

Welsh Government
M4 Corridor around Newport
Environmental Statement Volume 1
Chapter 13: Noise and Vibration

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13 Noise and Vibration

13.1 Introduction

13.1.1 This chapter of the Environmental Statement (ES) describes the noise and vibration effects that may arise during the construction and operational phases of the Scheme. The key objective of the noise and vibration assessment is to identify any adverse or beneficial effects that may arise during these phases of the Scheme. The key objectives of the assessment are to:

- determine the significance of effects on noise and vibration sensitive receptors (NVSRs) arising from the permanent changes in road traffic noise associated with the Scheme through the consideration of noise change, absolute levels and noise nuisance;
- determine the significance of effects on NVSRs from the temporary noise and vibration levels that would arise during the construction of the Scheme; and
- ensure that the most appropriate and effective mitigation measures have been included to minimise adverse effects without causing adverse effects in other environmental areas.

13.1.2 An explanation of noise and vibration terms is provided in Appendix 13.1, which includes example sound levels for various sources and situations.

13.2 Legislation and Policy Context

13.2.1 Noise and vibration can have a significant effect on the environment and on the quality of life enjoyed by individuals and communities. In this respect, the planning system promotes sustainable economic growth whilst ensuring that the quality of life is not unreasonably affected.

13.2.2 National standards and planning policy are primarily concerned with noise and vibration effects at residential receptors and vibration effects on structures. Noise and vibration effects at residential receptors for new or modified road schemes, including consequential changes on related roads, are considered primarily in terms of the noise change and change in annoyance due to increases or decreases in road traffic noise. However, in some circumstances, it is also relevant to consider the possibility of health and quality of life effects, such as sleep disturbance.

13.2.3 Vibration effects on buildings and structures may be considered in terms of the potential for damage to occur. However, vibration levels at which even cosmetic damage can occur are relatively high and, generally, these are only generated by blasting or from some other construction activities that would need to occur in very close proximity to buildings. For a reasonably maintained road without speed control measures, such as speed humps, vibration arising during operation is likely to be minimal. In relation to vibration, the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 (HD 213/11) para 3.32 (Highways Agency *et al.*, 2011) states that:

'PPVs [peak particle velocity] in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s. Normal use of a building such as closing doors, walking on suspended wooden floors

and operating domestic appliances can generate similar levels of vibration to those from road traffic.' (Paragraph 3.32)

- 13.2.4** On this basis, vibration effects associated with road traffic on the completed highway are considered likely to be negligible and are not considered further, i.e. this element, as relating to the potential for building damage and human exposure to vibration, has been scoped out of the EIA process. However, vibration effects during construction are potentially likely and are considered within this chapter.

Relevant Legislation

- 13.2.5** The Environmental Noise Directive (2002/49/EC) (END) provides the general European Union (EU) policy context under which Wales is implementing policies to manage environmental noise, including traffic noise. Other relevant legislation is described in Appendix 13.1 and identified below.

- Control of Pollution Act 1974.
- Environmental Noise (Wales) Regulations 2006.
- Land Compensation Act 1973.
- Noise Insulation Regulations 1975 (as amended 1988).
- Well-being of Future Generations Act (Wales) 2015.

Policy Context

- 13.2.6** This section sets out relevant policy at the national and the local level. These policies are introduced below and discussed in further detail in Appendix 13.1.

National Planning Policy

- 13.2.7** Planning Policy Wales (Welsh Government, 2016a) provides the following introduction to national planning policy with regards to noise (and by implication vibration):

'Noise can affect people's health and well-being and have a direct impact on wildlife and local amenity. Noise levels provide an indicator of local environmental quality. The objective of a policy for noise is to minimise emissions and reduce ambient noise levels to an acceptable standard. Noise Action Plans, drawn up by the Welsh Ministers in relation to Wales under the Environmental Noise Directive, and the Wales Regulations, aim to prevent and reduce environmental noise where necessary and preserve environmental noise quality where it is good. They are a planning consideration in the use and development of land.'

- 13.2.8** The goal of the Transport Strategy for Wales 'One Wales: Connecting the Nation' is to promote sustainable transport networks that safeguard the environment while strengthening the country's economic and social life. The transport strategy identifies a series of high level outcomes. Outcome 15 is to '*improve the positive impact of transport on the local environment*' (Welsh Assembly Government, 2008).

- 13.2.9** National planning guidance on noise is contained within Technical Advice Note (Wales) 11 (TAN 11) (Welsh Government, 1997). This document does not

provide any specific guidance relating to the assessment of noise from new or altered roads but does refer to the Noise Insulation Regulations 1975.

Local Policy

13.2.10 The Scheme falls within the administrative areas of Monmouthshire County Council and Newport City Council.

Monmouthshire County Council

13.2.11 Monmouthshire County Council published their adopted Local Development Plan in February 2014 (Monmouthshire County Council, 2014).

13.2.12 Policy EP1 of the Local Development Plan seeks to prevent development proposals that would result in unacceptable risk or harm due to air, light, noise or water pollution, contamination or land instability.

Newport City Council

13.2.13 Newport City Council published their adopted Local Development Plan in January 2015 (Newport City Council, 2015). The Local Development Plan has a number of strategic and general policies relating to noise, summarised below.

- SP14: Transport proposals will be supported where they result in environmental improvements, including noise reduction.
- GP2: Development will be permitted where there will not be a significant adverse effect on local amenity, including in terms of noise, disturbance etc.
- GP4: Development proposals should be designed to avoid or reduce noise pollution.
- GP6: Good quality design will be sought in all forms of development. The aim is to create a safe, accessible, attractive and convenient environment. All development should maintain a high level of pedestrian access, connectivity and be laid out so as to minimise noise pollution.
- GP7: Development will not be permitted which would cause or result in unacceptable harm to health because of land contamination, dust, instability or subsidence, air, heat, noise or light pollution, flooding, water pollution, or any other identified risk to environment, local amenity or public health and safety.

13.3 Assessment Methodology

13.3.1 This noise and vibration assessment has considered the significance of effects on NVSRs of operational changes in road traffic associated with the Scheme on noise change and absolute levels and noise nuisance, including an assessment of the effectiveness of proposed mitigation measures. This assessment of operational effects has included consideration of effects arising on the existing road network (including the existing M4) and on the proposed new section of motorway.

13.3.2 The assessment has also evaluated the significance of temporary noise and vibration effects on NVSRs associated with the construction of the Scheme. It should, however, be noted that construction activities, and hence effects, are primarily associated with the proposed new section of motorway. The physical

works associated with the Complementary Measures are limited and would generally occur within the footprint of the existing road alignment/land take.

13.3.3 This chapter of the ES considers the potential effects of noise and vibration on human receptors and structures only. Noise and vibration effects on ecological receptors are considered in Chapter 10: Ecology and Nature Conservation but these are based upon the noise and vibration predictions reported within this chapter.

Relevant Guidance

13.3.4 The standards and guidance upon which this methodology is based are described in outline in the paragraphs below and presented in more detail in Appendix 13.1. An explanation of the terms used is also provided in Appendix 13.1.

Department of Transport (Welsh Office 1988) CRTN

13.3.5 Calculation of Road Traffic Noise (CRTN) (Department of Transport/Welsh Office, 1988) provides the Welsh Government's approved methodology for calculating noise from road traffic. The calculations are based on the traffic flow data and the spatial relationship between the receptor and the road. Noise levels are determined using the L_{A10} index, which is the 10th percentile of the A-weighted sound pressure level. The index is normally determined for an 18-hour day (06.00 - 24.00 hours) based on the annual average weekday traffic. CRTN also provides methodologies for noise surveys.

DMRB

13.3.6 The DMRB Volume 11, Section 3, Part 7 (Highways Agency *et al.*, 2011) Noise and Vibration (HD 213/11) provides guidance on assessing the noise and vibration impacts from road schemes. This has been updated in places by Interim Advice Note 185/15 (Highways Agency, 2015) and requires additional analysis based upon more appropriate speed profiles.

13.3.7 The DMRB defines scoping and sets out simple and detailed methods for assessing the impacts of road traffic noise (Highways Agency *et al.*, 2011). Thresholds for significant operational traffic noise effects are a 1 dB change in the short term, assessed for the opening year, and a 3 dB change in the long term, assessed by comparing the change between the opening year and the future assessment year. The baseline and future assessment years for construction and operational effects are defined as follows.

- For an assessment of temporary noise and vibration impacts (i.e. from construction or maintenance activities), the baseline year is taken as that immediately prior to the start of works. The future assessment year would be a year during the period of construction/maintenance works.
- For an assessment of permanent noise and vibration impacts, the baseline year is taken as the opening year of the road project (prior to opening). This is considered to be the year which is most representative of the situation immediately before a road project opens to traffic. It should be noted that the baseline year used for this assessment could be different to the year used when predicting the Prevailing Noise Level for any calculations undertaken for the relevant Noise Insulation Regulations. The future assessment year for

operation is typically the 15th year after the opening year of the road project as that is when traffic flows are generally at their highest but, in some circumstances, this may occur before the 15th year. For this Scheme, the greatest traffic flows will generally occur in the 15th year and this is taken as the future assessment year.

13.3.8 The methodology requires CRTN noise predictions to be made for dwellings and other NVSRs affected by the Scheme, both with and without the Scheme for the opening year and future year. This enables both the short term and long term changes to be evaluated. The latest version of DMRB Volume 11, Section 3, Part 7 (Highways Agency *et al.*, 2011) includes separate classifications of impact magnitude for the short term and long term noise changes.

13.3.9 The DMRB sets out the approach to simple and detailed assessments. At the simple stage, the following two comparisons are made in order to determine the impact of the Scheme in the short term and the long term.

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

13.3.10 At the detailed stage, the following three comparisons are made in order to better understand the impact of the Scheme.

- Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year.
- Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year.
- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

British Standards

[British Standard 5228 'Code of practice for noise and vibration control on construction and open sites', Parts 1 and 2, 2009 \(as revised 2014\)](#)

13.3.11 British Standard (BS) 5228 is a two part standard which comprises:

- BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (British Standards Institution, 2014a); and
- BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' (British Standards Institution, 2014b).

13.3.12 The Standard provides guidance, information and procedures on the assessment, mitigation and control of noise and vibration from demolition and construction sites.

British Standard 4866:2010 'Mechanical Vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures'

13.3.13 Construction and industrial plant and machinery can generate groundborne vibration that is perceptible to occupants of nearby buildings. The primary cause of community concern generally relates to building damage, although concerns are often expressed at levels of vibration significantly lower than that likely to cause damage.

13.3.14 BS 4866:2010 (British Standards Institution, 2010) provides guidance on the measurement of vibration in buildings including methodologies, measurement instrumentation, location and fixing of transducers and data evaluation. Annexes also provide advice on classifying buildings with regard to their likely sensitivity; estimating peak stress from peak particle velocity; and random data. A bibliography is also provided. The Standard supersedes BS 7385-1:1990 'Evaluation and measurement of vibration in buildings - Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings' (British Standards Institution, 1990).

13.3.15 Assessment of the potential for cosmetic or structural damage is provided within BS 7385-2:1993 (British Standards Institution, 1993). Guidance on vibration from piling activities is contained within Part 2 of BS 5228 (British Standards Institution, 2014b). Guidance relating to the human response to vibration in buildings is contained within BS 6472-1:2008 (British Standards Institution, 2008).

British Standard 7385-2:1993 'Evaluation and measurement for vibration in buildings - Part 2: Guide to damage levels from groundborne vibration'

13.3.16 BS 7385-2:1993 (British Standards Institution, 1993) provides guidance on the levels of vibration above which buildings could suffer damage. It identifies the factors that influence the vibration response of buildings and describes the basic procedure for carrying out measurements. It also states that there is a particular difference between the sensitivity of people feeling vibration and the onset of levels of vibration that damage structures, and that levels of vibration at which adverse comment from people is likely are below levels of vibration which damage buildings.

British Standard 6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting'

13.3.17 The human body is an excellent detector of vibration, which can become perceptible at levels that are substantially lower than those required to cause even cosmetic building damage. The way in which people perceive vibration in buildings depends upon various factors, including the vibration duration, frequency, direction and activity.

13.3.18 The standard (British Standard Institution, 2008a) indicates that how people inside a building respond to vibration from sources within and outwith the building, with the exception of blasting, is best evaluated with the Vibration Dose Value (VDV). The VDV's associated with various probabilities of adverse comment within residential buildings are provided in Table 1 of the Standard.

