

SECTION 7

NOISE & VIBRATION

7.1 Introduction

7.1.1 This chapter presents the findings of the noise and vibration assessment of the proposed An Camas Mòr development. It assesses the potential noise and vibration effects associated with the Proposed Development, including construction and operational emissions. The objectives of the assessment are to:

7.1.2 Determine the potential noise and vibration effects caused and received by the proposed development:

- Develop, as necessary, mitigation and control measures to prevent, reduce and where possible offset significant adverse effects;
- Highlight any significant residual effects that cannot be mitigated; and
- Describe any cumulative effects the Proposed Development may have in combination with other developments.

7.1.3 The Proposed Development encompasses sensitive areas overlooking the River Spey and forms part of the Cairngorms National Park. Extensive construction works would be necessary and a new traffic scheme would be developed to service the Proposed Development. Noise and vibration effects would occur mainly during the construction phase of the Proposed Development, as a result of the operation of large items of plant. This equipment would have the potential to generate noise levels considerably higher than current conditions.

7.1.4 The area of the Proposed Development is principally rural in character, notwithstanding the town of Aviemore occupying the western bank of the River Spey. A number of smaller settlements, comprising residential and commercial properties, are located in close proximity to the site. Accordingly, the nature of construction work activities to be undertaken, duration of the operations, distance from noise source to receptor and traffic flows, are considered key to the significance of the Proposed Development effects.

7.1.5 The assessment covers a number of stages, including liaison with local authorities and modelling. Criteria against which predicted noise and vibration effects are assessed have been developed from recognised national and international guidance, as detailed in Section 7.2. The area likely to be affected by the Proposed Development is presented in Section 7.5. Predicted effects are discussed in Section 7.9 and the scope for mitigation has been investigated in Section 7.12. Any residual and cumulative effects remaining after mitigation are outlined in Section 7.13 and Section 7.14 respectively. Conclusions are detailed in Section 7.15.

7.1.6 The construction programme and methodology has not been refined in detail at the present application stage of the Proposed Development. Similarly, a detailed plan of the Proposed Development is unavailable. Consequently, in order to undertake an

assessment of the potential noise effects, it has been necessary to make a number of assumptions in order to predict the scale of potential noise effects.

7.1.7 A glossary of the acoustic terminology used in this chapter is provided in Appendix E.

7.2 Methodology

Legislative and Regulatory Context

7.2.1 The Scottish Government offer guidance and strategy in relation to the potential noise effect from new developments. This guidance is detailed in the documents specified below:

- Circular 10/1999: Planning and Noise¹;
- Planning Advice Note 56 (PAN 56): Planning and Noise²;
- Planning Advice Note 58 (PAN 58): Environmental Impact Assessment³;
- Planning Advice Note 50 (PAN 50): Controlling the Environmental Effects of Surface Mineral Workings⁴; and
- Planning Advice Note 50 (PAN 50) Annex A: The Control of Noise at Surface Mineral Workings⁵.

7.2.2 Circular 10/1999 states:

“...the planning system has a role to play in preventing and minimising the impact of noise through its influence over the location and design of new developments. It should aim to do this without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.”

7.2.3 A structure for managing environmental noise and development is outlined in PAN 56. The guidance states that a noise impact assessment would assist planning authorities where developments could raise significant noise issues. The need for balancing the benefits of development with environmental noise effects is detailed in PAN 56:

“Noise can have a significant impact upon our health, quality of life and the environment generally. This advice note demonstrates the role of the planning system in preventing and limiting the adverse effects of noise without prejudicing investment in enterprise, development and transport.”

¹ The Scottish Office. (1999). Circular 10/1999: Planning and Noise.

² The Scottish Office. (1999). Planning Advice Note 56: Planning and Noise.

³ Scottish Executive. (1999). Planning Advice Note 58: Environmental Impact Assessment.

⁴ Scottish Executive. (1996). Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings.

⁵ The Scottish Executive. (1996). Planning Advice Note 50 Annex A: The Control of Noise at Surface Mineral Workings.

7.2.4 PAN 56 does not set out objective criteria for the level of noise produced during construction. Paragraph 34 does, however, specifically deal with construction noise and states:

“Whilst planning conditions can be used to limit noise from temporary construction sites it is most effectively controlled by means of the Control of Pollution Act 1974 (see Annex 4). Notice can be served in advance of works and site conditions set to control activities. Detailed guidance on noise issues relating to construction sites can be found in BS 5228 Noise control on construction and open sites. In particular, Part 1, “Code of Practice for basic information and procedures for noise control” would be useful because as well as giving general advice, it describes a method for predicting noise from construction sites.”

7.2.5 According to PAN 56, the noise impact assessment should seek to:

“Measure or predict and describe noise levels (including traffic noise) to be generated by the proposed development; or that the proposed development is to be subjected to criteria for assessing the impact of noise on its surroundings and outline measures available to reduce noise impact to acceptable levels.”

7.2.6 PAN 56 cross-references other relevant guidance, such as PAN 50. Although not directly applicable to construction noise, PAN 50 provides useful reference information for activities of a similar character. Construction noise, however, normally covers greatly reduced working periods. The role of Annex A of PAN 50 is to:

“...provide advice on how the planning system can be used to keep noise emissions from surface mineral workings within environmentally acceptable limits without imposing unreasonable burdens on minerals operators.”

7.2.7 PAN 58 identifies the need for a noise impact assessment to be carried out that includes consultation with planning authorities and consultees, where appropriate.

In addition to Scottish Government guidance, specific direction in relation to construction noise and vibration is also given in:

- Control of Pollution Act, 1974 (CoPA)⁶;
- Environmental Protection Act, 1990 (EPA)⁷; and
- British Standard 5228 (BS 5228): Noise and Vibration Control on Construction and Open Sites⁸.

7.2.8 CoPA may be used to control noise and vibration via imposing or negotiating operating conditions on the development site. Under Part III of the EPA, a Local

⁶ Control of Pollution Act (1974). Part III, HMSO.

⁷ Environmental Protection Act (1990). Part III, HMSO.

