

10. NOISE AND VIBRATION

10.1 Introduction

This section of the environmental impact statement was prepared by TMS Environment Ltd and considers the potential noise and vibration impacts associated with the proposed development. Impacts of the construction and operational phases are considered in the context of appropriate standards and guidelines, together with requirements for noise and vibration monitoring and control.

The subject lands are located in the townland of Crodaun, immediately north of Celbridge town centre and occupy an area of approximately 9.55ha. The proposed development for which planning permission is sought in this application comprises a residential development of approximately 372 residential units and all associated and ancillary infrastructure and open space provision.

10.2 Methodology

10.2.1 Impact Assessment Methodology

The EPA published the draft document *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* in 2017. These draft Guidelines take account of the revised EIA Directive (2014/52/EU) and are considered in this assessment. Impacts or effects are described in the draft Guidance in terms of quality, significance, magnitude, probability, duration and type. Table 10.1 below presents the description of the significance of effects and Table 10.2 presents the description of the duration of effects as shown in the Draft Guidelines.

Table 10.1 Describing the Significance of Environmental Effects (EPA 2017)

Significance of Effects	Description
Imperceptible	An effect capable of measurement but without noticeable consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Significant	An effect which, by its character, magnitude, duration or intensity, alters most of a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics

Table 10.2 Describing the Duration of Environmental Effects (EPA 2017)

Duration of Effects	Description
Momentary Effects	Effects lasting from seconds to minutes.
Brief Effects	Effects lasting less than a day.
Temporary Effects	Effects lasting less than a year.
Short-term Effects	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years.
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years.

In addition to the above, the methodologies presented below were used to inform the noise and vibration impact assessment and to identify and assess all cumulative impacts with the potential to impact upon the receiving environment and to propose mitigation and avoidance measures where required.

1. Carry out a series of baseline noise measurements to provide information on existing background and specific site noise levels at the nearest sensitive receptors.

A baseline noise survey was completed in the vicinity of the subject site according to the requirements of ISO 1996: Acoustics - Description and Measurement of Environmental Noise and in addition, with reference to the EPA publication; Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), 2016. Noise monitoring was carried out at a total of three representative noise monitoring locations in order to determine the existing noise environment at the proposed site locations. The detailed baseline noise monitoring survey is presented in Appendix H.

2. Identify appropriate criteria against which to assess the significance of the noise and vibration impacts associated with the proposed development. Criteria for noise assessment are discussed in Section 10.2.2 and the criteria for vibration assessment are discussed in Section 10.2.3 below.
3. Provide predictions of resultant noise and vibration levels at the nearest sensitive receptors and assess these against the selected assessment criteria.

Noise prediction modelling was carried out in order to predict the noise emissions that would be experienced at sensitive receptor locations as a result of the various activities associated with the proposed development. Prediction calculations for the noise generating activities including plant and equipment operation, construction activities and vehicle movements on site have been conducted generally in accordance with ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996.

4. Propose mitigation and avoidance measures where required.

5. Identify and assess all cumulative impacts with potential to impact upon the receiving environment.

10.2.2 Noise Assessment Criteria

There is no specific Irish legislation which sets out environmental noise limits that must be achieved and therefore the assessment criteria that are presented in this report are based on the guidelines set out by regulatory bodies such as the Environmental Protection Agency (EPA), the World Health Organisation (WHO), the Department of Housing, Planning, Community and Local Government (DHPCLG) whose guidance and standards are based on international best practice.

Construction Noise Criteria

Construction noise is temporary in nature and is usually experienced over a short to medium-term period and this characteristic requires it to be considered differently to other longer term noises. Construction activities on larger-scale construction projects such as this one will inevitably result in noise being generated.

British Standard 5228-1:2009+A1:2014 –*Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise* (BS 5228-1) is a commonly used Standard to assess the potential noise impacts associated with the construction phase of a project. This Standard states that noise complaints related to new industrial/commercial noise sources are more likely to arise as the difference between the industrial noise source and the existing background noise increases. Practical noise reduction measures are detailed in BS 5228-1 and these measures can be implemented in order to reduce the overall noise emissions from a construction site.

There is no Irish Guidance specifically published for the short to medium-term construction work such as that proposed for the subject site. Construction noise impacts are assessed in terms of the requirements of BS 5228-1. Annex E of this Standard details acceptable construction noise limits for differing scenarios. Annex E.2 looks at the significant of noise impacts based on fixed noise limits and states:

"noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- *70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas.*

These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments – and when working outside the normal hours say between 19.00 and 22.00 hours – the allowable noise levels from building sites will be less: such as the reduced values given in the contract specification or as advised by the Environmental Health Officer (a reduction of 10 dB(A) may often be appropriate). Noisy work likely to cause annoyance locally should not be permitted between 22.00 hours and 07.00 hours."