British Standard 6472-2:2008 'Guide to evaluation of human exposure to vibration in buildings – Part 2: Blast-induced vibration'

- 13.3.19** Limited blasting would be required during the construction phase, both for excavation of rock and in demolition.
- 13.3.20** BS 6472-2:2008 (British Standard Institution, 2008b) deals with the particular problems associated with periodic blasting within a range of inhabited buildings. For blasting, the current practice is to measure the peak particle velocity (PPV) and BS 6472-2:2008 suggests satisfactory vibration magnitudes in terms of PPV.
- 13.3.21** BS 6472-2:2008 also provides guidance on human exposure to blast-induced vibration in buildings and is primarily applicable to blasting associated with mineral extraction, although the criteria are also appropriate for demolition. For blasting, current practice is to measure PPV using velocity transducers (geophones).
- 13.3.22** For the purpose of the assessment of blasting, daytime is considered to be 08:00 to 18:00 hours Monday to Friday and 08:00 to 13:00 hours Saturday. For more than three blast vibration events per day, a reduced threshold of effect would be appropriate.
- 13.3.23** Whenever blasting is carried out, energy is transmitted from the blast site in the form of airborne pressure waves. The majority of the airborne energy is carried at frequencies below 20 Hz and hence is inaudible to the human ear but can be sensed as concussion or pressure. It is the combination of the sound and concussion that is known as air overpressure. Air overpressure can excite secondary vibrations at audible frequencies in buildings and it is often this effect that gives rise to adverse comments from the occupiers. However, the highest levels normally measured in the United Kingdom are generally less than 1% of the levels known to cause structural damage. Accurate prediction of air overpressure is almost impossible due to the variable effects of the prevailing weather conditions and the large distances often involved. The Standard does not suggest maximum satisfactory levels of air overpressure.
- 13.3.24** With regards to human response to vibration and air overpressure associated with blasting, BS 6472-2:2008 states that:
- 'Within residential areas people exhibit wide variations of vibration tolerance. Specific values are dependent upon social and cultural factors, psychological attitudes and expected degree of intrusion.'*
- and
- 'Experience shows that the fear of property damage has a more significant effect on human response than the effect of the vibration on the person directly, although discussion of this matter is beyond the scope of this British Standard.'*
- 13.3.25** With regard to air overpressure, levels measured at properties near quarries in the United Kingdom are generally around 120 dB(lin), which is 30 dB below or only 3% of the limit for cracking pre-stressed poorly mounted windows. This level of 120 dB(lin) is therefore the limit most commonly adopted to prevent excess air overpressure effects.

- 13.3.26** Quantification of effects from blasting would be subject to detailed assessment prior to any blasting works. Mitigation would be implemented to ensure that any adverse effects are minimised.

Study Area

- 13.3.27** The guidance in the DMRB (Highways Agency *et al.*, 2011) states that the primary study area for noise and vibration should correspond to a band 600 metres either side of the carriageway edge. However, following an initial review of predicted noise changes, due to the significance of the Scheme and the quietness of the surrounding area along the alignment of the new section of motorway, the study area has been increased to a band 1 km either side of the edge of the proposed new section of motorway and 1 km either side of the existing M4 (i.e. a 2 km corridor). This is to ensure that all potentially affected properties are duly considered; the study and calculation areas are shown on Figure 13.1.

Approach to Identification of Baseline Conditions

- 13.3.28** The noise environments in the vicinity of the existing M4 motorway and the proposed new section of motorway have been determined and characterised by means of baseline noise monitoring. This supplements the monitoring previously undertaken as part of earlier studies (Stage 2 Environmental Assessment (Welsh Government, 2014a)), which informed the selection of baseline noise survey locations. Locations were selected to be representative of areas of residential development, more isolated communities, recreational uses and sites of nature conservation value. Survey location selection was based upon experience and professional judgement and reflects the consultation responses received from Newport City Council and Monmouthshire County Council.
- 13.3.29** The baseline sound monitoring was undertaken between Tuesday 23rd June 2015 and Thursday 23rd July 2015. In total, 15 part attended long term, continuous surveys were completed, ranging from 7 to 16 days in duration and 28 fully attended short term surveys of 3 hours duration were completed during the daytime period. The majority of the survey period fell within school term-time, with the local schools' summer term ending 20th July 2015; the last two surveys to be collected ran into the holiday period by three days, having logged data during term-time for at least one week. Baseline data are described in Section 13.4 and Appendix 13.2.
- 13.3.30** Local meteorological conditions varied through the survey period and were logged at Gwaunshonbrown Farm, Pound Hill using an RPS deployed meteorological station co-deployed at this noise survey location. Noise surveys were only carried out when the weather conditions were appropriate or, where weather conditions were not appropriate (following the guidance in BS 7445), data were removed in accordance with best practice.
- 13.3.31** Traffic data have been provided for a range of existing and future scenarios and the key changes are summarised in Chapter 2. Further details are provided in the Traffic Forecasting report (Welsh Government, 2016b). This includes traffic data for future scenarios including both the proposed new section of motorway and Complementary Measures along the existing section of motorway. Existing road alignments and topography have been obtained from Ordnance Survey (OS) data and the project team.

Consultation

13.3.32 A summary of all consultation with stakeholders and consultees, such as local planning authorities, is provided in Table 13.1.

Table 13.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issue Raised	How/Where Addressed
Draft Plan consultation response (Welsh Government, 2014b)	Public responses - Concern regarding potential to resolve existing noise problems. Note that existing noise levels are high adjacent to the M4. Potential impacts on noise levels at Magor and Duffryn.	Effects on existing receptors are considered in Sections 13.6-13.12 of this chapter.
	Natural Resources Wales - Concern regarding effects of noise and vibration on biodiversity.	Within Chapter 10 of the ES: Ecology and Nature Conservation.
	Sustrans Cymru, CTC Cymru - Potential changes in noise in relation to cycle routes.	Effects on existing receptors are considered in Sections 13.6-13.12 of this chapter
Consultation during EIA process	Principal Environmental Health Officer (EHO) (Huw Owen) Newport City Council - Clarification of short and long term baseline noise monitoring locations and suggestions for other locations.	The baseline survey locations reflect the suggestions of the EHO; see Appendix 13.2.
	Environmental Health Manager (Michelle Tett) Monmouthshire County Council Clarification of short and long term baseline noise monitoring locations and suggestions for other locations.	The baseline survey locations reflect the suggestions of the Environmental Health Manager; see Appendix 13.2.
Response to Scoping Document	Views of Officers of the Council, reported by Area Manager West and Strategic Delivery for Streetscene and City Services of Newport City Council (Steve Davies) - Construction noise: Insulation/rehousing to be provided where other mitigation is unsatisfactory; noise monitoring during construction; provision of a Construction and Environmental Management Plan; out of hours work by prior permission and notification of locals with Public Liaison officer; and post-construction noise monitoring to verify noise levels.	Addressed within Section 13.9 of this chapter.

Assessment Criteria and Assignment of Significance

13.3.33 This subsection describes the approach taken to identifying sensitive receptors, predicting the magnitude of an impact and the significance of an effect.

13.3.34 Changes to the baseline conditions have been considered in terms of noise change, which is the predicted change in noise level due to the proposed new

section of motorway, and change in flow on the existing M4. Consideration of noise change also includes consideration of the absolute noise level as appropriate. Baseline survey data have been used to determine a lower threshold for existing noise levels.

Receptor Sensitivity

13.3.35 Within the study area, the following types of receptors have been considered:

- residential properties;
- recreational uses; and
- other sensitive receptors (such as schools, nursing homes, hospitals etc).

13.3.36 The sensitivity or value of each receptor has been described using the terms high, medium or low, taking into account the guidance set out in the DMRB Volume 11, Section 2, Part 5 HA 205/08 (Highways Agency *et al.*, 2008).

13.3.37 For residential properties within the study area, sensitivity has been valued as 'medium'; this is generally the case for residential receptors. This balances their high importance against their low rarity.

13.3.38 Recreational users on Public Rights of Way (PRoW), cycle routes and other facilities are also valued as 'low' or 'medium' sensitivity, depending on the anticipated duration of exposure and availability of alternative quieter areas, unless particular circumstances indicate otherwise.

13.3.39 Other sensitive receptors (such as schools, nursing homes, hospitals etc.) have been valued as 'medium' sensitivity, unless particular circumstances indicate otherwise. Examples of receptors that might be considered as high sensitivity include recording studios and vibration-sensitive manufacturing processes such as microelectronics facilities.

13.3.40 The approach to determining sensitivity is summarised in Table 13.2 below.

Table 13.2: Acoustic Receptor Sensitivity

Typical Criteria	Sensitivity
Users of PRoW; and other permitted recreational trails and users of recreational facilities where the purpose of that recreation is enjoyment of the countryside.	Low / Medium
Residential properties; and other sensitive receptors (such as schools, nursing homes, hospitals etc), unless particular circumstances indicate otherwise.	Medium
Sensitive receptors with particular circumstances - none identified.	High

13.3.41 The sensitivity and importance of ecological receptors is considered within Chapter 10: Ecology and Nature Conservation.

Magnitude of Impact

13.3.42 The magnitude of an impact is identified using the terms major, moderate, minor, negligible and no change. The DMRB defines 'impact' as follows:

‘Change that is caused by an action; for example land clearing (action) during construction which results in habitat loss (impact)’ (Highways Agency et al., 2008)

Construction Phase: Noise

13.3.43 The most significant potential impacts during construction are likely to arise from direct construction noise effects arising from plant and activities where these are within around 115 metres of NVSRs. Out of these, works at bridges, cuttings and other major earthmoving areas, for example, may be the most significant as large numbers of plant may be required, works may last for an extended duration at specific locations and work may need to extend beyond normal daytime working hours. Other activities, such as embankment construction (unless this includes a haul road), laying the new road surface etc. would be transitory along the length of the proposed new section of motorway, so particular NVSRs would only be affected for a relatively short duration.

13.3.44 Noise from construction traffic is not expected to result in widespread significant impacts but may affect receptors particularly close to parts of the existing highway network.

13.3.45 The Magor area is underlain by limestone and sandstone and is likely to require a combination of open cut excavation and controlled blasting around the Magor Interchange. It is possible that blasting in other locations would also be required. It is intended that the blasting would be carried out once a day under controlled conditions during the period of major earthworks. Local residents and businesses would be given advanced warning of when the blasting would take place. In addition, blasting may be required in the demolition of the existing Pound Hill Overbridge.

13.3.46 The criteria for assessing noise impact from the road construction works have been based on ‘Example Method 2- 5 dB Change’ contained within Annex E of BS 5228-1 (British Standards Institution, 2014a). This indicates that:

‘Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect.’

Table 13.3: Construction Noise Levels – Assessment Criteria for the Determination of Impact Magnitude

Assessment Category and Threshold Value Period (LAeq)	Threshold Value in Decibels (dB) ¹			
	No change / Negligible	Minor	Moderate	Major
Night-time (23.00 to 07.00 hours)	<40	40 - 45	45 – 55	>55
Evenings (19.00 to 23.00 hours weekdays). Weekends (13.00 to 23.00 hours Saturdays and 07.00 to 23.00 hours Sundays)	<50	50 - 55	55 – 65	>65
Daytime (07.00 to 19.00 hours) and Saturdays (07.00 to 13.00 hours)	<60	60 - 65	65 - 75	>75

1) Subject to duration criteria, and where ambient noise levels are low.

- 13.3.47** The calculation method contained within BS 5228-1 (British Standards Institution, 2014a) takes account of the duration of an activity per hour, the ‘on-time’ and the attenuation of sound due to the effects of distance, ground attenuation and barriers or topographic features or buildings which act as barriers.
- 13.3.48** The assessment has been based on reasonably expected construction phases, plant items and on-times based on the information provided within BS 5228-1 (British Standards Institution, 2014a) and in Chapter 3: Scheme Construction.
- 13.3.49** For works near the existing M4 (including those works which could also be categorised as rural or urban), the higher baseline sound levels would indicate that acceptable levels of construction noise would be higher than the lower threshold values for day and night-time working.
- 13.3.50** Where predicted construction noise levels are up to 5 dB below the level criteria given in paragraph 13.3.46 above or of short duration, this has been considered to be a ‘no change’ or negligible adverse magnitude of impact. For works of significant duration (of one month or more, unless works of a shorter duration are likely to result in a significant effect). Where levels are between 5 dB below and equal to the criteria from paragraph 13.3.46, this has been considered to be a minor adverse impact. Where the criteria are exceeded by up to 10 dB, this has been considered a moderate adverse impact. Noise levels greater than 10 dB above the criteria have been considered a major adverse impact depending on the context and duration of the works.
- 13.3.51** Table 13.4 has been used in the assessment of noise impact associated with construction traffic on the local road network and from temporary diversion routes resulting from construction of the Scheme (see Chapter 3: Scheme Construction). Although for a given noise change, the DMRB indicates a greater magnitude of impact in the short term compared to the long term, the temporary nature of construction works decreases the magnitude of impacts for the same noise change.