⁸ British Standard 5228 (1997). Parts 1-4: Noise and Vibration Control on construction and open sites. Code of Practice for Basic Information and Procedures for Noise and Vibration Control.

Authority has a duty to investigate a complaint of noise from vehicles, machinery or equipment, as amended by the Noise and Statutory Nuisance Act 1993. An abatement notice may be served by the Local Authority if an environmental health officer is satisfied that a statutory nuisance has occurred.

7.2.9 The potential effects of construction noise can be determined in accordance with the principles of BS 5228. This standard provides guidance on typical construction plant noise levels, prediction methods and mitigation procedures that can be used to reduce noise. It is the most widely used guidance for construction noise assessment in the United Kingdom.

7.2.10 The effects of increased public road network activity may be assessed using the methodologies outlined in the following documents:

- Calculation of Road Traffic Noise (CRTN)⁹; and
- Design Manual for Roads and Bridges (DMRB)¹⁰.

7.2.11 CRTN is an internationally accepted method of calculating future noise levels as a result of changes to road traffic flows or design. The methodology uses measured or predicted movements, road type, average speed data and traffic flow composition (percentage of HGV's) to determine noise levels as a result of project and no-project scenarios.

7.3 Assessment Methodology

7.3.1 A range of factors determine the acceptability of construction site noise in addition to the actual noise levels produced by plant items. These include the location of work positions, hours of work, baseline conditions, noise screening, the nature of work being carried out and the attitudes of the receptor and site operator.

7.3.2 It is generally accepted by Local Authorities that due to the temporary nature of construction noise, it warrants less stringent controls on noise emissions than that of a permanent operational development. Strict noise control measures can also be difficult to impose due to the transient nature of the works and may also hinder site progress.

7.3.3 The type of equipment used would vary in sound power level, with heavy plant items, such trucks, excavators and piling rigs being the most significant source of noise. These sources typically have a greater low frequency noise content (20 Hz to 200 Hz) and their emissions are generally not attenuated as effectively by atmospheric effects and ground absorption as mid and high frequency noise. This has the effect of low frequency noise being more audible at greater distances.

7.3.4 Fixed limits do not apply to construction site noise in the UK. Although BS 5228 specifies a noise and vibration prediction methodology, it does not recommend a method for determining the level of potential disturbance arising from the received

⁹ Calculation of Road Traffic Noise (1988), HMSO.

¹⁰ Design Manual for Roads and Bridges (1993). Volume 11, HMSO.

noise levels. In this instance, a significance criterion has been developed based on the guidance of the Department of Environment's Advisory Leaflet 7211 (DoE AL 72). Although DoE AL 72 is no longer in print (first published in 1976), the document remains the most commonly cited reference in construction noise assessments in the UK.

7.3.5 DoE AL 72 recommends that the daytime noise levels outside the nearest occupied room in a noise sensitive property should not exceed the following levels over a normal working day:

- 75 dB(A) in urban areas near to main roads in heavy industrial areas; or
- 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise.

7.3.6 The DoE AL 72 guidance is normally taken to represent the values above which moderate to major effects can take place. It is recognised that prolonged exposure to construction noise at a level significantly above the DoE AL72 urban criterion of 75 dB(A) is likely to result in disturbance to the occupiers of nearby properties or other receptors.

7.3.7 The practicality of any proposed construction noise effect criterion, in addition to the likely level of noise generated and the duration of exposure, should be considered when establishing a standard that is designed to protect the local environment.

7.3.8 Appropriate reference values for reduced effects have been derived based on the guidance provided by DoE AL 72, in addition to that of the World Health Organisation Community Noise Guidelines¹¹ and PAN 50 Annex A. The significance criterion used in the assessment of construction noise is presented in Table 7.1.

Table 7.1: Construction Noise Significance Criterion

Effect Significance	Description	Duration	Construction Noise at Receptor dB(A)
Major	A significant change in conditions	Months	65 – 70
		Weeks	70 – 75
		Days	> 75
Moderate	A material but non-significant change in conditions	Months	60 – 65
		Weeks	65 – 70
		Days	70 – 75
Minor	A perceptible but restricted change in conditions	Months	55– 60
		Weeks	60 – 65
		Days	65 – 70
Negligible	A potentially perceptible but non-significant change in conditions	Months	< 55
		Weeks	< 60
		Days	< 65

7.3.9 The significance criterion detailed in Table 7.1 represent a balanced compromise between practical limitations and the necessity to maintain an acceptable local noise climate. The potential effect of traffic using public roads in the vicinity of the Proposed Development during construction and operation will be assessed based on the guidance of CRTN and DMRB.

7.3.10 Road traffic noise calculated using the CRTN methodology is based on traffic flow. An increase in traffic volume of 25 % is required in order to increase road traffic noise levels by 1 dB(A). DMRB Volume 11 (Ref. 8.9) advises that a change of 1dB(A) is barely perceptible whilst PAN 56 states that a change in noise level of 3 dB(A), equivalent to a doubling or halving of traffic flow, is just perceptible. It is therefore assumed that a change in traffic noise level between 1 dB(A) and 3 dB(A) is barely perceptible. The significance criterion used in the assessment of transportation noise is presented in Table 7.2.

Table 7.2: Road Traffic Noise Significance Criterion

Effect Significance	Description	Change in Traffic Noise Level (LA10, 18hr) dB(A)
Major	A significant change in conditions	≥ 5
Moderate	A material but non-significant change in conditions	3 - < 5
Minor	A perceptible but restricted change in conditions	1 - < 3
Negligible	A potentially perceptible but non-significant change in conditions	< 1

¹¹ World Health Organization (2000), 'Guidelines for Community Noise'

7.3.11 The assessment will relate to the change in noise produced by a road rather than the absolute value at any specific location.

7.4 Consultation

7.4.1 Discussions were held with the Environmental Health department of The Highland Council on 17th September 2008 regarding the noise and vibration assessment methodology and the need for a baseline survey.

7.4.2 It was agreed that the use of best practice guidance, as detailed in Section 7.2 and Section 7.3 would offer a sufficient level of protection to receptors in the immediate vicinity of the Proposed Development. Furthermore, baseline monitoring was deemed to be necessary due to the relative sensitivity of the local environment.

