have been considered within a study area of 100m (according to LA 111) with reference to BS 5228-2 (see Table 11-5) for human response, and BS 7385-2 to quantify the potential for risk of cosmetic damage to buildings (see). Human response predictions have been made at first floor level, as a worst-case, taking into account the vibration amplification which could occur higher up the building. Potential building damage predictions are made at the base of the building for comparison with the criteria set out inTable 11-7.

11.8.20 Table 11-15 shows the predicted construction vibration levels, in terms of PPV at first floor level of the nearest sensitive receptors for assessment against the human response criteria and Table 11-5. shows the construction vibration levels, in terms of PPV predicted at the base of the nearest sensitive receptors in order to assess the potential for building damage. Where the PPV is given as N/A, the receptor is at a distance greater than 100m from the works.

11.8.21 The PPVs shown are representative of the instantaneous worst-case vibration predicted on occasions for a period of time during the closest approach of the works to each sensitive receptor. Actual vibration levels will be dependent on ground conditions, coupling between the ground and the structure and resonances within the receptor building.

Table 11-15 Unmitigated construction vibration levels for human annoyance assessment (buildings only – worst-case predictions at first floor)

Receptor	Peak Particle Velocity (PPV, mm/s)		
	Earthworks	Road pavement surfacing	Driven piling
(1) Properties lying south of Ch 0+000	5.1	2.7	N/A
(3) NW corner of Banwell village	1.9	1.0	N/A
(4) Stonebridge Farm	1.3	0.7	N/A
(7) Riverside	2.3	1.2	8.2
(11) Castle Hill / Park Lane	3.7	2.0	N/A

Human Annoyance

11.8.22 The vibration levels predicted at first floor, would result in several receptors exceeding the SOAEL for human response to vibration, due to earthworks, pavement works or driven piling. The number of receptors represented by each assessment location which are expected to exceed SOAEL are also shown:

(1) Properties lying south of Ch 0+000 – 15 receptors

(3) NW corner of Banwell village – 4 receptors

(4) Stonebridge Farm – 2 receptors

(7) Riverside – 2 receptors

(11) Castle Hill / Park Lane – 35 receptors

11.8.23 Vibration levels at these receptors are above SOAEL but less than 10mm/s and therefore a moderate adverse impact is predicted during earthworks, pavement works and/or piling at these receptors.

11.8.24 Residents would be advised of the nature and likely duration of

vibratory works ahead of them taking place. For the likely worst affected properties, vibration impacts would be managed as appropriate using methods as described in section 11.9.

11.8.25 The general construction processes proposed for the main scheme alignment (compaction), where the use of intensive vibration generating plant has been identified, would largely follow a linear progression along the Scheme route, or would be of short duration (piling). The duration of the SOAEL exceedances are therefore estimated to be of short duration i.e. less than ten days, hence these impacts are assessed as not significant.

Table 11-16 Unmitigated construction vibration levels for building damage assessment (predicted at base of building/structure)

Receptor	Peak Particle Velocity (PPV, mm/s)		
	Earthworks	Road pavement surfacing	Driven piling
(1) Properties lying south of Ch 0+000	1.3	0.7	N/A
(3) NW corner of Banwell village	0.5	0.2	N/A
(4) Stonebridge Farm	0.3	0.2	N/A
(7) Riverside	0.6	0.3	2.1
(11) Castle Hill / Park Lane	0.9	0.5	N/A

Building Damage

11.8.26 The appropriate impact criteria for transient vibration at structurally sound properties is 12mm/s. The predicted vibration levels at all receptors are below the impact criteria of 12mm/s, however, the highest predicted vibration level of 2.1mm/s from driven piling at receptor 7 is also below the impact criteria of 6mm/s for potentially vulnerable buildings.

Vibration – 'Offline' Works for Wider Area construction works

11.8.27 Much of the proposed WNM and PM construction activities would likely bring vibration intensive plant into close proximity to properties. A qualitative assessment has been undertaken to provide a high level assessment of the potential vibration impacts that may occur during these 'offline' construction works. Table 11-6 provides guidance on the vibration thresholds for Human response within buildings. These levels would likely be exceeded in many cases where these works are situated in very close proximity to existing sensitive buildings.

11.8.28 Most of the proposed plant used for these works would produce low levels of vibration. However, all instances where compaction works are required, are likely to produce substantial levels of vibration, especially where these works would need to be in very close proximity to existing buildings.