Table 13.4: Classification of Magnitude of Temporary Construction Traffic Noise Impacts

Noise Change $L_{A10, 18h}$	Magnitude of Impact
0 dB	No change
0.1– 2.9 dB	Negligible
3.0 – 4.9 dB	Minor
5.0 – 9.9 dB	Moderate
10.0+ dB	Major

(Source: Table 3.1 Highways Agency *et al.*, 2011)

Operational Phase: Noise

- 13.3.52** Traffic noise and disturbance would increase for some properties affected by the proposed new section of motorway. However, many receptors situated in close proximity to the existing heavily trafficked M4 motorway would experience some decrease in traffic noise and hence disturbance. The detailed assessment of noise and noise disturbance changes has been undertaken to indicate where both beneficial and adverse changes would occur for the Scheme.
- 13.3.53** The DMRB Volume 11, Section 3, Part 7 (Highways Agency *et al.*, 2011) provides a classification for the magnitude of impact of traffic noise from a road scheme.

- 13.3.54** A change in road traffic noise of 1 dB in the short term (e.g. when a scheme is opened) is the smallest that is considered perceptible. In the long term, a 3 dB change is considered perceptible. The magnitude of impact is, therefore, considered different in the short term and the long term. The classification of magnitude of impacts used for traffic noise is given in Table 13.5 (short term) and Table 13.6 (long term). These impacts relate to changes in noise due to the permanent operation of the Scheme (not construction traffic).

Table 13.5: Classification of Magnitude of Noise Impacts in the Short-term

Noise Change $L_{A10, 18h}$	Magnitude of Impact
0 dB	No change
0.1 – 0.9 dB	Negligible
1.0 – 2.9 dB	Minor
3.0 – 4.9 dB	Moderate
5.0+ dB	Major

(Source: Table 3.1 Highways Agency *et al.*, 2011)

Table 13.6: Classification of Magnitude of Noise Impacts in the Long Term

Noise Change $L_{A10, 18h}$	Magnitude of Impact
0 dB	No change
0.1– 2.9 dB	Negligible
3.0 – 4.9 dB	Minor
5.0 – 9.9 dB	Moderate
10+ dB	Major

(Source: Table 3.2 Highways Agency *et al.*, 2011)

- 13.3.55** These descriptors of impact magnitude are consistent with the terminology used elsewhere in the DMRB. For example, Volume 11, Section 3, Part 2 (HA 208/07) (Highways Agency *et al.*, 2007) sets out example noise impact descriptors (Table 13.7). These can be used as descriptions for the above noise changes.

Table 13.7: Definitions of Impact Magnitude

Magnitude of Impact	Typical Descriptors
Major	Gross change of noise or change to sound quality
Moderate	Noticeable differences in noise or sound quality
Minor	Limited changes to noise levels or sound quality
Negligible	Very slight changes in noise levels or sound quality
No Change	No audible changes

Construction Phase: Vibration

- 13.3.56** The most significant potential impacts are likely to arise from direct construction vibration from plant and activities where these occur within close proximity of NVSRs. A study area of 150 metres between source and receptor is used within the assessment, with the anticipated distances at which adverse impacts might occur being well within this. During construction, piling and earthworks at bridges or cuttings may be the most significant as these may last for a longer duration at specific locations and may occur outside normal daytime working hours.
- 13.3.57** Vibration from construction traffic is not expected to result in widespread significant impacts but may affect receptors particularly close to parts of the existing highway network or haul roads.
- 13.3.58** BS 5228-2 'Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 2: Vibration' (British Standards Institution, 2014b) provides

guidance relevant to vibration from construction and demolition. It includes sections on: community relations; vibration and persons on site; neighbourhood nuisance; project supervision; control of vibration and measurement.

- 13.3.59** As set out in Section 13.2, the normal index for predicting and measuring vibration levels from construction is the peak particle velocity (PPV). Based on the levels provided in BS 5228-2 (British Standards Institution, 2014b) Table B.1, a criterion of 1 mm/s has been taken as the onset of a significant impact for vibration on people due to construction activities. The level marks where *'It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents'*. This criterion relates to human response, with the level corresponding to the onset of cosmetic building damage being an order of magnitude greater.
- 13.3.60** BS 5228-2, Table B.2, provides limits for transient vibration above which cosmetic damage, i.e. non-structural, could occur. These are a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hertz (Hz) and 20 mm/s at frequencies above 15 Hz. A building of historic value should not, unless it is structurally unsound, be assumed to be more sensitive. Further detail is provided in Appendix 13.3.
- 13.3.61** Where blasting is required, mitigation will be implemented to prevent significant effects from vibration at sensitive receptors. With regard to criteria, in addition to those for the effects upon structures, BS 6472-2:2008 (British Standards Institution, 2008b), provides guidance on acceptable levels of vibration and air overpressure relative to human exposure. Appropriate limits would be set based upon those relating to building damage and those relating to human exposure in Table 1 and Section 7 of BS 6472-2:2008. The Construction Environmental Management plan (CEMP) will set out the necessary measures to ensure compliance with these. A Pre-CEMP is provided at Appendix 3.2 of this ES.

Operational Phase: Vibration

- 13.3.62** Vibration effects on buildings and structures may be considered in terms of their potential to cause damage. However, vibration levels at which even cosmetic damage can occur are relatively high and, generally, these are only generated by blasting or some construction activities in very close proximity to buildings. For a reasonably maintained road without speed control measures, such as speed humps, vibration arising during operation is likely to be minimal. As set out in Section 13.2 above, the DMRB states that peak particle velocity in close proximity to roads rarely exceeds 2 mm/s and is typically below 1 mm/s.
- 13.3.63** The effects of groundborne vibration associated with motorways are generally minimal and below perception due to the distances between the carriageways and residential receptors and the good quality road surfaces. Therefore, a quantitative assessment of this aspect has been scoped out.

Significance of Effect

- 13.3.64** The DMRB Volume 11 Section 2 Part 7 (HA 218/08) defines 'effect' as follows:
- 'Term used to express the consequence of an impact (expressed as 'significance of effect'), which is determined by correlating the magnitude of the impact to the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria. For example, land clearing during construction results in*

habitat loss (impact), the effect of which is the significance of the habitat loss on the ecological resource'. (Highways Agency *et al.*, 2008)

13.3.65 With regards to noise and vibration, the assessment of significance is based on the guidance provided in DMRB, Volume 11, Section 2, Part 5 (HA 205/08) (Highways Agency *et al.*, 2008). The significance of effect is described using the terms very large, large, moderate, slight and neutral, depending on the environmental sensitivity and the magnitude of impact.

Table 13.8: Assessment of Significance

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

13.3.66 The assessment of noise and vibration has been based on the Scheme with permanent acoustic measures in place (i.e. including measures forming part of the highway engineering design) (Sections 13.6-13.8). In addition, an assessment of noise and vibration has been undertaken with proposed mitigation in place, such as acoustic barriers (Sections 13.10-13.12).

Limitations of the Assessment

13.3.67 In all assessments, it is good practice to consider uncertainty, which can arise from a number of different aspects of an assessment. There is a degree of uncertainty associated with: the instrumentation itself; the use of instrumentation, i.e. the measurements; the source terms used; the sound propagation model; and the subjective response of residents to the sound sources.

13.3.68 Uncertainty due to instrumentation error has been significantly reduced with the introduction of modern instrumentation. Uncertainty is reduced further by ensuring that all instrumentation is calibrated before and after each measurement period and is within accepted calibration intervals.

13.3.69 Every effort has been made to reduce the uncertainty of the baseline sound level measurements. Uncertainty in the baseline data has been reduced significantly by carrying out the baseline sound level survey over a period of seven days, allowing analysis of how representative the baseline data is given the naturally varying noise level at the site.

13.3.70 A quantitative assessment has been undertaken based on likely source levels provided by the appropriate British Standards. This approach minimises uncertainty associated with the source term inputs to the sound propagation model.

13.3.71 With regard to subjective response of receptors, the acoustics standards and guidance adopted for the assessment are based on the subjective response of the majority of the population. This is considered to be the best that can be achieved in a population of varying subjective responses, which are dependent upon a wide range of factors.

13.3.72 The traffic data considered in the assessment make use of speed-pivot analysis to best match the anticipated speed profiles. For the noise model, a minimum speed of 20 kph has been assumed, as required by the DMRB.

13.3.73 Predicted noise levels consider noise only from road links for which traffic data have been provided. This excludes many of the smaller road links around the Caldicot Levels. The prediction does not include noise from any other sources, such as wind/environmental noise, agricultural activity or industry. From the baseline survey data, a minimum long term environmental noise baseline level of 40 dB L_{Aeq} /42 dB $L_{A10,18hr}$ has been determined (see Section 13.4). Where operational noise levels (either existing or future) are predicted (on the basis of only the traffic data) to fall below 42 dB $L_{A10,18hr}$, a level of 42 dB $L_{A10,18hr}$ has been assumed.

13.3.74 The assessment is based on annual traffic data, following the guidance given in the DMRB. This gives an average-case assessment, as the DMRB method does not fully account for congestion, etc. Correction to the speed data has been made to implement the requirements of Interim Advice Note (IAN) 185/15.

13.3.75 On the basis of the above, measures have been taken to minimise this aspect in accordance with best practice.

13.4 Baseline Environment

13.4.1 The methodology and results of the baseline study are provided in Appendix 13.2, which includes supporting information and is summarised below.

13.4.2 A summary of the results of the baseline study is provided in Table 13.9 for the long term surveys and Table 13.10 for the short term surveys; all levels are displayed to the nearest decibel.

Table 13.9: Sound Survey Results Summary – Long Term

Survey	Location		dB L_{Aeq}	dB L_{Amax}	dB L_{A10}	dB L_{A50}	dB L_{A90}
LT1 (e,p)	The Court, Coal Pit Lane	16hr day	51	70-90	52	49	46
		8hr night	46	62-74	49	44	40
LT2 (e,p)	Gwaunshonbrown Farm, Pound Hill	16hr day	54	72-84	56	53	49
		8hr night	48	64-76	52	47	42
LT3 (e)	6 Church Crescent	16hr day	54	74-78	56	52	49
		8hr night	49	67-78	53	47	43
LT4 (e)	6 Nant-Y-Moor Close	16hr day	57	72-83	59	57	54
		8hr night	52	68-76	56	51	45
LT5 (p)	36 Manor Park, Duffryn	16hr day	52	73-97	54	47	40
		8hr night	50	70-77	54	38	33
LT6 (p)	ABP Office Block, Newport	16hr day	55	79-88	58	50	44

Survey	Location		dB L _{Aeq}	dB L _{Amax}	dB L _{A10}	dB L _{A50}	dB L _{A90}
		8hr night	52	75-88	54	46	41
LT7 (p)	Rose Cottage, Hart Farm, Picked Lane	16hr day	47	79-88	47	42	37
		8hr night	41	68-75	43	36	33
LT8 (p)	Permitted development north of Queen's Way	16hr day	53	73-91	56	51	45
		8hr night	49	69-78	52	45	40
LT9 (p)	Grangefield, NP26 3DF	16hr day	53	86-91	51	38	32
		8hr night	48	70-82	50	34	29
LT10 (p)	Well Cottages, Llandevenny	16hr day	50	75-88	51	46	40
		8hr night	49	72-88	48	41	35
LT11 (p)	11 Blenheim Close, Magor	16hr day	50	74-98	50	44	39
		8hr night	46	69-79	47	41	37
LT12 (p)	12 Queens Gardens, Magor	16hr day	43	73-81	45	40	37
		8hr night	42	63-73	46	39	35
LT13 (e,p)	15 Quarry Rise - rear garden	16hr day	53	67-88	53	49	44
		8hr night	47	59-71	50	45	41
LT14 (e,p)	24 Fford Maes Y Graig, Undy	16hr day	52	79-87	55	49	45
		8hr night	50	61-72	53	48	43
LT15 (e,p)	Court Farm, S of Green Farm, Llanfihangel	16hr day	61	77-84	64	61	55
		8hr night	55	72-86	59	53	48

e) representative of locations near the existing M4

p) representative of location near the Scheme

Table 13.10: Sound Survey Results Summary – Short-term

Survey	Location	dB L _{Aeq}	dB L _{Amax}	dB L _{A10}	dB L _{A50}	dB L _{A90}
ST1 (e,p)	Castleton Rise, Castleton	67	88-96	71	58	45
ST2 (p)	Ty'n-y-brwyn	48	69-76	49	40	38
ST3 (e,p)	Little Orchard nr Berryhill Farm	59	70-74	62	57	51
ST4 (p)	Church Lane, Coedkernew	54	75-84	55	42	37
ST5 (p)	Kidwelly Close, Duffryn	48	68-74	51	37	33
ST6 (p)	Orchard Farm, Lighthouse Road	67	87-92	71	53	41