7.5 Baseline Conditions

Description of Baseline Environment

7.5.1 The Proposed Development is to be set in a location that can be described as rural in character. The general area is National Park and farm land, used for recreational and agricultural pursuits, respectively. The terrain is undulating and the area has a mature tree population in places. The River Spey forms an approximate western boundary of the Proposed Development.

7.5.2 Although background noise levels in the immediate area vary according to individual surroundings, the conditions at the nearest receptors are generally controlled by natural sources of noise such as that produced by meteorological effects, watercourses and wildlife. As such, much of the receptor positions are relatively tranquil. Background noise levels are likely to increase during periods of inclement weather, owing to the rural and geographical nature of the area, specifically the terrain, forestry and the River Spey.

7.5.3 There is a degree of variation in background noise levels in the vicinity of the Proposed Development, due to natural noise sources and those generated by human activity. Road traffic noise from the B970 contributes to the local noise climate at positions typically to the east and south of the site, whilst the B9152 generally influences environmental conditions to the west, and to a lesser extent north of the Proposed Development area. The level of road traffic noise reduces during evening and night-time periods. All other roads are generally single track or private with low traffic movements.

7.5.4 A wide variety of noise receptors are located in the nearest town of Aviemore, those identified as most likely to be affected by the development are dwellings or holiday villas. Potentially affected buildings are generally semi-detached and detached structures of varying designs and sizes. The nearest receptor is located at Dalfaber, approximately 200 m to the north-west of the site.

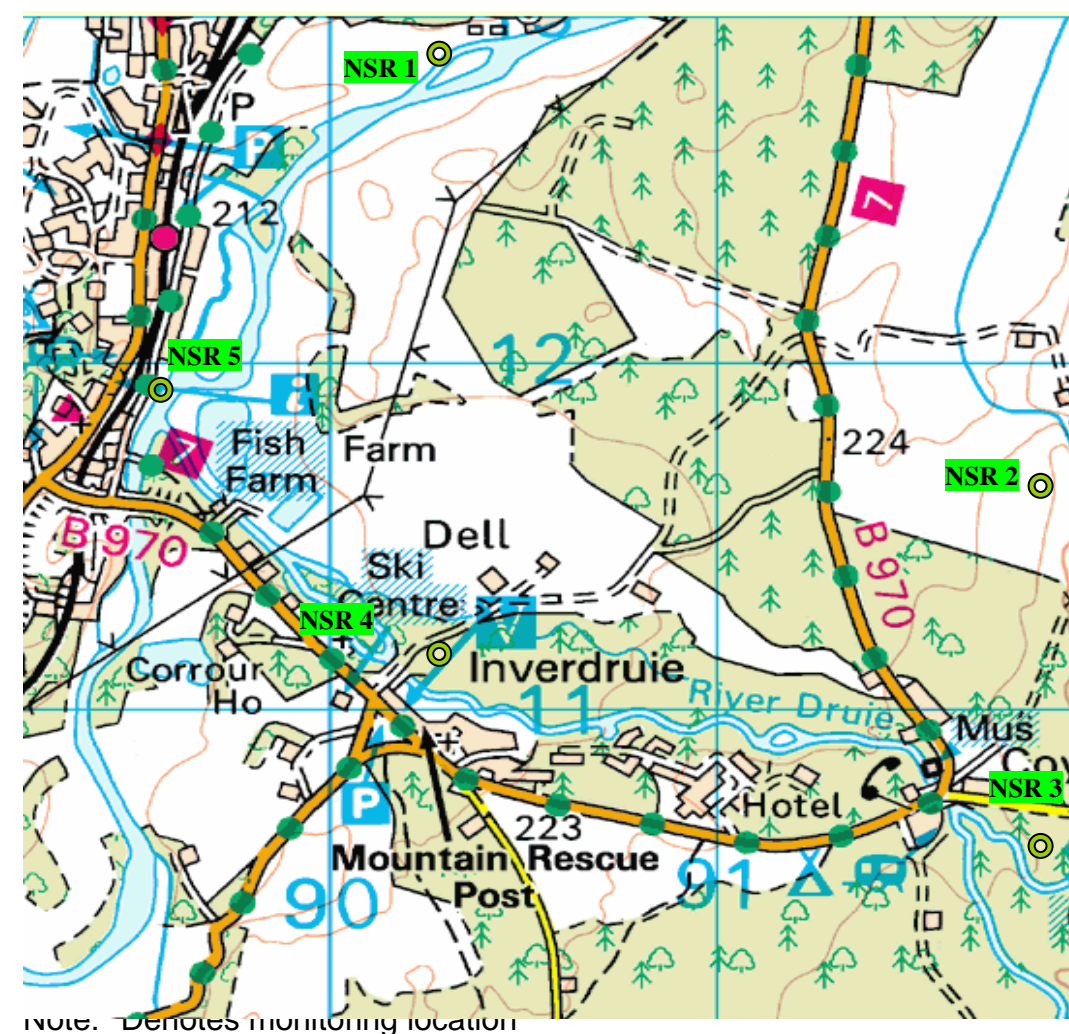
7.5.5 The daytime sounding of train horns on the Strathspey steam railway is audible at all locations in the general locale of the site between the months of March to October.

Other modes of transport including aircraft do not have a discernable effect on background noise levels.

7.6 Baseline Survey Positions

7.6.1 A long-term unattended monitoring survey of existing conditions was undertaken following discussion with The Highland Council. Continuous monitoring was carried out in free-field conditions at five receptors over a measurement interval of eight days, incorporating daytime and night-time periods. The receptors were selected as they are believed to be the most representative of the potential worst-case effects as they are understood to be the closest receptors to the Proposed Development. The monitoring positions are specified in Figure 7.1 and described in further detail in Table 7.3.

Figure 7.1: Baseline Measurement Positions



7.6.2 The distance of each receptor relative to the Proposed Development site boundary is detailed in Table 7.3. The baseline measurements logged LAeq, 1 hour and LA90, 1 hour indices using a 'fast' time weighting. A number of other environmental indices were recorded during the survey to further characterise the noise climate for future reference.