International best practice dictates that noise limits in the range 65dB L_{Aeq,1hr} to 75dB L_{Aeq,1hr} are generally acceptable in the community during daytime construction activities.

Transport Infrastructure Ireland (TII) (formerly the National Roads Authority (NRA)) is the only government body in Ireland to publish construction noise limits which are presented in their document '*Guidance for the Treatment of Noise and Vibration in National Road Schemes (2004)*'.

The guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration. The Guidance points out that there is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, it states that Local Authorities, where appropriate, should control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. The NRA Guidance presents indicative noise levels that are typically deemed acceptable during construction phase of road developments. These are presented below in Table 10.3.

Table 10.3 NRA Maximum Permissible Construction Phase Noise Levels at the façade of dwellings

Days & Times	LA _{eq} , (1hr) dB	L _{pA} (max) slow dB
Monday to Friday - 07:00 to 19:00hrs	70	80
Monday to Friday - 19:00 to 22:00hrs	602	652
Saturday - 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays - 08:00 to 16:30hrs	602	652

- Note 1: Noise levels measured at facade of dwellings.
- Note 2: Construction activity at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant local authority.

The Kildare County Council Second Noise Action Plan (2013 – 2018) refers to the same noise limits as those in Table 10.3 in order to control construction noise impacts at noise sensitive buildings. Therefore, the noise limits set out in Table 10.3 above represent a good compromise between the practical limitations in a construction project such as this one and the requirement to ensure acceptable noise levels at the nearest noise sensitive receptor locations.

For this development project it is considered appropriate to adopt the construction noise criteria presented in Table 10.3 above for all sensitive receptor locations.

Operational Noise Criteria

The WHO *Guidelines for Community Noise* states that, "*in dwellings, the critical effects of noise are on sleep, annoyance and speech interference*". In order to avoid sleep disturbance, it is recommended that indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{AMax} for single sound events. However, it is noted that lower levels may be annoying, depending on the nature of the noise source. During the night-time, sound pressure levels at the outside facades of the living spaces should not exceed 45dB L_{Aeq} and 60dB L_{AMax}, so that people may sleep with bedroom windows open. These values have been determined by the WHO by assuming that the noise reduction from outside to inside with a window partly open is 15dB. Similarly, during the daytime the outdoor sound level from steady, continuous noise should not exceed 50dB L_{Aeq} on balconies, terraces and in outdoor living areas to protect the majority of people from being moderately annoyed.

The *Design Manual for Roads and Bridges Volume 11, Section 3* (Highways Agency 2011) also offers guidance on 'long-term' noise impacts associated with changes in traffic noise level. For the Operational Phase, traffic impacts are assessed against the 'long-term' impact classification, presented in Table 10.4.

Table 10.4 Classification of Magnitude of Traffic Noise Impacts in the Long-Term (Operational Phase)

Change in Sound Level (dB L _{A10})	Magnitude of Impact
0	No change
0.1 to 2.9	Negligible
3.0 to 4.9	Minor
5.0 to 9.9	Moderate
10+	Major

The criteria above reflect the key benchmarks that relate to human perception of noise. A change of 3dB is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10dB change in noise represents a doubling or halving of the noise level.

It is considered that the criteria specified in Table 10.4 above provide a good indication as to the likely significance of changes in noise levels in this case and have been used to assess the impact of the operational noise.

10.2.3 Vibration Assessment Criteria

Some activities during the construction phase of the proposed project have the potential to generate ground vibrations at sensitive receptor locations. Activities such as rock-breaking, movement of loaded HGVs and other construction traffic can all cause significant vibration to occur. The levels of vibration associated with these activities would not normally be expected to cause structural damage to buildings but may have the potential to impact negatively on humans depending on environmental factors such as distance from source and mitigation measures employed. Blasting activities would have the potential to cause significant negative impact on sensitive receptors but it is not planned to carry out any blasting as part of this project.

The operational phase of the proposed development will not generate any observable vibration emissions and is consequently not required to be considered.

Construction Vibration Criteria

Vibration standards are concerned with those dealing with human comfort, and those dealing with structural or cosmetic damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

Humans are particularly sensitive to vibration and can detect vibration levels as low as 0.3 mm/sec PPV and levels above this may cause annoyance. However, significantly higher levels than this are tolerated for single short-term events and do not cause annoyance or disturbance to humans. British Standard BS 5228-2:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites* provides guidance on vibration and its control and management on various site types. The standard also presents details on the human response to vibration and Table 10.5 below outlines these effects.

Table 10.5 Human Response to Vibration

Vibration Level (mm/sec)	PPV	Effect
0.14		Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3		Vibration might be just perceptible in residential environments.
1.0		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.
10		Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

The response of a building to groundborne vibration is affected by numerous factors including the type of foundation, underlying ground conditions, the building construction and the state of repair of the building.