11.8.29 To try and avoid and mitigate for these vibration effects, trials would be conducted at the start of works to establish actual vibration levels at the nearest sensitive receptors and where necessary, alternative plant or methods would be utilized e.g. more passes with compaction plant operating in 'static' mode or use of lower vibration equipment. In either case there is a trade-off between the vibration level experienced and the time taken to complete the works (i.e. potentially lower vibration impacts for a longer duration).

11.8.30 Where it is considered to impracticable to operate the vibratory rollers in 'static' mode, residents would be advised of the nature and likely duration of these vibratory works ahead of them taking place. For the likely worst affected properties, vibration impacts would require careful management as appropriate using BPM, these would be set out in the CEMP.

11.8.31 In summary, it would be expected that adverse vibration impacts would arise from vibratory compaction works, especially for much of the Placement Measures which would come extremely close to buildings facing onto Knightcott Road, Emmerson Terrace, East Street and Castle Hill. Appropriate mitigation measures would need to be implemented (when more detailed construction methods are established) in these areas to minimise these likely effects. As these impacts are estimated to be of short duration i.e. less than ten days, these impacts are assessed as not significant.

Operation

11.8.32 The predicted operational noise effects for the noise chapter are described with mitigation included as per the requirements of DMRB LA 111 and therefore all effects are as reported in Section 11.10.

11.9 Proposed Mitigation and Enhancement Measures

Construction Mitigation – Noise

11.9.1 Best Practicable Means (BPM), including for example, the selection of quieter equipment, location of equipment on site, switching off engines when not in use, the provision of acoustic enclosures (as specified in BS 5228 Annex B – Noise sources, remedies and their effectiveness) is assumed as embedded mitigation to control construction noise. Earth stockpiles or purpose-built perimeter noise fences may be effective where noise sensitive receptors are within around 200m of works. Beyond this distance, especially over soft ground, their effectiveness is likely to be limited.

11.9.2 Further details of construction noise mitigation measures will be included in the CEMP and Section 61 applications to the local authority.

Construction Mitigation – Vibration

11.9.3 As for construction noise above, BPM is assumed as embedded mitigation. For vibration this should include using low vibratory construction methods where practicable e.g. augured piling as opposed to impact piling methods.

11.9.4 Where specific vibration impacts are predicted as a result of compaction activities close to receptors, alternative plant or methods should be used e.g. more passes with compaction plant operating in 'static' mode or use of lower vibration equipment. In either case there is a trade-off between the vibration level experienced and the time taken to complete the works (i.e. potentially lower vibration impacts for a longer duration).

11.9.5 Further details of construction vibration mitigation measures will be included in the CEMP and Section 61 applications to the local authority.

Operation

11.9.6 The horizontal alignment of the Scheme has been designed to avoid built-up areas with noise sensitive receptors as far as is practicable.

11.9.7 To ensure that mitigation in the form of noise fence barriers is

practicable and sustainable, the provision has been subject to the following tests:

a) effectiveness at reducing noise impacts and significant effects

b) consideration of the monetary noise health benefits compared to cost of the mitigation (value for money)

c) other environmental effects potentially caused by the mitigation (e.g. landscape or visual effects).

d) stakeholder engagement

11.9.8 As part of the mitigation design a noise barrier is included along the northwest side of the proposed link road connecting with East Street (ES Volume 2 - Figures 11.1 to 11.5). The fence barrier is approximately 340m in length and is 3m high relative to the road surface with a short taper down to 1m at the southern end to integrate it into the landscape as part of the visual design.

11.9.9 Other mitigation was assessed but was found not to meet the requirements of one of more of the tests set out above, in particular not being effective at reducing noise impacts or significant effects coupled with poor value for money.

11.10 Residual Environmental Effects (following mitigation)

Construction Noise

11.10.1 Due to the early stage of the construction works planning, detailed mitigation has not yet been designed into the Scheme and therefore it is not possible to quantify the effects of construction noise mitigation precisely and the residual effects should be assumed to be as presented in Section 11.10 as a worst-case. It should however be feasible to reduce some of the impacts through best practicable means (BPM) and localised noise barriers. Localised noise barriers may reduce noise levels at sensitive receptors by up to around 5 and 10dB dependent on proximity amongst other factors.