Table 7.3: Baseline Measurement Positions

Receptor	Monitoring Location	Description	Approximate Distance from Proposed Development Boundary (m)	Grid Reference
NSR 1	Dalfaber Lodges	Dwelling	200	290515, 812950
NSR 2	Guislich Farm	Dwelling	550	291890, 811900
NSR 3	Coylum Road	Dwelling	1050	291745, 810795
NSR 4	Dell Farm	Dwelling	550	290340, 811315
NSR 5	Dalfaber Road	Dwelling	550	289553, 812053

7.6.3 All noise monitoring was carried out between the 25th September and 2nd October 2008.

7.7 Baseline Survey Results

7.7.1 To be consistent with the overall conservative approach to assessing the effects of environmental noise from the Proposed Development, it is appropriate to consider the minimum LA90, 1 hour levels that were measured at each receptor. A summary of the acquired baseline environmental noise data at each of the receptors is detailed in Table 7.4 where the time of day at which the minimum LA90, 1 hour levels occurred is indicated.

Table 7.3: Baseline Monitoring Positions

Receptor	Monitoring Location	Minimum LA90, 1 hour	Time of Day Minimum LA90, 1 hour was Measured
NSR 1	Dalfaber Lodges	27.5	04:00
NSR 2	Guislich Farm	19.7	19:00
NSR 3	Coylum Road	25.1	14:00
NSR 4	Dell Farm	33.4	04:00
NSR 5	Dalfaber Road	29.9	14:00

7.7.2 The Dalfaber Lodges monitoring location was located immediately to the north of the River Spey, approximately 100 m from the watercourse. Measurements were made on land near the dirt track to the south of the Aviemore Highland Resort, at a position west of the Scottish Water works. The dominant sound at this location is that of distant road traffic and meteorological effects.

7.7.3 Guislich Farm is located to the east of the Proposed Development. This noise climate at this location is controlled by natural sources of sound such as that produced by foliage during a breeze. Manmade sources of noise are typically infrequent at this receptor.

7.7.4 The monitoring location at Coylum Road was partially removed from the nearest source of noise, the B970 road, by positioning the equipment in the back garden of a home which did not border the highway. Environmental noise levels at this receptor were generally influenced by a mixture of road traffic, domestic and natural sound sources.

7.7.5 Dell Farm is located to the south of the Proposed Development. The environmental noise conditions at this location are dominated by natural sources of sound owing to this property being surrounded by numerous mature trees. Manmade sources of noise are experienced mainly during daytime due to the working status of the farm and forestry management practices.

7.7.6 The monitoring at the receptor located off Dalfaber Road took place in the rear garden of a residential property. Although this receptor is located near a lightly-trafficked road and the railway line, the noise climate was controlled by natural sound sources due to the presence of well established foliage and the River Spey being located approximately 50 m from the garden perimeter.

7.7.7 Minimum LA90, 1 hour noise levels in the range of 19.7 dB(A) to 33.4 dB(A) were measured over the monitoring period. The minimum recorded LA90, 1 hour level of 19.7 dB(A) occurred at Guislich Farm at 19:00 on 27th September 2008.

7.8 Further Baseline Survey Results

7.8.1 All measurement equipment complied with the relevant Type 1 requirements of IEC651 Specification for Sound Level Meters and IEC804 Specification for Integrating Averaging Sound Level Meters. The sound level metres were checked calibrated shortly before the surveys and again shortly after the surveys were completed, the instrumentation reading correctly on all occasions. The following instrumentation was used throughout the survey:

- Rion NL-32 Integrating Datalogging SLM, Serial Number 00872234;
- Rion NA-28 Integrating Datalogging SLM, Serial Number 001070571;
- Rion NL-32 Integrating Datalogging SLM, Serial Number 01070574;
- Rion NA-28 Integrating Datalogging SLM, Serial Number 00472146;
- Rion NA-28 Integrating Datalogging SLM, Serial Number 01260205; and
- Rion NC-74 Class 1 Acoustical Calibrator, Serial Number CAL100505.

7.8.2 Noise measurements were taken in varied weather conditions, of standard temperature and pressure. Pre-polarised microphones were used throughout the survey and positioned 1.5 metres above ground level and removed from vertical facades. All non-external sound equipment (sound level meter and gel-cell batteries) were placed in a locked weatherproof case and the sound level meters were fitted with a wind shield at all times.

7.8.3 The ambient sound levels were measured in accordance with the principles of British Standard, BS7445: 2003, 'Description and measurement of environmental noise. Guide to quantities and procedures', and BS 4142: 1997: 'Method for rating industrial noise affecting mixed residential and industrial areas'.

7.9 Predicted Effects

Summary

7.9.1 The potential for adverse noise and vibration effects exist during the construction and operational phases of the Proposed Development. The likelihood of construction or operational activity to cause disturbance is determined in a different manner due to the temporary and permanent nature of each noise source, respectively.

7.9.2 A construction noise assessment enables the extent of effects to be established in conjunction with the identification of appropriate mitigation measures to minimise adverse effects. Noise emissions during the construction phase would arise from a range of static and moving sources. Static sources of construction noise normally include construction plant positioned at specific fixed locations, whilst moving sources typically comprise mobile construction plant and vehicles.

7.9.3 The prediction of construction noise has been carried out based on the methodology outlined in BS 5228. The standard provides information on how best to minimise the level of noise intrusion, and details guidance on noise measurement and prediction methods. The calculation methodologies cover the prediction of moving construction traffic noise and work activities at fixed locations. Typical noise levels of construction plant and activities are also detailed in the standard.

7.9.4 Although fixed limits do not apply to construction noise in UK legislation, predicted noise levels can be compared with absolute noise limits beyond which it is generally accepted that construction noise is likely to provoke complaints, as outlined in Section 7.3. Construction traffic movement on public roads is assessed in terms of the likely subjective impression of changes in road traffic noise emissions as compared to baseline conditions using the methodology outlined in CRTN.