British Standard 7385 *Evaluation and Measurement for Vibration in Buildings* provides guidance on vibration measurement, data analysis and reporting as well as building classification and guide values for building damage. The damage threshold criteria presented in BS 7385-2 are based upon systematic studies using a carefully controlled vibration source in the vicinity of buildings. The Standard states that there should be no cosmetic damage to buildings if transient vibration levels do not exceed 15 mm/sec in the low frequency range and this rises to 20 mm/sec at frequencies of 15 Hz and 50 mm/sec at 40 Hz and above. These guidelines should be reduced by up to 50% for listed structures or similar. It is also noted that the probability of damage to buildings tends towards zero at 12.5 mm/sec at component PPV.

The NRA in their Guidance Document recommends vibration levels to ensure that there is no potential for vibration damage during road construction activities. These values have been derived through consideration of various European standards and compliance with their guidance should ensure that there is little to no risk of even cosmetic damage to buildings. The guide values are presented below in Table 10.6.

Table 10.6 NRA Maximum Permissible Construction Phase Vibration Levels

Vibration Level – Peak Particle Velocity at the closest part of any sensitive property to the source of vibration at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

10.3 Receiving Environment

10.3.1 Introduction

The baseline noise monitoring survey consisted of carrying out noise measurements at three locations in the vicinity of the subject site. The subject site was assessed to determine the existing noise levels at sensitive receptor locations surrounding the proposed site location. The detailed noise monitoring survey report (TMS Ref No 26065-2) is presented in Appendix H.

10.3.2 Existing Noise Climate

The baseline noise monitoring locations were chosen in order to best represent the current noise climate at the nearest noise sensitive receptor (NSR) locations in the vicinity of the subject site. In total three noise monitoring locations were chosen to complete the baseline survey and measurements were carried out during the daytime period (07.00 to 19.00), the evening time period (19.00 to 23.00) and the night-time period (23.00 to 07.00).

The measurement parameters included meteorological observations of prevailing conditions at the time of the survey. The main measurement parameter was the equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$. Monitoring periods for the noise survey were 15-minute intervals. A statistical analysis of the measurement results was also completed so that the percentile levels, $L_{AN, T}$, for $N = 90\%$ and 10% over 15-minute measurement intervals were also recorded. The percentile levels represent the noise level in dB(A) exceeded for $N\%$ of the measurement time. A glossary of noise related terms is presented in Appendix H.

The results of the baseline noise monitoring survey are summarised in Table 10.7 below. These results are an accurate representation of the existing baseline noise climate in the vicinity of the site.

Table 10.7 Baseline Noise Monitoring Results

Location ID	Date	Time Interval	Measured Noise levels / dB				Comment
			L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	
N1	27.02.19	14.26-14.41	47	43	49	67	The noise environment is dominated by the passing traffic on the adjacent R449 Road. Noise from the M4 business park was noted during the daytime intervals. Passing traffic on the M4 Motorway was observed during the evening and night-time measurements.
	27.02.19	14.42-14.57	46	43	48	62	
	27.02.19	14.58-15.13	50	44	52	65	
	27.02.19	19.51-20.06	52	50	54	64	
	28.02.19	00.30-00.45	47	40	50	56	

Location ID	Date	Time Interval	Measured Noise levels / dB				Comment
			L _{Aeq}	L _{A90}	L _{A10}	L _{Amax}	
N2	28.02.19	00.46-01.01	44	34	48	57	The noise environment is dominated by the constant passing traffic on the R405 Road and also traffic into and out of Crodaun residential estate. Some bird noise was also noted here. Overhead aircraft noise was noted here during daytime intervals.
	27.02.19	15.22-15.37	54	44	52	74	
	27.02.19	15.39-15.54	48	44	50	71	
	27.02.19	15.57-16.12	48	45	49	65	
	27.02.19	20.14-20.29	48	46	50	59	
	28.02.19	01.09-01.24	44	23	40	75	
N3	27.02.19	16.18-16.33	49	46	49	72	The noise environment is dominated by the constant passing traffic on the M4 motorway and to a lesser extent traffic entering Crodaun Forest Park estate. Overhead aircraft noise was also noted here.
	27.02.19	16.33-16.48	49	47	51	59	
	27.02.19	16.50-17.05	53	51	54	67	
	27.02.19	20.34-20.49	48	45	49	57	
	28.02.19	01.47-02.02	35	26	35	58	
	28.02.19	02.03-02.18	35	25	37	63	

10.3.3 Existing Vibration Climate

There are no significant sources of vibration in the vicinity of the subject site. The main vibrations experienced at the nearest sensitive receptor locations relates to the passing traffic along the surrounding road network. Low-level, short-term vibrations could be experienced when fully loaded HGVs travelling at speeds in excess of 50km/hr pass in close proximity to private residences. There is no residential area close enough to the subject site to be of concern in terms of vibration activity for the current application.