Construction Vibration

11.10.2 Taking into account the short duration of compaction works or piling in any one location, it is not anticipated that there will be any significant construction vibration effects.

Operation

11.10.3 Daytime and night-time traffic noise levels within the study area have been predicted and are assessed for:

a) Residential receptors exceeding the SOAEL

b) Residential receptors between the LOAEL and SOAEL

c) Non-residential receptors

11.10.4 The following figures have been produced to present the impacts of the Scheme (together with the baseline presented on Image 11.1):

a) ES Volume 2 - Figure 11.2 Operational Do-Something Noise Level Contour Map - Opening Year (2024). This shows the noise level contours with the Scheme in operation in the opening year.

b) ES Volume 2 - Figure 11.3 Operational noise difference contour map – Opening Year (2024). This shows the changes in noise resulting from the operation of the Scheme between the Do-Minimum and Do-Something scenarios in the opening year (2024).

c) ES Volume 2 - Figure 11.4 Operational Noise Difference Contour Map Between Do-minimum Opening Year and Do-

Something Future Year (2039). This shows the change between the Do-Minimum in the opening year (without Scheme) and the Do-Something in the future year (2039) with the Scheme in operation.

d) ES Volume 2 - Figure 11.5 Operational Noise Significantly Affected Receptors. This shows the significantly affected receptors with beneficial or adverse effects.

11.10.5 These figures should be referred to for the following assessment description. The noise contours shown on these figures are representative of the noise levels at 4m above local ground level. ES Volume 3 - Appendix 11.D - Operational Noise Assessment Results provides tabulated noise level results at all NSRs within the study area.

11.10.6 Table 11-17 summarises the residual likely significant effects on noise sensitive receptors within the operational noise study area. These results include daytime, night-time, direct and indirect effects. All operational noise effects are considered to be permanent effects.

Table 11-17 Summary of preliminary likely significant operational noise effects.

Type of effect	Number of dwellings	Number of non-residential noise sensitive receptors
Significant Adverse above the SOAEL	16*	0
Significant Beneficial above the SOAEL	134	1
Significant Adverse (between LOAEL and SOAEL)	32	0
Significant Beneficial (between LOAEL and SOAEL)	199	3
Not significant	935	8

* At 12 of these dwellings, situated on Summer Lane, these effects are only anticipated in the future year, as a result of increased traffic from new developments.

Residential receptors

11.10.7 There are 16 dwellings predicted to experience likely significant adverse effects above the SOAEL. For 12 properties on Summer Lane this would be as a result of traffic increases in the future year scenario on Summer Lane affecting the closest properties

to the road. Five of these properties would be subject to major impacts and seven properties would be subject to moderate impacts. There would be a negligible effect at these properties in the opening year but as a result of the future HIF development (details are in Chapter 1), traffic flows are predicted to increase substantially on Summer Lane in the future. Three properties subject to effects above the SOAEL are located on Castle Hill where there would be minor impacts in the opening year. The same impact would apply to one property located on Wolvershill Road close to the Scheme.

11.10.8 There are 134 dwellings predicted to experience at least a 1dB reduction in noise from a starting noise level above SOAEL (in fact these are all experiencing a minimum 3dB reduction in noise on at least one façade). These are situated mainly around East Street, Castle Hill, West Street and Knightcott Road due to reductions in traffic through the centre of Banwell, together with a small number of properties closest to Wolvershill Road. These dwellings are predicted to experience a likely significant beneficial effect above the SOAEL.

11.10.9 Thirty-two dwellings are predicted to experience a likely significant adverse effect between the LOAEL and the SOAEL. The majority of these are facing Scheme roads, including the eastern edge of Summer Lane Park Homes, properties to the north-east of Wolvershill Road and on Cooks Lane, properties on Moor Road, properties to the north of the Scheme on Riverside and Eastermead Lane.

11.10.10 Likely significant beneficial effects between LOAEL and SOAEL are predicted at 199 dwellings, including 18 dwellings to be occupied within a committed development on Wolvershill Road. Similar to the beneficial effects above SOAEL, these are situated predominantly around East Street, Castle Hill, West Street, Knightcott Road and Wolvershill Road but extend further out where existing noise levels are at a lower level.