7.9.5 Potential adverse effects arising from the completed development would generally be attributable to direct local changes in road traffic flows. This would include commuter traffic and vehicles servicing the operational development and will be evaluated using the methodology detailed in CRTN. Other potential sources of noise include effects associated with leisure and commercial operations, however, these are predicted to be negligible as a result of the transmission distances to the nearest receptors.

7.10 Sources of Noise

Construction Noise

7.10.1 The primary source of noise during construction activity would generally be attributable to large plant such as piling rigs, excavators, cranes, and dump trucks. Such sources of noise typically have greater low frequency noise content (20 Hz to 200 Hz) and their emissions in the main are not attenuated as effectively by atmospheric effects and ground absorption as mid and high frequency noise. This has the effect of low frequency noise being more audible at greater distances.

7.10.2 Noise emissions from small construction plant such as generators and compressors typically have lower sound power levels and potential noise effects from such plant can be effectively controlled by way of positioning and screening, as recommended in BS 5228.

7.10.3 The noise levels generated during construction activity depend on plant in use and operational mode, however, fixed plant sound power levels normally range from LWA 100 dB to LWA 120 dB whilst moving heavy vehicles typically produce noise levels of approximately LWA 110 dB. Idling plant and vehicles emit significantly reduced noise levels.

Operational Noise

7.10.4 The methodology detailed in CRTN for predicting road transportation noise levels has been used in this assessment to determine the change in noise emissions from the public road network as a result of operational development flows. The predicted relative change in noise levels are then compared with baseline conditions from the main public roads which allows a significance criterion to be assigned to a given road.

Construction Noise

General Construction

7.10.5 The noise levels generated during the construction phase of the project are likely to be higher than those produced during operation, due to the need for impact activities. It is generally accepted however that controlled higher levels of noise during the construction phase of a given project are justifiable due to the nature of the works.

7.10.6 In addition to direct effects arising from construction activities, indirect noise effects may also occur, mainly in the form of construction traffic. The effects of direct sources of noise on receptors depend primarily on the distance to affected properties and the nature of the noise source. A summary of the factors that determine the likelihood of noise disturbance are detailed below:

- Noise generated by plant or equipment on site, expressed as sound power level (LWA);
- Distance between the noise source and receptor;
- Periods of time construction plant is operational;

- Phasing of construction works;
- Meteorological effects; and
- Level of attenuation likely due to ground absorption, air absorption and barrier effects.

7.10.7 There are a number of unknowns at this stage in regards to the construction stage of the proposed development, specifically in terms of the phasing, equipment to be used and techniques to be employed at site. It has therefore been necessary to make a variety of assumptions based on experience of similar projects. Consequently, worst case noise levels have been used in the assessment, i.e. selection of plant that would emit higher noise levels than may actually be the case. The assumptions allow for all calculations to be performed in accordance with the guidance of BS 5228 Part 1 and therefore take account of:

- Likely construction plant and activities;
- Plant noise levels resulting from operation at full power;
- Distance attenuation;
- Plant use over a normal working day; and
- Identified work areas.

7.10.8 Construction activities that retain the potential to create audible noise at nearby receptors include tree felling, excavation works, piling, concrete mixing, road construction, building construction and utility installation. The predicted effects of these activities are summarised in Table 7.5. The indicative noise levels have been calculated in accordance with BS 5228 and are conservative in nature, as it is assumed that plant items are in use for 100% of a typical working day on a partly porous ground surface without acoustic screening. The figures in bold denote exceedance of the recommended DoE AL 72 rural limit of 70 dB(A).

Table 7.5: Predicted General Plant Construction Noise Effects (dBA)

From	To	LA10 dB (2012 – No Development)	LA10 dB (2012 – With Development)	Change dB
Aviemore Southern Junction	South	74.0	74.0	0
Aviemore Southern Junction	North	73.6	73.6	0
A9	B9152	61.3	61.5	+0.2
A9 junction link rd	South	62.4	62.4	0
A9 junction link rd	B970	68.2	68.2	+0.1
B970	Aviemore central	66.1	66.2	+0.1
B9152	Dell Rd	63.4	63.7	+0.2
Dell Rd	Nethy Bridge Rd	61.7	64.1	+2.4
Ski Rd	An Camas Mòr SE access	53.3	60.6	+7.3
An Camas Mòr SE access	North	55.1	55.1	0
B970	Glenmore	62.8	62.8	0
B970	An Camas Mòr (Via New B970 Substation Route)	n/a	n/a	n/a

7.10.9 The findings presented in Table 7.5 indicate that received noise levels for most construction activities are of minor or negligible significance, other than for tree felling and road construction activities at Coylum Road (NSR 3) where effects of moderate significance are predicted as both of these activities are likely to generate noise levels at the receptor of between 70 – 75 dB(A) for only a number of days. The work associated with tree felling and road construction, however, is unlikely to produce noise levels in excess of 70 dB(A) for an extended period of time at Coylum Road. Noise levels of between 65 – 70 dB(A) are expected to occur for the remaining time at this receptor.

7.10.10 The noise effects of these construction activities should only be described as major if work takes place over an extended period, for example, where noise levels in excess of 70 dB(A) occur for a number of weeks. Whilst piling would generate the highest source sound levels, tree felling and road construction would result in the highest received noise levels due to their respective proximity to sensitive receptors.

7.10.11 Tree felling and road construction would be mobile processes that gradually increase in distance from the receptor. Accordingly, the predicted local effects at Coylum Road would be of moderate significance. As a result of the aforementioned factors, the predicted effects at this receptor for other construction activities are deemed to be of minor to negligible significance.

7.10.12 Although construction noise would be audible above the existing noise climate detailed in Table 7.4, it would generally not be considered intrusive in the context of the limited duration of site activity at a specific location.

Construction Traffic Noise

7.10.13 Traffic noise levels with and without the Proposed Development have been assessed for the years 2012, 2016 and 2018. The same prediction method has also been applied to 2028 on project completion. The predicted changes in road traffic noise levels at the 2012 stage of the development are detailed in Table 7.6.