Survey	Location	dB L _{Aeq}	dB L _{Amax}	dB L _{A10}	dB L _{A50}	dB L _{A90}
ST7 (p)	Wales Coast Path	42	68-73	44	40	38
ST8 (p)	Disused road adjoining Traston Road, Newport	49	74-86	50	46	44
ST9 (p)	Broad Street Common nr Pye Corner	51	73-80	53	42	38
ST10 (p)	Solutia Nature Reserve	44	58-90	43	40	36
ST11 (p)	Broad Street Common nr Moorbarn Farm	59	83-84	54	47	41
ST12 (p)	Layby, North Row Road towards Redwich	58	81-83	57	50	45
ST13 (e,p)	Magor, St Brides Rd & Netherwent View	58	77-92	60	54	52
ST14 (e,p)	Magor, Redwick Rd & Blenheim Ave	57	76-79	61	49	40
ST15 (e)	36 Western Avenue - rear garden	63	69-75	64	63	61
ST16 (e)	Near Rear garden of 96 Highcross Road, Newport	53	71-80	54	52	51
ST17 (e)	Allt-Yr-Yn Avenue	58	73-82	62	56	53
ST18 (e)	Footpath behind Goodrich Crescent	53	69-79	54	51	49
ST19 (e)	Land at end of Pant Road	60	80-84	62	58	56
ST20 (e)	Layby east of Pillmawr Farm	Survey aborted for safety reasons				
ST21 (e)	16 Harrogate Road - rear garden	63	69-79	64	63	61
ST22 (e)	140 Beaufort Road - rear garden	63	69-79	64	63	61
ST23 (e)	rear of Christchurch Road	69	76-78	70	68	66
ST24 (e)	Land off Royal Oak Hill	66	75-80	67	66	64
ST25 (e)	27 Blossom Close - rear garden	57	68-86	59	57	55
ST26 (e)	Land adj. to 89 Waltwood Park Drive	59	66-71	61	59	57
ST27 (e)	nr Waun-arw, NW of Magor	56	67-72	58	55	52
ST28 (p)	Magor Marsh Reserve (western Boundary)	52	70-76	54	49	45
ST29 (p)	Land off Watch House Parade	61	73-79	63	60	57

e) representative of locations near the existing M4

p) representative of location near the proposed Scheme

13.4.3 Baseline noise level data acquired for the Stage 2 Environmental Assessment (Welsh Government, 2014a) are available for various locations in close proximity to the new section of motorway. However, the data are between one and seven years old. As such, characterisation and determination of existing baseline conditions has been undertaken primarily based on the 2015 data from the baseline surveys, with reference made to historic survey data, as appropriate.

13.4.4 Whilst noise levels vary from location to location and from day to day, it is considered useful to provide quantitative sound levels that are representative of general areas. These have been interpreted from the baseline surveys and may not be appropriate in all situations. Where baseline noise levels for a specific area are required, the baseline survey data have been used directly. The general characterisation of baseline sound levels in the study area is presented in Table 13.11.

Table 13.11: General Characterisation of Baseline Sound Levels

	Daytime (07:00 – 23:00)		Night-time (23:00 – 07:00)	
	$L_{Aeq, 16hr}$	$L_{A90, 16hr}$	$L_{Aeq, 8hr}$	$L_{A90, 8hr}$
Near existing M4	55 - 65 dB	45 - 55 dB	50 - 60 dB	40 - 50 dB
Urban areas	45 - 55 dB	35 - 45 dB	40 - 50 dB	30 - 40 dB
Rural areas	40 - 50 dB	30 - 40 dB	35 - 45 dB	25 - 35 dB

13.4.5 From the survey data, it is apparent that the $L_{Aeq,18hr}$ does not significantly differ from the $L_{Aeq,16hr}$.

13.4.6 The L_{A10} levels for daytime and night-time are, on average, 2 to 3 dB higher than for the corresponding L_{Aeq} day/night period, respectively.

13.4.7 As an indication of the lower noise level typically experienced away from urban areas, a level of 40 dB $L_{Aeq,16hr}$ has been adopted. This equates to a level of 42 dB $L_{A10,18hr}$. It should be noted that these are average levels for the period 06:00 to 24:00 hours and noise levels may occasionally fall below these average levels from time to time during this period and at night, i.e. between 00:00 and 06:00 hours.

Future Baseline Conditions

13.4.8 In the absence of the Scheme, baseline noise levels around and through Newport on the existing M4 and the surrounding areas are likely to increase in accordance with the expected traffic growth for the area. In some locations, despite the growth in traffic, the predicted change in traffic speed or anticipated Heavy Goods Vehicle (HGV) content results in a slight decrease in noise levels. Traffic growth figures indicate that motorway traffic in Wales increased by nearly 3% between 2013 and 2014. Growth on the existing M4 between 2014 and 2037 in the absence of the Scheme is expected to be between 1 and 2% per annum. In terms of the related increase in noise level, this would be minimal (approximately 1 dB) and the increase may also be mitigated, to some extent, by improvements in vehicle technology and legislative requirements, which will tend to reduce the sound contribution from each vehicle.

13.5 Mitigation Measures Forming Part of the Scheme Design

Construction

- 13.5.1** Following consultation with Newport City Council in relation to the Scoping Report, the Council has requested that:

‘With regards to construction noise and vibration, we suggest that where in spite of mitigation, noise levels exceed trigger levels, it would be expected that a scheme of sound insulation (of costs of [sic]) or temporary rehousing of affected residents [be offered] as appropriate, are provided. This is stated in Annex E of BS5228.

Noise monitoring (and vibration where appropriate) should be carried out at residential premises during construction to check compliance with noise and vibration limits.

Newport City Council will require a Construction and Environmental Management Plan to be produced and submitted, including details of proposed hours of work.

With regards to out of hours work, approval must be sought in advance from Environmental Health at Newport City Council and [where] work is agreed, affected residents must be notified in advance and kept up to date as the scheme progresses. We also feel that a public liaison officer should be appointed.’

- 13.5.2** This section outlines the measures that have been taken into account in the assessment of effects in Section 13.7 below. These are established good practice measures, that would be implemented through the Pre-Construction Environmental Management Plan (Pre-CEMP). Additional measures identified during the EIA process are set out in Section 13.9.

- 13.5.3** Noise and vibration monitoring would be carried out, as appropriate, at or around residential and other sensitive properties during the construction phase to check compliance with noise and vibration limits agreed with Newport City Council and Monmouthshire County Council or other regulators, as appropriate to the specific area.

- 13.5.4** The proposed hours of work during the construction phase are set out in Chapter 3: Scheme Construction. Approval would be sought from Monmouthshire and Newport City Council’s Environmental Health Officers (or equivalent experts or regulators), as appropriate to the specific area. This would be undertaken in advance of the works commencing. This approval may be formalised, as deemed appropriate by the regulator/s, through the Section 61 Control of Pollution Act procedure for ‘Prior consent for work on construction sites’. Where the works are agreed, affected residents would be notified of the programme for the intended works, and particularly of the requirement for any out-of-hours works, and kept up to date as construction progresses.

- 13.5.5** Standard best-practice construction working methods (such as use of silenced plant, turning off plant when not in use and selecting quieter plant where available) would be adopted during the construction phase.

13.5.6 In terms of the construction programme and activities, the Principal Contractor would engage with the local planning authorities prior to the commencement of construction.

13.5.7 Details are set out in the Pre-CEMP which is provided in Appendix 3.2. The Pre-CEMP would be developed into a full CEMP prior to construction commencing. A Public Liaison Officer would be responsible for the day-to-day communication with the EHO and the general public. An Environmental Clerk of Works would be responsible for the day-to-day implementation of the CEMP.

13.5.8 The following mitigation measures are included in the Pre-CEMP.

Communication:

- Regularly engaging with stakeholders and the local community before and during the works.
- Informing the community when and where noisy activities are expected to take place and for how long.
- Displaying the project contact details including a 24-hour public helpline on the site notices.

Complaints:

- Putting in place a suitable complaints log and investigation procedure. This procedure will be managed with the use of the Incidents, Complaints and Enquiries Database (ICE).

Working Hours:

- Adopting the working hours set out in Chapter 3 – Scheme Construction. Where work needs to take place outside normal construction hours, this will be discussed with the Local Planning Authority via the Public Liaison Officer and agreed through the CoPA Section 61 process, as agreed where appropriate.

Access Routes:

- Routing construction traffic away from NVSRs.

13.5.9 The above measures have been assumed to be in place within the assessment presented in Section 13.7 below.

Operation

13.5.10 During operation, both beneficial and adverse noise effects are anticipated as a result of the Scheme. The new section of motorway would reduce congestion on the existing M4. Noise measures incorporated into the design of the Scheme (embedded mitigation) include the provision of a thin road surface system, which is relatively low noise.

13.5.11 In addition, a solid safety barrier of 0.9 metres in height, along the central reservation of the new section of motorway alignment may provide some screening of noise generated at the tyre-road interface. This is not primarily intended as a noise-control measure nor does its presence provide any noise mitigation within the noise model due to the source height that has to be adopted i.e. in reality, the central reservation would provide attenuation where vehicles are travelling at or close to the speed limit where the tyre/road interface is the main

noise source. These mitigation measures are included in the assessment of potential operational effects set out in Section 13.8 below.

13.6 Assessment of Potential Land Take Effects

Proposed New Section of Motorway

- 13.6.1** Land take associated with the new section of motorway would have no direct adverse acoustic impact or effect on the surrounding area. The assessment of noise and/or vibration generated within the affected land, as arising from the construction and subsequent use of the Scheme, is reported within the construction and operational noise assessments in Sections 13.7 and 13.8 below.
- 13.6.2** Land take for the new section of motorway would require the demolition of twelve residential properties. The noise model indicates that eleven of these twelve properties would be subject to noise levels exceeding 60 dB $L_{A10,18hr}$ in the opening year 2022 without the Scheme, primarily due to the existing M4. These properties are: The Conifers; White Cottage; San Remo; The Glen; Quarry Cottage; Myrtle House; Berryhill Cottage; Berryhill Farm; Woodland House; Undy House; and Dunline. Only Barecroft House is predicted to be subject to levels below 60 dB $L_{A10,18hr}$.
- 13.6.3** Where land take would remove residential properties from areas that are currently subject to high noise levels, such as in the immediate vicinity of the existing M4, this may be considered to be an acoustic benefit for the residents; assuming that residents would be likely to relocate to a quieter environment. Such effects must be viewed, however, in the context of the non-acoustic impacts and the effects demolition of such properties may have. These effects are identified elsewhere within this ES (see Chapter 8 (Cultural Heritage) and 15 (Community and Private Assets)).
- 13.6.4** The removal of these 12 properties, with regards to any acoustic screening they might have previously provided to residences beyond, has been taken into account within the noise assessment.
- 13.6.5** With regard to noise, there are no significant adverse effects arising from permanent land take associated with the Scheme.

Complementary Measures

- 13.6.6** The Complementary Measures would have no discernible effect in terms of land take as the works are proposed to be undertaken within the existing alignment/land take and no additional NVSRs would require demolition (other than those listed for the proposed new section of motorway in the section above).

13.7 Assessment of Potential Construction Effects

- 13.7.1** A construction noise and vibration assessment report is provided in Appendix 13.3. This contains a description of the prediction methodology, noise source levels, model input and results.

Proposed New Section of Motorway

Construction Noise

13.7.2 Noise from construction activities associated with the Scheme has been considered in Appendix 13.3. The findings are summarised in this section.

13.7.3 Construction works have been separated into several categories: earthworks; roadwork elements; other structures; and the River Usk Crossing (piling & ancillary equipment; main operations). Of these, the earthworks activity has been identified as the most noisy, with driven piling also a noisy source. However, all activities are predicted to be within 7 dB of these most noisy works, which is within the expected variation expected day-to-day across all works. Construction noise levels would also vary significantly over time and from location to location.