Non-residential receptors

11.10.11 Banwell Methodist Church is predicted to experience a likely significant beneficial effect and is currently exceeding the SOAEL as a result of the Scheme. This receptor is located on West Street and approximately 600m from the Scheme.

11.10.12 Banwell village hall and Banwell Primary School, are predicted to experience likely significant beneficial effects between the LOAEL and SOAEL as a result of the Scheme. The levels of beneficial impact would be moderate and major in the opening year respectively. They are situated just off from West Street, in Banwell.

11.10.13 There are no adverse impacts on non-residential receptors during operation of the Scheme.

Noise important areas (NIAs)

11.10.14 There is one NIA (NIA ID 3830) that lies within the Banwell study area on the M5. The properties that lie within both the study area and the NIA are industrial and therefore not noise sensitive. The level of impact at properties in this area would be negligible in the opening year and future year of the Scheme.

Noise insulation eligibility

11.10.15 LA 111 (Annex E/2) requires that potential noise insulation eligibility is considered as part of the assessment. There are three dwellings that are predicted to exceed the criteria to be eligible for noise insulation under the Noise Insulation Regulations. These are residential dwellings situated on Castle Hill where the Scheme ties in to the existing road.

Effects beyond 600m from the Scheme

11.10.16 LA 111 requires consideration of impacts on noise sensitive receptors alongside non-scheme road links beyond 600m from the Scheme (new and altered roads) and bypassed road links where noise levels change by 1dB(A) or more in the opening year, or 3dB(A) in the future year.

11.10.17 In the wider area where the current traffic patterns would be indirectly influenced as a result of the proposed scheme, dwellings located within 50m from the road edges would be considered in the assessment. This includes areas affected by the Wider Area construction works (Wider Mitigation) although no account has been taken of the speed limit reductions through the villages of Winscombe, Sandford and Churchill. As described in paragraph 11.4.12 this is not expected to alter the conclusions presented in this assessment.

11.10.18 No road links, beyond 600m from the Scheme, have been identified to give an increase noise levels greater than 1dB(A) in the opening year. A 3dB(A) change in the future year flow has been identified on the northbound A370 slip road between the B3440 Bristol Road and M5 Junction 21. This is a short section of road adjacent to the A370 so although there are houses within 50m, it is unlikely that a 3dB change would be realized and hence this has not been assessed further.

11.10.19 At the request of the local planning authority further detail is presented below for the villages of Winscombe, Sandford and Churchill, although these locations do not meet the LA 111

criteria for inclusion in the study area. Table 11-18 presents the predicted annual average weekday traffic flows from the traffic modelling and the resultant predicted road traffic noise levels at a reference distance of 10m from the road edge.

Table 11-18 BNL changes in Winscombe, Sandford and Churchill

Area	Road	Traffic flow, AAWT-18hr*			Predicted road side noise levels @10m, $dBL_{A10, 18h}$			Noise level difference, dB	
		DM2024 (without scheme)	DS2024 (with scheme)	DS2039 (with scheme)	DM2024 (without scheme)	DS2024 (with scheme)	DS2039 (with scheme)	Short-term (opening year)	Long-term (future year)
Winscombe	Church Road	3231	3350	3612	62.1	62.5	64.6	0.4	2.5
Winscombe	A371 Banwell Road	8148	8508	10576	69.0	69.1	69.8	0.1	0.8
Winscombe	A371 Woodborough Road	5739	6326	8459	62.9	63.2	64.4	0.3	1.5
Churchill	A368 Dinghurst Road	9831	11304	13407	67.1	67.5	68.1	0.4	1.0
Sandford	A368 Station Road	8453	10507	12748	66.4	67.0	67.7	0.6	1.3
Sandford	A368 Towerhead Road	8155	10270	12645	66.3	66.9	67.7	0.6	1.4
Sandford	A368 Greenhill Road	9106	10707	12807	66.9	67.4	68.0	0.5	1.1

* Annual average weekday traffic (06:00 to 00:00)

11.10.20 Table 11-18 shows that noise levels through the villages of Winscombe, Sandford and Churchill are not expected to meet the threshold of an increase of 1dB(A) in the opening year or 3dB(A) in the future year and hence have not been considered further and would not result in any significant noise effects.

Scheme compliance with government policy

11.10.21 The government policy objectives (see paragraph 11.3.8) are defined in the *England National Application Annex* to DMRB LA 111 *Noise and vibration*. In accordance with the assessment requirements, the scheme's compliance against these objectives is set out in Table 11-19.