Table 7.6: Predicted Construction Traffic Noise Effects for 2012 (dB)

From	To	LA10 dB (2012 – No Development)	LA10 dB (2012 – With Development)	Change dB
Aviemore Southern Junction	South	74.0	74.0	0
Aviemore Southern Junction	North	73.6	73.6	0
A9	B9152	61.3	61.5	+0.2
A9 junction link rd	South	62.4	62.4	0
A9 junction link rd	B970	68.2	68.2	+0.1
B970	Aviemore central	66.1	66.2	+0.1
B9152	Dell Rd	63.4	63.7	+0.2
Dell Rd	Nethy Bridge Rd	61.7	64.1	+2.4
Ski Rd	An Camas Mòr SE access	53.3	60.6	+7.3
An Camas Mòr SE access	North	55.1	55.1	0
B970	Glenmore	62.8	62.8	0
B970	An Camas Mòr (Via New B970 Substation Route)	n/a	n/a	n/a

7.10.14 The predicted change in noise levels between the 2012 no development and with development scenarios is forecast to be of negligible to minor significance for all existing roads other than the B970 Ski Road where a major impact is predicted due to the projected increase in traffic.

7.10.15 An assessment of future traffic noise levels with and without the Proposed Development for 2016 indicates similar results to that of 2012. The predicted changes in road traffic noise levels at the 2016 stage of the development are detailed in Table 7.7 below.

Table 7.7: Predicted Construction Traffic Noise Effects for 2016 (dB)

From	To	LA10 dB (2016 – No Development)	LA10 dB (2016 – With Development)	Change dB
Aviemore Southern Junction	South	74.3	74.4	+0.1
Aviemore Southern Junction	North	73.8	74.0	+0.2
A9	B9152	61.6	62.5	+0.9
A9 junction link rd	South	62.6	62.6	0
A9 junction link rd	B970	68.3	68.7	+0.3
B970	Aviemore central	66.2	67.0	+0.7
B9152	Dell Rd	63.6	65.2	+1.6
Dell Rd	Nethy Bridge Rd	61.9	64.5	+2.7
Ski Rd	An Camas Mòr SE access	53.3	61.2	+7.9
An Camas Mòr SE access	North	54.9	55.9	+1.0
B970	Glenmore	63.0	63.0	0
B970	An Camas Mòr (Via New B970 Substation Route)	n/a	n/a	n/a

7.10.16 The predicted change in noise levels between the 2016 no development and with development scenarios is forecast to be of negligible to minor significance for all existing roads other than the B970 Ski Road where a major impact is predicted due to the projected increase in traffic.

7.10.17 The future traffic noise levels with and without the Proposed Development for 2018 have been assessed. The predicted change in road traffic noise levels at this stage of the development are detailed in Table 7.8 below.

Table 7.8: Predicted Construction Traffic Noise Effects for 2018 (dB)

From	To	LA10 dB (2018 – No Development)	LA10 dB (2018 – With Development)	Change dB
Aviemore Southern Junction	South	74.5	74.6	+0.1
Aviemore Southern Junction	North	73.8	74.1	+0.3
A9	B9152	61.7	63.1	+1.4
A9 junction link rd	South	62.8	62.8	0
A9 junction link rd	B970	68.4	68.9	+0.5
B970	Aviemore central	66.2	67.3	+1.1
B9152	Dell Rd	63.5	65.8	+2.3
Dell Rd	Nethy Bridge Rd	62.2	62.1	0
Ski Rd	An Camas Mòr SE access	53.6	52.0	0
An Camas Mòr SE access	North	54.8	56.2	+1.4
B970	Glenmore	63.0	63.0	0
B970	An Camas Mòr (Via New B970 Substation Route)	n/a	63.0	n/a

7.10.18 The predicted change in noise levels between the 2018 no development and with development scenarios is forecast to be of negligible to minor significance for all existing roads.

7.10.19 The predicted change in noise levels resulting from the new B970 road (Substation route) specifies a noise level of 63.0 dB(A). A comparison of the predicted 63.0 dB(A) with current LA10 noise levels is not considered to be appropriate and would not represent a worst-case assessment as the pre-existing conditions are not controlled by road traffic noise effects. The minimum existing LA90 noise level of 33.4 dB(A) as presented in Table 7.4 is instead compared to the 63.0 dB(A) figure, minus a correction of 3 dB(A) for conversion from LA10 to LA90. The impact therefore calculated to be 26.6 dB(A) at the roadside, which constitutes an effect of major significance.

7.10.20 The receptor at Dell Farm is however likely to be located approximately 250 m from the proposed B970 road (Substation route). Moving traffic radiates noise in a cylindrical manner, which means that the area affected by the noise is directly proportional to distance. As such, the sound generated by traffic would decline by 3 dB(A) per doubling of distance. At a range of 250 m from Dell Farm, the predicted roadside noise level of 63 dB(A) less the 3 dB conversion correction is predicted to be 36 dB (A) which constitutes an increase of 2.6 dB, representing an increase in effect of minor significance.

Operational Noise

7.10.21 Potential effects would generally be attributable to changes in road traffic flows, including commuter traffic and commercial vehicles. Sources of noise such as that associated with leisure and commercial operations in addition to minor fixed plant are predicted to be negligible due to the transmission distances to the nearest receptors.

7.10.22 The change in the level of traffic noise associated with the operational development has been determined in accordance with CRTN. A comparison of future traffic noise levels with and without the Proposed Development is necessary, incorporating features such as the projected growth in traffic for the year of completion (2028). Annual Average Daily Traffic (AADT) flows and traffic composition over a twenty-four hour period have been used in place of 18-hour (LA10, 18hour) flow data in order to allow for a worst case assessment. It has been assumed that traffic would travel at or near the speed limit for the road under assessment. The predicted change in road traffic noise levels as a result of the completed development are detailed in Table 7.9.