13.7.4 The estimated magnitude of impact and significance of effect is provided in Appendix 13.3 and summarised in Table 13.12 below. The range of magnitude of impact equates to the different construction activities.

Table 13.12: Construction Noise Distance Thresholds – Daytime, Rural/Urban

Distance between Worksite and NSR	Magnitude of Impact	Significance of Effect
25 m from worksite	Major	Moderate or Large
50 m from worksite	Moderate	Moderate
75 m from worksite	Minor to Moderate	Slight or Moderate
100 m from worksite	Minor to Moderate	Slight or Moderate
125 m from worksite	Negligible to Minor	Neutral or Slight
150 m from worksite	Negligible to Minor	Neutral or Slight
200 m from worksite	Negligible	Neutral or Slight
250 m from worksite	Negligible	Neutral or Slight
300 m from worksite	No Change to Negligible	Neutral or Slight
400 m from worksite	No Change to Negligible	Neutral or Slight
500 m from worksite	No Change	Neutral
750 m from worksite	No Change	Neutral
1000 m from worksite	No Change	Neutral

13.7.5 The majority of all construction works would be undertaken during the daytime period.

13.7.6 Calculations indicate that, without any specific mitigation and in relation to a generic worksite, the predicted noise level from plant and activities associated with the construction phase is estimated to be in the region of 68 to 74 dB at 50 metres from a construction worksite, 60 to 66 dB at 100 metres from a worksite, 50 to 56 dB at 250 metres from a worksite and 43 to 49 dB at 500 metres from a worksite, as identified in Table 3 of Appendix 13.3. Calculations are provided in Annex B of Appendix 13.3.

13.7.7 Within the expected variation of construction noise predictions, it is appropriate to approximate the distances for daytime works as: major impacts within approximately 45 metres of a worksite; moderate impacts within approximately 115 metres of a worksite; and minor impacts within approximately 180 metres of a worksite. These distance bands are shown in Figures 13.2. A summary of the properties within each band is provided in Table 13.13 below.

Table 13.13: Summary of Construction Effects

Impact	Buffer distance	Number of residential NVSRs potentially affected	Significance	
Major	45 m	166	Moderate or Large	Significant
Moderate	115 m	326	Moderate	Significant
Minor	180 m	328	Slight	Not significant

13.7.8 Subject to the nature and duration of the works, properties within the distance bands identified above and in Table 13.13, have been identified and are listed in Annex C of Appendix 13.3. Clusters of properties potentially significantly or slightly affected are located around Castleton, Coedkernew, Magor/Undy, and the Beeches Caravan Park.

13.7.9 In addition, seven non-residential NVSRs have been identified as potentially significantly affected which are:

- Nash Baptist Chapel, Meadows Road, Newport, NP18 2BU – now understood to be in residential use;
- Greenfields Nursery, Magor Court, Newport Road, Magor, Monmouthshire, Caldicot, NP26, 3BZ;
- The Old Court, Old Court Farm, Caldicot Road, Rogiet, Monmouthshire, Caldicot, NP26 3UR;
- Church Of St Michael And All Saints, Caldicot Road, Rogiet, Monmouthshire, NP26 3UR;
- Hampton By Hilton Hotel, Wales 1 Business Park, Newport Road, Magor, Monmouthshire, Caldicot, NP26 3DG;
- Appletree Nurseries Limited, Wales 1 Business Park, Newport Road, Magor, Monmouthshire, NP26 3DG; and
- Premier Inn, Newport Road, Castleton, Newport, Cardiff, CF3 2UQ.

13.7.10 Residential NVSRs within around 115 metres of any worksite are considered likely to experience a moderate or major adverse impact. This would result in significant effects (moderate or large adverse), which would be temporary and would occur only during the most intense periods of construction. There are approximately 492 residential properties within 115 metres of the proposed construction works who may experience a moderate adverse effect from construction noise. Of these, 166 properties fall within 45 metres and may experience a major adverse magnitude of impact, leading to a moderate or large adverse significance of effect.

13.7.11 A total of approximately 328 further residential properties have been identified within 180 metres of the temporary land take area, who may experience a minor adverse impact, leading to an effect of slight adverse significance.

13.7.12 At some locations, more substantial construction works may be required, for example, where more major earthworks or piled foundations occur. Whilst these, without additional mitigation, have the potential to adversely affect properties beyond the 115 metre corridor identified above, the shorter duration of such works and appropriate control of noise emissions would mean that few, if any, additional properties would experience a significant adverse effect.

13.7.13 Significant or regular construction activities are not anticipated to occur within the evening or night periods. In the event that such works were to occur, however, and at a similar intensity to that for the day, the following effects would be anticipated.

- Evening works: Receptors within approximately 113 metres from a construction worksite may experience a major adverse impact due to construction noise. Between approximately 113 and 283 metres from a worksite, a moderate impact may occur. Minor impacts may occur within approximately 448 metres from a worksite, with a negligible magnitude of impact predicted beyond this distance.
- Night-time works: Receptors within approximately 283 metres from a construction worksite may experience a major adverse impact due to construction noise; between approximately 283 and 710 metres from a worksite, a moderate impact may occur. Minor impacts may occur within approximately 1,125 metres from a worksite, with a negligible magnitude of impact predicted beyond this distance.

13.7.14 Other night-time construction activities would only occur for exceptional works; for example, lifting a bridge structure into place. In accordance with the Pre-CEMP, such works would be carefully controlled and monitored to ensure any adverse effects were minimised. Prior consent would be sought through the Control of Pollution Act Section 61 process.

13.7.15 Through the measures set out in the Pre-CEMP, and implemented through the subsequent CEMP, including the implementation of best practicable means and standard mitigation measures, noise and vibration would be minimised as far as is reasonably practicable. Details of the proposed measures are given in section 13.9 of this chapter.

Construction Vibration

13.7.16 The results of the assessment of construction vibration are provided in Annex D of Appendix 13.3 for a range of potentially vibratous construction activities. Considered are: pneumatic hammer to break-out existing road-surface; vibratory compaction (steady state); vibratory compaction (start-up/down); percussive piling; and vibratory piling.

13.7.17 From the assessment criteria discussed in Appendix 13.1, at a PPV level of 0.3 mm/s, vibration might be just perceptible in residential environments. At 1.0 mm/s PPV, it is likely that vibration in residential environments would cause complaint but could be tolerated if prior warning and explanation has been given to residents.

13.7.18 For the construction activities considered, predicted PPV vibration levels are expected to be less than 1 mm/s at approximately 30 metres; and less than 0.3 mm/s beyond around 75 metres. On this basis, and with reference to the thresholds adopted for construction vibration impacts, even cosmetic damage is not expected to occur at any NSR. Nor would vibration generally be perceptible within houses assuming normal, competent ground conditions.

13.7.19 With appropriate notification of residents, scheduling, best practice mitigation and monitoring, there would be no significant effect.

Construction Road Traffic Noise

- 13.7.20** The DMRB (Highways Agency *et al.*, 2011. Annex 1, Page A1/3) states that:
- 'A change in noise level of 1 dB $L_{A10,18h}$ is equivalent to a 25 % increase or a 20 % decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3 dB $L_{A10,18h}$ is equivalent to a 100 % increase or a 50 % decrease in traffic flow.'*
- 13.7.21** Where the additional traffic significantly increases the percentage heavy goods vehicle (HGV) content, noise changes greater than those indicated in the DMRB may occur. The change can be quantified using the procedure in the CRTN (Department of Transport/Welsh Office, 1988).
- 13.7.22** The traffic requirements for the construction of the Scheme are set out in Chapter 3: Scheme Construction. During the most intensive periods of construction, a significant number of HGVs per day would be required. The magnitude of impact for NVSRs near an access or haul route but remote from any construction worksite is estimated to be negligible to minor for the majority of HGV movements during the daytime; with moderate impacts only likely for short durations during the most intense periods of construction.
- 13.7.23** With regards to residential dwellings, effects would be considered of neutral or slight significance and would not be significant for properties not already identified as affected by construction noise.
- 13.7.24** For those links where estimates of daily HGV movements have been provided, the effect of these being added to the existing traffic (based on the 2014 baseline flows) have been considered – calculations are provided in Annex D and are summarised in Table 13.14.

Table 13.14: Construction Traffic Noise Change

Road Section	Base 2014			Base 2014 + Construction Traffic		Noise Change (dB)
	18-hr AAWT (06:00 - 00:00 hr)			18-hr AAWT (06:00 - 00:00 hr)		
	Flow	% HGV	Speed (km/h)	Hourly HGVs	Combined %HGV	
A48 Plant Crossing	18153	4.5	77	22	6.5	0.5
M4 Dock Links	10056	15.1	99	24	18.6	0.6
A48 Fabrication Yard Works Access	18153	4.5	77	22	6.5	0.5
Duffryn Works Access	No data					-
Lighthouse Rd Works Access	1715	15.2	51	24	32.2	3.2
Nash/Meadows Rd Works Access	11311	7.5	58	24	10.9	0.9
Glan Llyn Works Access	9401	13.6	52	24	17.4	0.8
TATA Works Access	9127	13.9	52	24	17.8	0.8
North Row Works Access	No data					-
Barelands Street Works Access	9724	24.1	64	24	27.3	0.6
Newport Rd Plant Crossing	10146	4.4	42	24	8.3	1.3
Newport Rd Temp Bridge	15161	3.2	47	24	5.9	1.0
Magor East Works Access	7659	9.7	105	24	14.5	0.9

13.7.25 From Table 13.14, it can be seen that NVSRs adjacent to eight of the 13 links considered would experience a noise change of less than 1 dB; two of the 13 links would experience a noise change of between 1 dB and 3 dB. NVSRs for which road traffic on these links are currently the dominant noise source would, therefore, experience an adverse impact of negligible magnitude. One link; Lighthouse Road, is predicted to experience a noise change of just above 3 dB. NVSRs for which road traffic on Lighthouse Road is currently the dominant noise source would experience an adverse impact of minor magnitude.

13.7.26 For two links: Duffryn Works Access and North Row Works Access, no baseline traffic data has been provided. On inspection of these two links, it is considered that construction traffic noise would not result in significant adverse effects, due to the separation from residential areas and class of road.

13.7.27 For residential receptors, in summary, construction traffic would be of slight adverse significance or less, which is not considered a significant effect within the assessment methodology.

Complementary Measures

13.7.28 Construction works associated with the Complementary Measures include: the works to remove or modify markings, signage or gantries along the reclassified M4; minor modification to alignment of slip-roads, where it involves construction works; and the construction of a proposed 120 metre retaining wall between the slip road and main road on the south side of Junction 25.

13.7.29 The majority of these construction works are minor in nature and would be completed without any significant adverse noise effects. The works associated with the construction of the proposed retaining wall around Junction 25, however, have the potential to result in adverse effects on the receptors in close proximity to the works; specifically the residential dwellings on Denbigh Road and Tudor Road nearest the existing M4 slip roads.

13.7.30 These works are likely to be of a lesser magnitude than that predicted for the construction of the new section of motorway. It is considered that, without additional specific mitigation, the four residential properties at the end of Denbigh Road and Tudor Road, nearest the existing M4 slip roads, may experience a minor adverse effect, depending on the duration of the works. This would result in an effect of slight adverse significance.

13.8 Assessment of Potential Operational Effects

13.8.1 While part of the proposed new section of motorway would lie within areas exposed to existing noise sources, such as areas close to the existing M4 or heavily industrialised areas, much of the route would introduce noise into predominantly quiet rural areas. The introduction of a new noise source would inevitably change the noise character of the immediate area. Noise sensitive receptors would experience a quantifiable noise change, which can be used to inform a determination of the overall effect of the Scheme and to ensure that all reasonably practicable measures are implemented to mitigate any adverse effects.