Table 11-19 Scheme compliance with government policy

Government policy objective (NPSNN)	Compliance with policy requirements
Aim 1: Avoid significant adverse impacts on health and quality of life from noise as a result of the new development. (NPSE describes this aim in relation to impacts above the SOAEL)	Significant adverse impacts from construction noise and vibration would be avoided through construction BPM, mitigation and noise insulation where established thresholds are exceeded. These controls would follow the principles and processes set out in the EMP to be developed alongside the ES. Some significant adverse effects are reported in this assessment for construction noise taking into account all mitigation measure that can be committed to at this stage given the level of the details of the construction planning. Mitigation, as far as is practicable and sustainable, would be detailed in the NVMP that will be prepared as required by the EMP which will be produced alongside the ES, following dialogue with local authorities. For operational noise, a number of properties are predicted to be subject to significant adverse effects above the SOAEL. Screening and other potential mitigation measures have been considered where effective to practicably, and sustainably, avoid these impacts. Noise insulation measures will be offered where appropriate (see paragraph 11.10.15).
Aim 2: Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development. (NPSE describes this aim in relation to impacts	Adverse impacts from construction noise and vibration would be mitigated and minimised through construction BPM. These controls would follow the principles and processes set out in the EMP to be developed alongside the ES. Some significant adverse effects for operational noise between the LOAEL and SOAEL are reported in this assessment. These would not

Government policy objective (NPSNN)	Compliance with policy requirements
between the LOAEL and SOAEL)	exceed the SOAEL in noise policy terms. All appropriate measures will be applied in these cases as far as it is practicable and sustainable to do so, to mitigate and minimise these effects.
Aim 3: Contribute to improvements to health and quality of life through the effective management and control of noise, where possible. (Applies to all noise levels)	Beneficial effects would occur at communities, outdoor amenity areas and at some dwellings within NIAs as a result of the scheme.

Potential effects due to climate change

11.10.22 Climate change impacts which have the potential to impact on receptors in combination with the impacts of the proposed development have been considered.

11.10.23 Relative changes in propagation of sound due to changes in temperature, humidity and wind speed/direction are likely to be negligible, taking into account the moderate worst-case meteorological conditions assumed in the calculation methodology and the relatively short distances under consideration.

11.10.24 In addition, the mean and maximum daytime and night-time temperatures could have an indirect effect on the average internal noise levels (within buildings) if windows are open more frequently. However, the noise assessment is based on noise level change rather than simply absolute noise levels inside buildings. Therefore, the reported noise effects do not alter when climate change is considered.

11.10.25 Although residents may need to open windows more often, that would also be true in future years in the absence of the Project, hence the occurrence of an impact would be equally as likely relative to Do-Minimum.

11.10.26 Stronger wind conditions have the potential to lead to additional maintenance requirements for acoustic barriers, however, stronger winds are not considered to be capable of directly affecting the performance of noise barriers. Instead, maintenance regimes for the proposed barriers would be adapted accordingly.

11.10.27 The in-combination climate change impact assessment concludes that there is no change to the significance of the

effects identified in this chapter associated with vulnerability to climate change. Further details can be found in ES Volume 3 - Appendix 14G - ICCI Assessment

11.11 Monitoring

11.11.1 The requirements of DMRB LA 111 Noise and vibration (Section 4) regarding monitoring and evaluation shall be followed.

11.11.2 For construction this will include:

a) Verification that specific noise and vibration mitigation measures are in place for activities where there is a potential for likely significant effects to occur in their absence.

b) Measurement of noise and/or vibration at key locations to be agreed with the local EHO and identified in the CEMP and Section 61 applications.

c) Checking that noise and vibration management procedures and practices are sufficient to ensure that adverse effects are no worse than set out in this report.

11.11.3 For operation this will include:

a) Ensuring mitigation measures included with the project design are incorporated with the as-built project. Where they are not included, ensuring resultant noise levels, taking account of any additional mitigation installed but not included in the assessed design, are no higher than set out in the project assessment.

b) Ensuring specifications of noise mitigation measures meet design specifications.

11.11.4 The prediction and assessment methodologies set out in section 11.4 Assessment methodology of this chapter will be used to support the verification of the effectiveness of any mitigation measures which are incorporated into the Scheme.