Table 7.9: Predicted Operational Noise Effects for 2028 (dB)

From	To	LA10 dB (2028 – No Development)	LA10 dB (2028 – With Development)	Change dB
Aviemore Southern Junction	South	75.0	75.2	+0.2
Aviemore Southern Junction	North	74.5	74.8	+0.3
A9	B9152	62.4	64.8	+2.3
A9 junction link rd	South	63.3	63.3	0
A9 junction link rd	B970	68.8	69.8	+1.0
B970	Aviemore central	66.6	68.6	+1.9
B970/B9152 roundabout	Substation Route	64.0	67.7	+3.7
Dell Rd	Nethy Bridge Rd	62.8	62.2	0
Ski Rd	An Camas Mòr SE access	54.2	50.7	0
An Camas Mòr SE access	North	55.2	57.7	+2.5
B970	Glenmore	62.9	62.9	0
B970	An Camas Mòr (Via New B970 Substation Route)	n/a	66.6	n/a

7.10.23 An increase in base road traffic flows is forecast for all roads irrespective of whether the development takes place due to annual increases in road traffic use. The predicted change in noise levels between the 2028 no development and with development scenarios for existing roads is forecast to be of moderate significance or below according to the road traffic noise significance criterion presented in Table 7.2.

7.10.24 The change in noise levels predicted as a result of the new B970 road (Substation route) indicates a noise level of 66.6 dB. Given that the pre-existing conditions are not dominated by road traffic noise, a comparison of the 66.6 dB with existing LA10 noise levels is not deemed to be appropriate and would not represent a worst-case assessment. Rather, the minimum existing LA90 noise level of 33.4 dB(A) as presented in Table 7.4 is compared to the 66.6 dB figure, less a 3 dB correction for conversion from LA10 to LA90. The impact therefore is 30.2 dB at the roadside, which constitutes an effect of major significance.

7.10.25 As is detailed in paragraphs 7.10.13-20, the separating distance between Dell Farm and the proposed B970 road (Substation route) would be approximately 250 m. As the noise generated by road traffic declines at a rate of 3 dB(A) per doubling of distance, the predicted roadside noise level of 66.6 dB(A) minus the 3 dB conversion correction at a distance of 250 m is calculated to be 39.6 dB(A). This represents an increase of 6.2 dB(A), denoting an impact of major significance.

7.10.26 It should be noted that the minimum LA90 noise level of 33.4 dB(A) occurred only on one occasion near Dell Farm over a measurement interval of eight days. This occurrence took place at approximately 3 am meaning that the occupiers of this property are very likely to be indoors. The attenuation provided by the weakest element of a building façade (a partially open window) would reduce the level of noise to within recommended norms. In addition to this, the lowest daily average background noise level recorded was 38.2 dB(A). The predicted worst-case road traffic noise level at 250 m is therefore envisaged to be 1.4 dB(A) above the average prevailing background noise conditions.

7.11 Vibration

Construction

7.11.1 Vibration from construction activity can affect the occupiers of a building or the structure itself. Such an occurrence is most typically associated with percussive piling works and normally only takes place where this type of work is carried out in close proximity to buildings. Cosmetic or structural damage to buildings generally require other factors such as differential settlement in order to develop.

7.11.2 The operation of heavy plant and construction vehicles other than piling normally generates markedly lower levels of vibration. The typical transmission distances to the nearest buildings are likely to ensure that complaints would not be provoked and that cosmetic or structural damage is unlikely to take place.

7.11.3 The vibration levels applicable to nearby receptors, are expected to be well within the necessary range for protection against cosmetic or structural damage. Similarly, the effects inside a given building are likely to be imperceptible. As such, potential vibration effects are deemed to be negligible.

Operation

7.11.4 The predicted change in road traffic flows between the no development and with development scenarios are likely to have a negligible effect on vibration levels received at the nearest receptors.

Frequency and Duration of Effects

Construction

7.11.5 Noise effects arising from the Proposed Development during construction would occur only during operation of equipment and site vehicles. Construction noise would be localised and is predicted to be of negligible to moderate significance for on site activities. Sources of noise would not remain in the same location for extended periods of time, as the work areas would move within the Proposed Development site on a daily or weekly basis depending on the activity being carried out.

7.11.6 The change in noise levels attributable to construction vehicles using public roads would occur during daytime periods only and would be intermittent in nature.

Operation

7.11.7 Effects following completion of the project would primarily be traffic related and would be intermittent in nature.

7.12 Mitigation

7.12.1 Specific mitigation measures cannot be detailed at present as the contractor has not yet been appointed and the scheme design is still to be finalised. The measures detailed below are considered to be proportionate and reasonable and include engineering, layout design and management techniques.

Construction Noise

7.12.2 Potential noise effects can be controlled by implementing the following measures, wherever practical to do so:

- Construction activities should be carried out in accordance with the good practice guidance of BS5228 and referenced in contractual documentation in order to ensure compliance. Noise monitoring should be carried out at representative intervals;
- General hours of working should be restricted to avoid sensitive periods of the day. Work outside these hours should only occur through prior written agreement with the local authority;
- An appropriate piling methods such as hydraulic, vibratory or bored systems should be used for the Proposed Development in place of the drop hammer technique where possible, so as to minimise noise levels at source;

- Piling rigs and similar equipment should be screened from receptors, where necessary and practicable, and throttled down to a minimum when not in use;
- Plant with directional noise features should be positioned so as to minimise the potential for noise disturbance;
- Nearby receptors should be informed in advance of activities likely to generate particularly high levels of noise. A site contact number for local residents should be provided;
- Site compounds and partly-static equipment should be located as far as practically possible from neighbouring residential dwellings. Material stockpiles and suitable work locations should be used so as to screen work locations and maximise the distance between work activities and receptors;
- All equipment should be maintained in good working order and fitted with appropriate noise control features at all times (for example, silencers and mufflers); and
- All site employees should be advised to adopt the quietest work practices, where appropriate.

Operational Noise

- Buildings should be designed for compliance with PAN 56 and WHO guidelines;
- Consideration should be given to noise emission levels at the detailed design stage, in addition to cost, when acquiring plant;
- HVAC and other fixed plant should be located in the best practicable positions in terms of noise attenuation;
- Adequate noise control measures such as acoustic enclosures, acoustic louvres and vibration isolation systems should be employed where necessary; and
- Appropriate road layout design and traffic calming measures should be incorporated into the completed development.