- 13.8.2** An operational noise and vibration assessment report is provided in Appendix 13.4. This contains a full description of the prediction methodology, model input and results. The findings are summarised in this section.
- 13.8.3** The assessment of potential operational effects includes mitigation measures that form part of the Scheme design (embedded mitigation), such as a quiet road surface and screening from a solid (concrete), central safety barrier.
- 13.8.4** A total of 20,743 NVSRs have been identified within the study area. Of these, 77 properties are non-residential but have been identified as noise-sensitive and 12 are residential dwellings that would be demolished as part of the Scheme.
- 13.8.5** Noise contours of predicted daytime noise levels for 2014 and for the Do-Minimum and Do-Something scenarios for opening and future years are provided in Figures 13.3 to 13.7. Numeric results are presented in the annex of Appendix 13.4.
- 13.8.6** The different scenarios assessed for this study are as follows.
- 2014 – Without Scheme.
 - 2022 – Opening year 2022 Do Minimum (without Scheme).
 - 2037 – Future year 2037 Do Minimum (without Scheme).
 - 2022 – Opening year 2022 Do Something (with Scheme and designed/embedded mitigation).
 - 2037FYDSCM – Future year 2037 Do Something (with Scheme and designed/embedded mitigation).
- 13.8.7** Two further scenarios have been assessed and the results are also provided within Appendix 13.4:
- 2022 – Opening year 2022 Do something (with Scheme, without designed or embedded mitigation).
 - 2037 – Future year 2037 Do Something (with Scheme, without designed or embedded mitigation).
- 13.8.8** To gain an understanding of the effects of any particular scenario, the Noise Change Matrices provided in Annex G of Appendix 13.4 give a comprehensive overview; the specific noise levels and associated changes in level are provided for each receptor assessed.
- 13.8.9** Traffic data have been provided for a range of existing and future scenarios and are summarised in Appendix 2.1. This includes traffic data for future scenarios including both the new section of motorway and reclassification of the existing M4. Existing road alignments and topography have been obtained from Ordnance Survey (OS) data and the project team.
- 13.8.10** The traffic data considered make use of speed-pivot analysis to best match the anticipated speed profiles. For the noise model, a minimum speed of 20 kph has been assumed, as required by DMRB.
- 13.8.11** Predicted noise levels consider noise only from road links for which traffic data have been provided. This excludes many of the smaller road links around the Caldicot Levels. The prediction does not include noise from any other sources,

such as wind/environmental noise, agricultural activity or industry. From the baseline survey data, a minimum long term environmental noise baseline level of 40 dB L_{Aeq} / 42 dB $L_{A10,18hr}$ has been determined (see Section 13.4). Where operational noise levels (either existing or future) are predicted (on the basis of only the traffic data) to fall below 42 dB $L_{A10,18hr}$, a level of 42 dB $L_{A10,18hr}$ has been assumed.

13.8.12 The operational noise assessment follows the procedure set out in the DMRB. As such, it considers the average noise levels arising from annual average traffic data. It does not, therefore, consider short term variations in traffic noise, such as those that might arise from traffic congestion.

Proposed New Section of Motorway

13.8.13 Noise contours of predicted daytime noise levels for 2014 and for the Do-Minimum and Do-Something scenarios for opening and future years are provided in Figures 13.3 to 13.7. Numeric results are presented in Annexes D and E of Appendix 13.4.

Do-Minimum Scenario in the Opening Year and the Future Assessment Year (Long Term)

13.8.14 Comparison of the Do Minimum scenario for the opening year and Do Minimum scenario in future year indicates that, out of the 20,666 residential receptors included in the noise model, during the daytime period, a noise increase of at least 3 dB is likely to occur at 38 receptors, with a maximum noise increase of up to 5 dB. In the absence of the Scheme, a noise decrease of at least 3 dB is not likely to occur at any receptors, with a maximum noise decrease of up to 2 dB likely to occur. No significant change is therefore likely to occur at 20,628 receptors. This relates to the magnitude of impact on the baseline in future years without the Scheme based on predicted traffic change and is summarised in Table 13.15.

Table 13.15: Residential Property Count – Without Scheme

Long-term without Scheme	Max change	Major	Moderate	Minor	Negligible	No Change	SubTotal
2037 <- 2022	/ dB	10+ dB	5-9.9 dB	3-4.9 dB	0.1-2.9 dB	+/-0.1 dB	
Decrease	-2	0	0	0	985	-	985
Increase	5	0	0	38	10075	-	10,113
Neutral	-	-	-	-	-	9568	9,568
						Total:	20,666

13.8.15 Out of the 77 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 3 dB is not likely to occur at any receptors, with a maximum noise increase of up to 2 dB and a maximum noise decrease of up to 0.2 dB.

13.8.16 Based on the predicted noise change, the magnitude of impact in the absence of the Scheme is considered to range between negligible beneficial and minor adverse, with the majority of receptors experiencing a negligible noise increase, due to general traffic growth in the area.

13.8.17 With regards to the assessment of significance, this is considered to result in an effect ranging from neutral or slight beneficial to slight adverse.

Do-Minimum Scenario and Do-Something Scenario in the Opening Year (Short Term)

13.8.18 Noise difference contours for this scenario are provided in Figure 13.8. Tables of noise change at each receptor are provided in Annex D and summarised in Annex E of Appendix 13.4.

13.8.19 Out of the 20,654 residential receptors included in the noise model, during the daytime period, a noise increase of at least 1 dB is likely to occur at 2,224 receptors, with a maximum noise increase of up to 21 dB. A noise decrease of at least 1 dB is likely to occur at 13,003 receptors, with a maximum noise decrease of up to 8 dB. No significant change is likely to occur at 5,428 receptors. This is summarised in Table 13.16.

Table 13.16: Residential Property Count – With Committed Mitigation

Short-term with scheme	Maximum change	Major	Moderate	Minor	Negligible	No Change	SubTotal	
2022 Do Something <- 2022 Do Minimum	/ dB	5+ dB	3-4.9 dB	1-2.9 dB	0.1-0.9 dB	+/-0.1 dB		
Decrease	-8	1370	2656	8977	3145	-	16148	
Increase	21	544	659	1021	1671	-	3895	
Neutral	-	-	-	-	-	611	611	
Total:								20654

13.8.20 Out of the 77 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 1 dB is likely to occur at 8 receptors, with a maximum noise increase of up to 9 dB. A noise decrease of at least 1 dB is likely to occur at 50 receptors, with a maximum noise decrease of up to 6 dB; and no significant change is likely to occur at 19 receptors.

13.8.21 Based on the predicted noise change, the magnitude of impact is considered to range between major beneficial and major adverse in the short term, although more receptors are likely to experience a noise decrease rather than a noise increase.

13.8.22 With regards to the assessment of significance, this is considered to result in an effect ranging from moderate or large beneficial to moderate or large adverse.

Do-Minimum Scenario in the Opening Year and Do-Something Scenario in the Future Assessment Year (Long Term)

13.8.23 Noise difference contours are provided in Figure 13.9. Tables of noise change at each receptor are provided in Annex D and summarised in Annex E of Appendix 13.4.

13.8.24 Out of the 20,654 residential receptors included in the noise model, during the daytime period, a noise increase of at least 3 dB is likely to occur at 1,264 receptors, with a maximum noise increase of up to 18 dB. A noise decrease of at least 3 dB is likely to occur at 2,125 receptors, with a maximum noise decrease of

up to 8 dB. No significant change is likely to occur at 17,268 receptors. This is summarised in Table 13.17.

Table 13.17: Residential Property Count - With Committed Mitigation

Long-term with scheme	Maximum change	Major	Moderate	Minor	Negligible	No Change	SubTotal
2037 Do Something – 2022 Do Minimum	/ dB	10+ dB	5-9.9 dB	3-4.9 dB	0.1-2.9 dB	+/-0.1 dB	
Decrease	-8	0	774	1351	11875	-	14000
Increase	18	37	548	679	4306	-	5570
Neutral	-	-	-	-	-	1084	1084
						Total:	20654

13.8.25 Out of the 77 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 3 dB is likely to occur at 6 receptors, with a maximum noise increase of up to 9 dB. A noise decrease of at least 3 dB is likely to occur at 9 receptors, with a maximum noise decrease of up to 5 dB; and no significant change is likely to occur at 62 receptors.

13.8.26 Based on the predicted noise change, the magnitude of impact is considered to range between moderate beneficial and major adverse in the long term, although more receptors are likely to experience a noise decrease rather than a noise increase.

13.8.27 With regards to the assessment of significance, this is considered to result in an effect ranging from moderate beneficial to moderate or large adverse.

13.8.28 In summary, in the short term, 1,203 receptors would experience a significant adverse effect; and 4,026 would experience a significant benefit. In the long term, 585 receptors would experience a significant adverse effect; and 774 would experience a significant benefit. Results are provided in full in Appendix 13.4.

Complementary Measures

13.8.29 In addition to the new section of motorway, the Scheme would incorporate Complementary Measures. The key elements of the Complementary Measures that have noise implications are described below.

- Improvements to safety, access arrangements and the ability to manage traffic by reclassifying the existing M4 between Magor and Castleton as a trunk road.
- Relief to Junction 23A of the existing M4 and the local road network with a new M4/M48/B4245 connection.
- Providing cycle and walking friendly infrastructure.

13.8.30 The noise effects of the Complementary Measures are associated primarily with the change in traffic flow on the existing M4. As this change is intrinsic within the traffic assessment for the Scheme (and included within the traffic model), this has been included within the assessment results presented above.

13.8.31 None of the other elements of the Complementary Measures would have an acoustic effect beyond those previously identified above for the proposed new section of motorway.

13.9 Additional Mitigation and Monitoring

13.9.1 In addition to the measures set out in Section 13.5, the following additional measures have been identified as part of the EIA process and are proposed.

Land Take Effects

13.9.2 No mitigation or monitoring is required to control land take effects.

Construction Phase Mitigation and Monitoring

13.9.3 For those properties located in close proximity to the works, noise levels may exceed those considered acceptable even with standard construction good practice measures in place. Such temporary effects would be managed during construction by means of additional mitigation as appropriate and to fully implement Best Practicable Means, in the form of:

- the use of temporary hoardings or noise barriers around worksites or particularly noisy activity; and, where still necessary,
- the offer of a scheme of sound insulation or temporary rehousing of affected residents as appropriate and assessed as eligible.

13.9.4 Specific monitoring measures would include noise and vibration monitoring at residential premises at key locations during construction to check compliance with noise and vibration limits.

13.9.5 The CEMP will, amongst other measures, set out the controls for noise and vibration levels during construction. A Pre-CEMP is provided at Appendix 3.2 of this ES.

13.9.6 As an indication of the effectiveness of the temporary noise barriers, it is assumed that they would provide approximately 10 dB attenuation to noise at ground floor for NVSRs near significant construction works. With the screening measures in place, the numbers of NVSRs adversely affected by construction noise would be reduced.

13.9.7 No specific mitigation is proposed to control noise from off-site construction traffic.

Operational Phase Mitigation and Monitoring

Monitoring

13.9.8 A scheme of post-completion or ongoing operational noise monitoring would be implemented, if appropriate, following completion of the Scheme.

Mitigation Measures

13.9.9 Mitigation measures, in addition to the embedded measures, comprising noise barriers of 2 metres height are proposed at four areas along the new section of motorway. This maximum height has been assumed to minimise other non-acoustic effects of the barriers, i.e. adverse landscape and visual effects. The locations of these barriers would be subject to further definitive evaluation and confirmation in due course. The indicative locations proposed are shown on Figure 13.10 and are as follows.

- Duffryn – north side of the new section of motorway – 1,670 metre run from the west extending to Lighthouse Road Overbridge – 2 metre height protecting some 100 properties.
- Duffryn – north side of the new section of motorway – 520 metre run east from Lighthouse Road Overbridge – 2 metre height protecting some 80 properties.
- North of Magor – south side of the new section of motorway – 1,100 metre run from Newport Road and Vinegar Hill - 2 metre height protecting approximately 150 properties. The barrier would only be provided where comparable attenuation is not already provided by the cutting for the new section of motorway or existing barriers.
- West of Magor – southeast side of the new section of motorway – 750 metre run south from Green Moor Lane. 2 metre height protecting approximately 100 properties and Caldicot Levels.

13.9.10 The exact locations, alignments, heights and specification of these barriers will be developed during the detailed design phase. However, the barriers would generally be such as to remove the direct line-of-sight between the carriageway and some or all windows of the nearer receptors.

13.9.11 Despite these measures, there may be isolated dwellings or small groups of properties that may still be subject to noise increases. These may therefore qualify for noise insulation or other compensation, subject to other acoustic and non-acoustic criteria being met. These would be addressed following the procedure in The Noise Insulation Regulations and Land Compensation Act following construction of the Scheme. Details of the Noise Insulation Regulations are outlined in Appendix 13.1.

13.10 Assessment of Land Take Effects

13.10.1 No significant effects have been identified associated with land take. Therefore, no acoustic mitigation or monitoring is considered necessary and the effects would, therefore, be as discussed in Section 13.6.