11.11.5 Where access is required onto private land for monitoring purposes, prior consultation would be undertaken with the occupier and appropriate arrangements would be made to enable the monitoring to be undertaken.

11.12 Summary and Conclusions

Construction assessment

11.12.1 A construction noise assessment has been undertaken based upon the present available data provided by the project team.

11.12.2 The principal activities considered with the potential to cause noise effects are site clearance (trees/shrubs and vegetation), earthworks (cuts/fills), piling for ground stabilisation/consolidation, structures and road construction (surfacing and V-ditches) works.

11.12.3 Based on the likely worst-case assessment presented for construction noise, adverse noise effects are predicted at 125 noise sensitive receptors adjacent to the Banwell Bypass. Of these, there are predicted to be major impacts at 44 residential receptors and moderate impacts at 81 residential receptors which are assessed as temporary likely significant adverse effects. These are direct effects above the SOAEL threshold, as described in government policy. No adverse noise effects are predicted at non-residential receptors from the main Scheme works.

11.12.4 Within Banwell and the neighbouring villages, likely significant adverse effects have been predicted at 39 noise sensitive receptors (including residential and non-residential receptors) during the daytime only. Of these, 38 are predicted to be major adverse impacts and one moderate adverse impact. These are assessed as temporary likely significant adverse effects. These are direct effects above the SOAEL threshold, as described in government policy.

11.12.5 It is likely that construction vibration levels generated by road surfacing activities, short-duration impact piling at receptor locations close to the scheme and due to wider mitigation and placemaking measures would result in adverse impacts above the SOAEL for human annoyance. However, the duration of these impacts is estimated to be less than ten days, hence these effects are assessed as not significant based on the LA 111 assessment criteria (paragraph 11.4.52). The building damage thresholds are not predicted be exceeded at any receptors.

Operation assessment

11.12.6 Daytime and night-time traffic noise levels within the study area have been predicted and are assessed in terms of residential receptors and non-residential receptors with the assessment

methodology set out in this report.

11.12.7 There are 16 dwellings predicted to experience likely significant adverse effects above the SOAEL. For 12 properties on Summer Lane this would be as a result of traffic increases in the future year scenario on Summer Lane. Five of these properties would be subject to major impacts and seven properties would be subject to moderate impacts. There would be a negligible effect at these properties in the opening year but as a result of the future HIF development (details are in Chapter 1), traffic flows are predicted to increase substantially on Summer Lane in the future. Three properties subject to effects above the SOAEL are located on Castle Hill where there would be minor impacts in the opening year. The same impact would apply to one property located on Wolvershill Road close to the Scheme.

11.12.8 There are 134 residential receptors together with Banwell Methodist Church which are assessed as being subject to likely beneficial effects above SOAEL where there is at least a 1dB(A) impact as a result of the proposed scheme. These receptors are mostly situated on East Street, Castle Hill, West Street and Knightcott Road due to reductions in traffic through the centre of Banwell, together with a small number of properties closest to Wolvershill Road.

11.12.9 There are 32 residential receptors which would be subject to likely significant adverse effects between the LOAEL and SOAEL. The majority of these are facing Scheme roads, including the eastern edge of Summer Lane Park Homes, properties to the north-east of Wolvershill Road and on Cooks Lane, properties on Moor Road, properties to the north of the Scheme on Riverside and Eastermead Lane.

11.12.10 There are 199 residential receptors, including 18 dwellings to be occupied within a committed development on Wolvershill Road, which would be subject to likely significant beneficial effects between the LOAEL and SOAEL. The majority of these are located around East Street, Castle Hill, West Street, Knightcott Road and Wolvershill Road but extend further out where existing noise levels are at a lower level.

11.12.11 Banwell Methodist church is predicted to experience a likely significant beneficial effect and is currently exceeding the SOAEL as a result of the Scheme.

11.12.12 A further two non-residential receptors: Banwell Primary School and Banwell village hall would be subject to likely significant beneficial effects between LOAEL and SOAEL.

Noise Important Areas

11.12.13 There is one noise important area, within the study area, situated on the M5. Properties within this NIA would be subject to negligible impacts as a result of the Scheme.