Vibration

7.12.3 Potential vibration effects can be controlled by implementing the following measures, wherever practical to do so:

- Vibration monitoring should be carried out where piling or other percussive activities are likely to occur in close proximity to receptors. Work methods should be altered where recommended limits are exceeded; and

- The contents of construction vehicles should be properly loaded at all times.

7.13 Residual Effects

Construction

7.13.1 Noise and vibration effects arising from construction would result in no residual effects following completion of the Proposed Development.

7.13.2 The predicted general plant construction noise levels may be reduced by up to 10 dB(A) by implementing the mitigation measures detailed previously. The residual effects during the activities that generate the highest noise levels, tree felling and road construction, are predicted to remain moderate at the most affected receptor. The residual vibration effect is judged to be negligible for all phases of construction. The predicted change in noise levels attributable to construction vehicles using public roads would remain the same.

Operation

7.13.3 The noise and vibration effects of road traffic on existing roads are expected to range from negligible to moderate as a result of the completed development. An effect of major significance is predicted as a result of traffic using the new B970 Substation Route although this is likely to form an effect of minor significance when considered in the context of the time of day that minimum background noise levels occur.

7.13.4 The effects of HVAC and other fixed plant associated with the Proposed Development should be negligible provided that the plant does not exhibit audible tones and is designed not to exceed the minimum baseline measurements presented in Table 7.4.

7.14 Cumulative Effects

Construction

7.14.1 The cumulative effect of the proposed scheme and any other project is deemed to be negligible, that is, not significant, due to the transmission distances to the nearest receptors and the limited increase in road traffic flows.

Operation

7.14.2 The cumulative effect of the completed scheme and any other project is deemed to be negligible, that is, not significant, due to the transmission distances to the nearest receptors and the limited increase in road traffic flows.

7.15 Conclusions

- 7.15.1** An assessment of the potential noise and vibration effects of the proposed An Camas Mòr development has been carried out. The Proposed Development has the potential to cause disturbance to nearby receptors due to the levels of noise and vibration that may be generated through construction and operation.
- 7.15.2** The outcome arising from construction of the Proposed Development would result in no residual effects following completion of the Proposed Development.
- 7.15.3** The assessment indicates that received noise levels for most construction activities are of minor or negligible, that is, not significant, other than for tree felling which would take a few weeks, and road construction activities at Coylum Road where moderate effects, that is, significant effects, are predicted. The use of silenced equipment and adequate attenuation such as barriers may reduce predicted noise levels by as much as 10 dB(A) but would not affect the assessment of significance of effects.
- 7.15.4** The predicted change in noise levels during construction is forecast to be minor or below, that is, not significant, for all existing roads other than the B970 Ski Road to An Camas Mòr SE access where a major, that is, significant, effect is predicted in 2012 and 2016. This change takes place as a result of the projected traffic volumes. It would occur during daytime periods only and would be intermittent in nature.
- 7.15.5** Although the predicted roadside change in noise levels resulting from the new B970 road (Substation route) in 2018 is a major, that is, significant, effect, the likely change in noise levels at Dell Farm some 250 m away is calculated to be 36 dB(A) which constitutes an increase of 2.6 dB above minimum baseline conditions, effectively representing a minor, that is, not significant, effect. All other roads in 2018 are predicted to experience minor or below, that is not significant, effects.
- 7.15.6** The effects of the operational development in 2028 would be primarily road traffic-based and these are expected to be of minor or below, that is, not significant, for existing roads other than traffic using the B970 from the B970/B9152 roundabout to the Substation Route where a moderate, that is, significant effect is predicted.
- 7.15.7** Although a roadside change in noise levels is predicted as a major (Paragraph 7.15.11), that is, a significant effect at 2028 as a result of traffic using the new B970 road (Substation route), however, it should be noted that the minimum LA₉₀ noise level of 33.4 dB(A) occurred only on one occasion near Dell Farm over a measurement interval of eight days. This occurrence took place at approximately 3 am meaning that internal household noise levels would be within recognised limits. Furthermore, the predicted worst-case road traffic noise level at 250 m (Dell Farm) is predicted to be a maximum of 1.4 dB(A) above the average prevailing background noise conditions, this represents a minor, that is, not significant effect when compared to average prevailing background noise conditions.
- 7.15.8** HVAC and other fixed plant associated with the Proposed Development should not have a discernable effect provided that the plant does not exhibit audible tones and is designed not to exceed minimum baseline measurements at receptors.
- 7.15.9** The potential for noise and vibration arising from construction of the Proposed Development should be managed in accordance with the principles of British Standard 5228 'Noise Control on Construction and Open Sites', and referenced in contractual documentation in order to ensure compliance. The need for appropriate control measures should be stated in the contract and work should be phased in such a way so as to reduce the potential for negative effects to a minimum.
- 7.15.10** The use of each of the mitigation measures detailed in this report may not be appropriate or feasible at all receptors due to site layout and the transitory nature of construction activities, for example. It is possible, however, to reduce the potential effects of the Proposed Development through the implementation of various mitigation measures detailed in this report. Such measures would allow for potential noise and vibration effects to be controlled at source and through proactive engineering, layout and management measures, thereby limiting the overall effect of the proposed scheme to a minimum.
- 7.15.11** Whilst piling would generate the highest source sound levels, tree felling and road construction would result in the highest received noise levels due to their respective proximity to receptors. Tree felling and road construction noise levels are predicted to exceed the recommended limit of 70 dB(A) as advised in the Department of Environment's Advisory Leaflet 72, constituting a moderate effect when the duration of these activities is considered. The predicted effects for other construction activities are judged to be minor to negligible, that is, not significant.
- 7.15.12** It is predicted that construction and operational vibration levels resulting from Proposed Development would remain at a level that is not likely to cause cosmetic damage to buildings or disturb inhabitants, this aspect therefore represents a negligible, that is, not significant, effect. Piling should not be carried out within 5 m of underground services (i.e. gas / water mains and sewers of brick construction). A study to establish the location of underground services should be conducted prior to commencement of piling works.

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