13.11 Assessment of Construction Effects

13.11.1 A detailed construction noise and vibration assessment report is provided in Appendix 13.3. This contains a description of the prediction methodology, noise source levels, model input and results. The assessment below summarises the effects after mitigation has been applied.

Proposed New Section of Motorway

13.11.2 As an indication of the effectiveness of the temporary noise barriers, it has been assumed that barriers or other temporary screening would provide approximately 10 dB attenuation to noise at the ground floor for NVSRs near significant construction works. In practice, the screening attenuation achieved would vary, depending on the topography of the area, spatial separation and the nature of the works.

13.11.3 With the screening measures in place, the numbers of NVSRs adversely affected by construction noise would be reduced.

13.11.4 Within the expected variation of construction noise predictions, it is appropriate to approximate the distances for daytime works as: major impacts within approximately 18 metres of a worksite; moderate impacts within approximately 45 metres of a worksite; and minor impacts within approximately 71 metres of a worksite.

13.11.5 Residential NVSRs within around 45 metres of any worksite are considered likely to experience a moderate or major adverse impact, resulting in effects of moderate or large adverse significance. However, these effects would be temporary, and would occur only during the most intense periods of construction. There are approximately 166 residential properties within 45 metres of the construction works which may experience a potentially significant moderate adverse effect from construction noise. Of these, it is estimated that 68 fall within 18 metres and may experience a major adverse impact, leading to an effect of moderate or large adverse significance. An estimated 107 properties fall within 45 to 71 metres, and would experience a minor impact, leading to an effect of slight adverse significance. These distance bands are shown in Figure 13.11. A summary of the properties within each band is provided in Table 13.18 below.

Table 13.18: Summary of Construction Effects (with mitigation)

Impact	Buffer distance	Number of residential NVSRs potentially affected	Significance	
Major	18 m	68	Moderate or Large	Significant
Moderate	45 m	98	Moderate	Significant
Minor	71 m	107	Slight	Not significant

13.11.6 An indication of the properties potentially affected is given in Appendix 13.3, although the actual properties affected would depend on the detailed nature of the construction works. Measures implemented through the CEMP would ensure that any evening or night effects do not significantly increase from the effects identified above.

13.11.7 No specific mitigation is proposed to control noise from off-site construction traffic. Effects would be as reported in Section 13.7; construction traffic would be of slight adverse significance or less, which is not considered significant in EIA terms.

Complementary Measures

13.11.8 Works associated the Complementary Measures would follow construction of the new section of motorway and are expected to be completed within a further two years. Other than works associated with the retaining wall around Junction 25, no significant noisy works are proposed. Any impact arising from the Complementary Measures would be minor or negligible such that there would be no significant noise emissions predicted.

13.12 Assessment of Operational Effects

13.12.1 An operational noise assessment report is provided in Appendix 13.4. This contains a description of the prediction methodology, model input and results. Assessment is made of effects after mitigation has been applied.

Proposed New Section of Motorway

- 13.12.2** To allow consideration of the proposed mitigation set out in Section 13.9 above, assessment has been made for the scenarios discussed in Section 13.8 with the proposed noise barriers in place. For the Do-Minimum scenario (2022 and 2037), the assessment set out in Section 13.8 remains unchanged.
- 13.12.3** Noise barriers of 2 metres in height have been considered in four areas along the new section of motorway, as discussed previously. The height and locations of these barriers would be subject to evaluation and confirmation.
- 13.12.4** Noise contours of predicted daytime noise levels for the Do-Something scenarios for opening and future years with additional mitigation are provided in Figures 13.12 to 13.13. Results are presented in Annex D and Annex E of Appendix 13.4.

Do-Minimum Scenario and Do-Something Scenario with Mitigation in the Opening Year (Short Term)

- 13.12.5** Noise difference contours are provided in Figure 13.14. Tables of noise change at each receptor are provided in Annex D and summarised in Annex E of Appendix 13.4.
- 13.12.6** Out of the 20,654 residential receptors included in the noise model, during the daytime period, a noise increase of at least 1 dB is likely to occur at 2,197 receptors, with a maximum noise increase of up to 21 dB. A noise decrease of at least 1 dB is likely to occur at 13,056 receptors, with a maximum noise decrease of up to 8 dB. There is, therefore, no significant change likely to occur at 5,401 receptors. This is summarised in Table 13.19.

Table 13.19: Residential Property Count – With Additional Mitigation

Short term with scheme	Maximum change	Major	Moderate	Minor	Negligible	No Change	SubTotal
2022 Do Something <- 2022 Do Minimum	/ dB	5+ dB	3-4.9 dB	1-2.9 dB	0.1-0.9 dB	+/-0.1 dB	
Decrease	-8	1395	2706	8955	3137	-	16193
Increase	21	499	618	1080	1654	-	3851
Neutral	-	-	-	-	-	610	610
						Total:	20654

- 13.12.7** Out of the 77 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 1 dB is likely to occur at 8 receptors, with a maximum noise increase of up to 9 dB. A noise decrease of at least 1 dB is likely to occur at 52 receptors, with a maximum noise decrease of up to 6 dB. No significant change is likely to occur at 17 receptors.
- 13.12.8** Based on the predicted noise change, the magnitude of impact is considered to range between major beneficial and major adverse in the short term, although more receptors are likely to experience a noise decrease rather than a noise increase.

13.12.9 With regards to the assessment of significance, this is considered to result in an effect ranging from moderate or large beneficial to moderate or large adverse.

Do-Minimum Scenario in the Opening Year and Do-Something Scenario in the Future Assessment Year with Mitigation (Long Term)

13.12.10 Noise difference contours are provided in Figure 13.15. Tables of noise change at each receptor are provided in Annex D and summarised in Annex E of Appendix 13.4.

13.12.11 Out of the 20,654 residential receptors included in the noise model, during the daytime period, a noise increase of at least 3 dB is likely to occur at 1,154 receptors, with a maximum noise increase of up to 18 dB. A noise decrease of at least 3 dB is likely to occur at 2,167 receptors, with a maximum noise decrease of up to 8 dB. There is therefore no significant change likely to occur at 17,336 receptors. This is summarised in Table 13.20.

Table 13.20: Residential Property Count - With Additional Mitigation

Long Term with Scheme	Maximum change	Major	Moderate	Minor	Negligible	No Change	SubTotal
2037 Do Something <- 2022 Do Minimum	/ dB	10+ dB	5-9.9 dB	3-4.9 dB	0.1-2.9 dB	+/-0.1 dB	
Benefit	-8	0	774	1393	11911	-	14078
Disbenefit	18	30	496	628	4343	-	5497
Neutral	-	-	-	-	-	1079	1079
						Total:	20654

13.12.12 Out of the 77 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 3 dB is likely to occur at 6 receptors, with a maximum noise increase of up to 9 dB. A noise decrease of at least 3 dB is likely to occur at 9 receptors, with a maximum noise decrease of up to 5 dB. No significant change is likely to occur at 62 receptors.

13.12.13 Based on the predicted noise change, the magnitude of impact is considered to range between moderate beneficial and major adverse in the long term, although more receptors are likely to experience a noise decrease rather than a noise increase.

13.12.14 With regards to the assessment of significance, this is considered to result in an effect ranging from moderate beneficial to moderate or large adverse.

13.12.15 In summary, with additional mitigation: in the short term, 1,117 receptors are subject to a significant adverse effect; and 4,101 are subject to a significant benefit. In the long term, 526 receptors are subject to a significant adverse effect; and 774 are subject to a significant benefit.

13.12.16 Initial calculations indicate that in the long term, the noise barriers would provide a significant benefit for 110 properties, decreasing noise sufficiently to change the impact category for these properties either: from major adverse to moderate adverse; from moderate adverse to minor adverse; or from minor adverse to

negligible. There would be 73 fewer properties within the long term adverse category with the barriers in place. Results are provided in full in Appendix 13.4.

- 13.12.17** When considered as a whole, the Scheme has a net benefit, with an average noise level difference of -1.4 dB per property across the 20,654 properties assessed for the opening year, when comparing the Do-Minimum scenario against the Do-Something scenario. This equates to approximately a 66,700 'dB·people' improvement due to the Scheme.

Complementary Measures

- 13.12.18** As set out in Section 13.8 above, the effects of the Complementary Measures with regards to noise are associated primarily with the change in traffic flow on the existing M4. As this change is intrinsic within the traffic assessment for the Scheme, this is included within the assessment set out above.
- 13.12.19** None of the other elements of the Complementary Measures would have an acoustic effect beyond those previously identified above for the proposed new section of motorway.

13.13 Assessment of Cumulative Effects

- 13.13.1** If worksites for different projects are located within 250 metres of each other and the construction phases overlap, potential cumulative impacts on NVSRs could occur. However, with the implementation of best practice and standard mitigation measures, noise and vibration would be minimised as far as is reasonably practicable.
- 13.13.2** Other committed developments are included within the traffic model for the Scheme and, therefore, noise effects associated with operational traffic for these developments are included within the operational assessment set out above.
- 13.13.3** Further details of potential cumulative effects are provided in Chapter 17 of this ES.

13.14 Inter-relationships

- 13.14.1** The operational assessment is based on the traffic model for the Scheme. Details of operational traffic are provided in Chapter 2 and in the Traffic Forecasting Report (Welsh Government, 2016b). Construction traffic information is provided in Chapter 3 and the assessment of construction effects has been informed by the construction methodology provided in Chapter 3.
- 13.14.2** The results of the acoustic modelling have been used to determine the effects on ecological receptors (Chapter 10), communities (Chapter 15) and cultural heritage assets (Chapter 8) and to inform the Health Impact Assessment (Appendix 5.4). Further details of potential inter-related effects are provided in Chapter 17 of this ES.

13.15 Summary of Effects

- 13.15.1** The planning system promotes sustainable economic growth, whilst ensuring that quality of life is not unreasonably affected. It is considered that the Scheme

appropriately reflects these aims with regard to the noise and vibration effects associated with the construction and subsequent operation of the Scheme.

- 13.15.2** During the construction phase, standard best construction practice would be adopted. In addition, where necessary, additional mitigation would be put in place, including temporary hoardings or noise barriers around worksites or particularly noisy activity and sound insulation where appropriate.
- 13.15.3** Specific monitoring measures would include noise monitoring and vibration monitoring at residential premises at key locations during construction to check compliance with noise and vibration limits.
- 13.15.4** A Construction Environmental Management Plan (CEMP) will set out the controls for noise and vibration levels during construction. A Pre-CEMP is provided at Appendix 3.2 of this ES.
- 13.15.5** With the generic mitigation measures discussed and temporary noise barriers where appropriate, it is estimated that 213 residential NVSRs may experience a moderate or major adverse impact, leading to effects of moderate or large significance. An estimated 140 properties fall within 45 to 71 metres of a construction site and would experience a minor impact, leading to a slight adverse significance of effect.
- 13.15.6** During operation, both beneficial and adverse noise effects are predicted to occur. The proposed new section of motorway would reduce congestion on the existing M4 potentially resulting in higher road-speeds and increased vehicle noise. Measures have been incorporated into the design of the Scheme to reduce noise for receptors in proximity to the proposed new section of motorway, including the provision of a thin road surface system which is relatively low noise and screening in the form of planting, bunding and retaining walls. Noise barriers of 2 metres in height area proposed at four areas along the new section of motorway, although these are subject to detailed design.
- 13.15.7** Based on the predicted noise change, the level of significance is considered to range between major beneficial and major adverse in the short term. In the long term, the range decreases to levels of significance between moderate beneficial and major adverse. Considering the difference between the situations in 2022 without the Scheme compared to the same year with the Scheme (without noise barriers), 1,203 receptors would experience a significant adverse effect and 4,026 would experience a significant benefit. With noise barriers in place, it is predicted that 1,117 receptors would experience a significant adverse effect and 4,101, a significant beneficial effect.
- 13.15.8** When considered as a whole, the Scheme has a net benefit, with an average noise level difference of -1.4 dB per property across the 20,654 properties assessed for the opening year, when comparing the Do-Minimum scenario against the Do-Something scenario. This equates to approximately a 66,700 'dB·people' improvement because of the Scheme.
- 13.15.9** It is considered, on balance that the Scheme would not result in unacceptable risk or harm due to noise pollution. Moreover, the Scheme would result in a positive improvement in the noise environment surrounding the existing M4 though Newport.