Compliance against the three aims of Government policy (NPSNN)

11.12.14 Compliance with Government policy objectives (defined in the England National Application Annex to LA 111) has been achieved by means of mitigation measures. This includes scheme alignment and noise screening. The mitigation would minimize noise impacts at residential communities and sensitive non-residential receptors. Where significant adverse effects would remain, all appropriate measures have been applied as far as it is practicable and sustainable to do so to avoid, mitigate and reduce these effects.

11.13 References

11.1 Highways England, Transport Scotland, Welsh Government and Department for Infrastructure Northern Ireland, “Design Manual for Roads and Bridges LA 111, Noise and Vibration,” 2020.

11.2 “The Environmental Noise (England) Regulations 2006. SI 2006/2238,” HMSO, London, 2006.

11.3 “The Environmental Noise (England) (Amendment) Regulations 2018. SI 2018/1089,” HMSO, London, 2018.

11.4 “The Environmental (Amendment etc.) (EU Exit) Regulations 2019. SI 2019/458,” HMSO, London, 2019.

11.5 “Control of Pollution Act 1974. c.40,” HMSO, London, 1974.

11.6 “Land Compensation Act 1973. c.26,” HMSO, London, 1973.

11.7 The Noise Insulation Regulations 1975. SI 1975/1763,” HMSO, London, 1975.

11.8 Department for Environment, Food & Rural Affairs, “Noise Policy Statement for England,” 2010.

11.9 Ministry of Housing, Communities & Local Government, “National Planning Policy Framework,” 2021.

11.10 Ministry of Housing, Communities & Local Government, “Planning Practice Guidance - Noise - GOV.UK,” 6 March 2019. [Online]. Available: https://www.gov.uk/guidance/noise--2. [Accessed 17 May 2021].

11.11 Department of Transport and Welsh Office, “Calculation of Road Traffic Noise,” TSO, London, 1988.

11.12 “BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Noise,” BSI, 2014.

11.13 “BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Vibration,” BSI, 2014.

11.14 BS 7385-2:1993, Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration, BSI, 1993.

11.15 Department for Transport, Transport use during the coronavirus (COVID-19) pandemic 3 June 2020. https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic

11.16 PG Abbott and PM Nelson, “PR/SE/451/02, Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping,” TRL, 2002.

11.17 BS ISO 4866:2010, Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures, BSI, 2010.

11.18 World Health Organization, “Guidelines for community noise,” 1999.

11.19 World Health Organization, “Night Noise Guidelines For Europe,” 2009.

11.20 World Health Organization, “Environmental Noise Guidelines for the European Region,” 2018.

11.30 UK Government, “Noise Action Planning Important Areas Round 2 England,” 2021. [Online]. Available: https://data.gov.uk/dataset/fc786717-3756-4fd1-9c7d-c082331e40e4/noise-action-planning-important-areas-round-2-england.

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[1] PPG-Noise (noise exposure hierarchy table) defines an unacceptable adverse effect as ‘present and very disruptive’, with outcomes described as ‘Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory’.

[2] BNL: the ‘Basic Noise Level’ at a reference distance of 10m from the nearside carriageway edge, as defined in Calculation of Road Traffic Noise (CRTN).

[3] DMRB LA 111 Noise and vibration Paragraph 1.4 notes that: “Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects”.

[4] The equivalent continuous sound level ($L_{Aeq,T}$) is the level of a notional steady sound, which at a given position and over a defined period of time (T), would have the same A-weighted acoustic energy as the fluctuating noise.

[5] For the purposes of this assessment, T is assumed to be a 12-hour working day.

[6] Appendix A2 of DMRB LA 111 Noise and vibration notes that TRL Method 3 provides reliable results for most UK roads. Exceptions to this can include roads where the proportion of night-time traffic to daytime traffic is atypical.

[7] Any beneficial effects would also be identified due to noise reductions.

[8] BS 5228-2 notes in Table B.1: 'The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.' Consideration has been given to other guidance with regard to time varying exposure where appropriate – the BS 6472 guidance makes use of the 'Vibration Dose Value' metric (VDV).

[9] Including a correction of +2.5dB(A) to the free-field noise level to account for the reflection of noise from the façade. 11.1.1.

[10] Section 61 prior consent is an agreement between the developer and the council, which can outline a noise and vibration mitigation plan. With this agreement in place it protects the developer from legal action being taken under Section 60 of the Control of Pollution Act 1974 or Section 80 of the Environmental Protection Act 1990.