13.15.10 It is further considered that the Scheme would provide environmental improvements with regards to noise reduction through Newport. The Scheme would be of good quality and has been designed to avoid or reduce existing noise pollution. It is noted that, for some areas, significant adverse effects on local amenity may occur. With the mitigation measures proposed, the levels of adverse effect arising from noise would not result in unacceptable harm to health.

Table 13.21: Summary of Likely Environmental Noise and Vibration Effects with Mitigation

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
Construction Phase									
Construction noise effects on residential and other receptors	Medium	Construction Noise	Short/medium term	Major adverse: 166 residential NVSRs	Moderate or Large	Major adverse: 68 residential NVSRs	Moderate or Large	Significant	
				Moderate adverse: 326 residential NVSRs	Moderate	Moderate adverse: 98 residential NVSRs	Moderate	Significant	
				Minor adverse: 328 residential NVSRs	Slight	Minor adverse: 107 residential NVSRs	Slight	Not Significant	
Noise from Construction Traffic on residential and other receptors	Medium	Construction Traffic Noise	Short/medium term	Minor adverse	Slight	Minor adverse	Slight	Not Significant	
Construction vibration effects on residential and other receptors	Medium	Construction Vibration	Short/medium term	Below 1 mm/s at 30 metres; below 0.3 mm/s at 75 metres.	No significant effect	N/A	N/A	Not Significant	
Operational Phase									
Operational traffic	Medium - Residential Receptors	Noise Change (adverse)	Long term	Major adverse: 544 receptors Short / medium term; 37 receptors Long term	Moderate or Large	Major adverse: 499 receptors Short / medium	Moderate or Large	Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
						term; 30 receptors Long term			
				Moderate adverse: 659 receptors Short / medium term; 548 receptors Long term	Moderate	Moderate adverse: 618 receptors Short / medium term; 496 receptors Long term	Moderate	Significant	
				Minor adverse: 1021 receptors Short / medium term; 679 receptors Long term	Slight	Minor adverse: 1080 receptors Short / medium term; 628 receptors Long term	Slight	Not Significant	
				Negligible adverse: 1671 receptors Short / medium term; 4306 receptors Long term	Neutral or slight	Negligible adverse: 1654 receptors Short / medium term; 4343 receptors Long term	Neutral or slight	Not Significant	For reference

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
		Noise Change (beneficial)	Long term	Major beneficial: 1370 receptors Short / medium term; 0 receptors Long term	Moderate or Large	Major beneficial: 1395 receptors Short / medium term; 0 receptors Long term	Moderate or Large	Significant	
				Moderate beneficial: 2656 receptors Short / medium term; 774 receptors Long term	Moderate	Moderate beneficial: 2706 receptors Short / medium term; 774 receptors Long term	Moderate	Significant	
				Minor beneficial: 8977 receptors Short / medium term; 1351 receptors Long term	Slight	Minor beneficial: 8955 receptors Short / medium term; 1393 receptors Long term	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
				Negligible beneficial: 3145 receptors Short / medium term; 11875 receptors Long term	Neutral or slight	Negligible beneficial: 3137 receptors Short / medium term; 11911 receptors Long term	Neutral or slight	Not Significant	For reference
		Neutral	Long term	No Change: 611 receptors Short / medium term; 1084 receptors Long term	Neutral	No Change: 610 receptors Short / medium term; 1079 receptors Long term		Not Significant	For reference
	Medium - Non-residential NVSRs:	Adverse Noise Change at:							
	St Stephens Church, Alexandra Road, Newport	Place Of Worship	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not Significant	
	Nash Baptist Chapel*, Meadows Road, Newport *Now understood to be in residential use	Place Of Worship	(Short, Medium) / Long term	Major / Major Adverse	Moderate or Large	Major / Major Adverse	Moderate or Large	Significant	
	Church of St	Place Of	(Short,	Moderate /	Moderate	Moderate /	Moderate	Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	Michael and All Saints, Caldicot Road, Rogiet	Worship	Medium) / Long term	Moderate Adverse		Moderate Adverse			
	Pillgwenlly Library and Information Centre, Commercial Rd, Newport	Library	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not Significant	
	Duffryn High School, Lighthouse Road, Duffryn	Secondary School	(Short, Medium) / Long term	Moderate / Moderate Adverse	Moderate	Moderate / Moderate Adverse	Moderate	Significant	
	Coleg Gwent Newport Campus, Nash Road, Newport	University	(Short, Medium) / Long term	Minor / Minor Adverse	Slight	Minor / Minor Adverse	Slight	Not Significant	
	Lisweey High School, Nash Road, Newport	Secondary School	(Short, Medium) / Long term	Moderate / Moderate Adverse	Moderate	Moderate / Moderate Adverse	Moderate	Significant	
	Premier Inn, Newport Road, Castleton, Newport	Hotel/Motel	(Short, Medium) / Long term	Major / Major Adverse	Moderate or Large	Major / Major Adverse	Moderate or Large	Significant	
	Maes Ebbw Upper School, Maesglas Rd, Newport	Secondary / High School	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not Significant	
	Medium - Non-residential NVSRs:	Beneficial Noise Change at:							

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	Malpas Road Evangelical Church, Malpas Road, Newport	Church	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Newport City Council, Christchurch Cemetery, Christchurch Road, Newport	Cemetery / Crematorium / Graveyard. In Current Use.	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Greenfields Private Nursery, Primrose Cottage, Chepstow Road, Newport	Children?s Nursery / Crèche	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	The Old Barn Inn, Magor Road, Llanmartin, Newport	Hotel/Motel	(Short, Medium) / Long term	Major / Moderate Benefit	Large, Moderate	Major / Moderate Benefit	Large, Moderate	Significant	
	Holiday Inn Express, Lakeside Drive, Coedkernew, Newport	Hotel/Motel	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	South Gwent Childrens Centre, Serennu, Cwrt Camlas, Rogerstone, Newport	Hospital / Hospice	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	Holy Trinity Church, Christchurch Road, Newport	Place Of Worship	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Glan Usk Primary School, Bank Street, Newport	Primary School	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	The Caravan Club, Tredegar Park, Pencarn Way, Duffryn, Coedkernew, Newport	Holiday / Campsite	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	Parish Church Of Langstone, Langstone Court Road, Langstone, Newport	Place Of Worship	(Short, Medium) / Long term	Moderate / Moderate Benefit	Moderate	Moderate / Moderate Benefit	Moderate	Significant	
	St Martins Church, Magor Road, Newport	Place Of Worship	(Short, Medium) / Long term	Major / Moderate Benefit	Moderate or Large	Major / Moderate Benefit	Moderate or Large	Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	Trinity Methodist Church, Glasllwch Lane, Newport	Church	(Short, Medium) / Long term	Major / Minor Benefit	Large, Moderate or Slight	Major / Minor Benefit	Large, Moderate or Slight	Significant	
	Celtic Springs Day Nursery, Buchanan Way, Newport	Children's Nursery / Crèche	Long term	Moderate Benefit	Slight or Moderate	Moderate Benefit	Slight or Moderate	Significant	
	Ringland Presbyterian Church, Beatty Road, Newport	Church Hall / Religious Meeting Place / Hall	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	St Annes Church Hall, Church Close, Newport	Place Of Worship	(Short, Medium) / Long term	Moderate / Moderate Benefit	Moderate	Moderate / Moderate Benefit	Moderate	Significant	
	Catholic Church Of Julius The Martyr, Beaufort Road	Place Of Worship	(Short, Medium) / Long term	Major / Moderate Benefit	Moderate or Large	Major / Moderate Benefit	Moderate or Large	Significant	
	St Julians Baptist Church, Beaufort Road, Newport	Place Of Worship	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	St Julius and Aaron's Church, St Julians Avenue, Newport	Place Of Worship	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	All Saints Church, Brynglas Road, Newport	Children's Nursery / Crèche	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Osborne Childrens Nursery, Quantock Drive, Newport	Primary School	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	The Old Court, Old Court Farm, Caldicot Road, Rogiet, Monmouthshire	Boarding / Guest House / Bed And Breakfast / Youth Hostel	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Hampton By Hilton Hotel, Wales 1 Business Park, Newport Road, Magor, Monmouthshire	Hotel/Motel	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Appletree Nurseries, Wales 1 Business Park, Newport Road, Magor, Monmouthshire	Children's Nursery / Crèche	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Milton Junior & Infants School, Hendre Farm Drive, Newport	Children's Nursery / Crèche	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	Underwood Baptist Church, Underwood Baptist Free Church, Birch Grove, Llanmartin, Newport	Church	(Short, Medium) / Long term	Major / Major Benefit	Moderate or Large	Major / Major Benefit	Moderate or Large	Significant	
	St Mary's Church, Wilcrick Lane, Magor, Caldicot, Newport	Place Of Worship	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	St Marys Church Hall, Llanover Close, Newport	Church Hall / Religious Meeting Place / Hall	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	St Annes Church, Church Close, Newport	Place Of Worship	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	1 Kumon Educational Co Ltd, Lakeside Drive, Coedkernew, Newport	Other Educational Establishment	Long term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	Church Hall, St Julius And Aaron's Church, St Julians Avenue, Newport	Church Hall / Religious Meeting Place / Hall	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Celtic Guest Houses, Old Rectory, The Old Rectory, Magor Road, Llanmartin, Newport	Boarding / Guest House / Bed And Breakfast / Youth Hostel	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	Premier Inn, Chepstow Road, Langstone, Newport	Hotel/Motel	(Short, Medium) / Long term	Major / Major Benefit	Moderate or Large	Major / Major Benefit	Moderate or Large	Significant	
	The Waterloo Hotel & Bistro, Alexandra Road, Newport	Hotel/Motel	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Memorial Hall, Dinch Hill Lane, Undy, Monmouthshire	Cemetery / Crematorium / Graveyard. In Current Use.	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Crindau Primary School, Ailesbury Street, Newport	Primary School	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	St Julians Junior And Infants School, Beaufort Road, Newport	Preparatory / First / Primary / Infant / Junior / Middle School	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	Kimberley Nursery School, Blaen- Y-Pant Crescent, Blaen Y Pant Crescent, Newport	Children's Nursery / Crèche	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Evergreen Club, Blaen-Y- Pant Crescent, Newport	Children's Nursery / Crèche	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Newport City Council, Ysgol Gymraeg Bro Teyrnnon, Brynglas Drive, Newport	Preparatory / First / Primary / Infant / Junior / Middle School	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Hilton Country Park Hotel, Chepstow Road, Langstone, Newport	Hotel/Motel	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	St. Julians High School, Heather Road, Newport	Secondary School	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	Milton Junior And Infants School, Hendre Farm Drive, Newport	Infant School	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	High Cross Primary School, High Cross Junior And Infant School, High Cross Drive, Rogerstone, Newport	Primary School	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Glasllwch Junior & Infant School, Melbourne Way, Newport	Infant School	(Short, Medium) / Long term	Moderate / Minor Benefit	Slight or Moderate	Moderate / Minor Benefit	Slight or Moderate	Significant	
	Ringland Library, Ringland Circle, Newport	Library	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	The Celtic Manor Resort, The Coldra, Catsash, Newport	Hotel/Motel	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	Holiday Inn Newport, The Coldra, Newport	Hotel/Motel	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Community Education Department - Lifelong Learning, Community Education Department, Brynglas House, Brynglas Road, Newport	Other Educational Establishment	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	
	Langstone Methodist Church, Catsash Road, Langstone, Newport	Church	(Short, Medium) / Long term	Moderate / Moderate Benefit	Moderate	Moderate / Moderate Benefit	Moderate	Significant	
	Brynglas Adult Training Centre, Brynglas Road, Newport	College	(Short, Medium) term	Minor Benefit	Slight	Minor Benefit	Slight	Not Significant	
	Newport Chartist Telecoms Engineering, Christchurch Centre, Malpas Road, Newport	Place Of Worship	(Short, Medium) / Long term	Minor / Minor Benefit	Slight	Minor / Minor Benefit	Slight	Not Significant	

Activity/ Impact	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant	Notes
	St Mary's Church, Chapel Terrace, Magor	Church Hall / Religious Meeting Place / Hall	(Short, Medium) term	Negligible Change	-	Minor Benefit	Slight	Not Significant	Minor benefit only with noise barriers
	Magor Church Centre, The Church Hall, Sycamore Terrace, Magor	Church Hall / Religious Meeting Place / Hall	(Short, Medium) term	Negligible Change	-	Minor Benefit	Slight	Not Significant	Minor benefit only with noise barriers
Operational Phase	Vibration	NVSRs	Short, Medium / Long term	Minor adverse	Slight	Negligible Change	Neutral or Slight	Not Significant	