10.4 Characteristics of the Proposed Development

The proposed development for which planning permission is sought in this application comprises a residential development and associated and ancillary infrastructure and open space provision.

10.5 Potential Impact of the Proposed Development

10.5.1 Construction Phase

10.5.1.1 Predicted Impact of Construction Noise

The proposed construction works associated with the development proposed in this planning application is expected to take approximately 3 – 4 years on a phased basis, with the hours of construction typically from 07.00 to 19.00 Monday to Friday and 09.00 to 13.00 Saturdays. Although there may occasionally be the need to work outside the normal hours of construction, heavy or noisy construction activities will be minimised during these periods.

A variety of items of plant will be in use for the purposes of site clearance, preparation and construction activities. There will be no blasting techniques used during construction, and it is not envisaged that rock-breaking will be required as part of the site clearance works.

The actual noise level produced by construction work will vary at the nearest sensitive receptor boundary at any time depending upon a number of factors including the type of plant in use, plant location, duration of operation, hours of operation and intervening topography. It is therefore difficult to accurately determine the likely noise levels without knowing greater detail, however, the impact assessment carried out for the proposed development presents the highest likely noise levels at the nearest receptors based on soil movement, infrastructure work, general site activities and building construction work in the vicinity of the closest approach to the nearest noise sensitive receptors.

Calculations can be used to predict indicative noise levels using the guidance set out in BS 5228-1 for the main phases of the proposed construction works. The nearest noise sensitive receptor (NSR) locations to the proposed construction works are the properties within the residential estates and private houses located adjacent to and along the site boundary, and the secondary school (Salesian College) to the west of the site. The closest distance for the construction works to approach the NSRs is 20m from the private residences along the eastern and southern boundary of the site, 180m from the Salesian College. All other works will occur across the site at varying distances of up to 300m. The named NSR locations for the purposes of the impact assessment are:

- NSR1 – Eastern Boundary Residences at 30m from nearest site construction works;
- NSR2 – Southern Boundary Residences at 30m from nearest site construction works; and
- NSR3 – Salesian College at 180m from nearest site construction works.

Predicted noise levels have been calculated at each of the three closest NSR locations that have been identified during the baseline noise survey completed for the subject site. Tables 10.8 to 10.11 presents the predicted noise level for each of the construction phase stages. A worst-case scenario is assumed by having all plant and equipment items operating continuously for two thirds of the day at the construction boundary point in the vicinity closest to the noise sensitive receptor even though in reality they will be much further removed. A screening contribution from a Construction Barrier has also been considered in the assessment. The generators and cranes are assumed to operate for 100% of the time.

Therefore, the results presented in Tables 10.8 to 10.11 show the maximum noise levels predicted for each NSR and represent the noise levels when the construction activity is ongoing at the closest point within the construction site to each NSR.

Table 10.8 Calculated Construction Noise Levels for Excavation & Site Preparation Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB L_{Aeq,T} at the named receptor locations		
		NSR1	NSR2	NSR3
Tracked excavator	C2.2	58	58	49
Dozer	C2.11	60	60	51
Wheeled Loader	C2.28	57	57	48
Dump Truck	C2.30	60	60	51
Combined L _{Aeq} (when all plant items are operating together)		65	65	56

Table 10.9 Calculated Construction Noise Levels for General Site Activities

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB L_{Aeq,T} at the named receptor locations		
		NSR1	NSR2	NSR3
Dump Truck	C2.30	60	60	51
Wheeled Loader	C2.28	54	54	45
Mobile Crane	C2.15	45	45	36
Generator	C4.77	43	43	34
Angle Grinder	C4.93	58	58	49
Combined L _{Aeq} (when all plant items are operating together)		63	63	54

Table 10.10 Calculated Construction Noise Levels for Building Construction Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB L _{Aeq,T} at the named receptor locations		
		NSR1	NSR2	NSR3
Tracked Excavator	C2.2	55	55	46
Mobile Crane	C2.15	47	47	38
Tower Crane	C2.10	56	56	47
Dump Truck x2	C2.30	60	60	51
Generator x 2	C4.77	43	43	34
Concrete Pump & Truck	C4.28	54	54	45
Poker vibrator	C4.34	56	56	47
Cutting & grinding	C4.72	57	57	48
Combined L _{Aeq} (when all plant items are operating together)		65	65	55

Table 10.11 Summary Assessment of Construction Phase Works

Noise Sensitive Receptor	Highest Predicted Construction Noise Level dB L _{Aeq, 1hr}	Compliance with Assessment Criteria	
		70dB L _{Aeq 1hr}	
NSR 1	65		Yes
NSR 2	65		Yes
NSR 3	56		Yes

The results indicate that the predicted construction noise levels associated with site works will not exceed the NRA and Kildare County Council assessment criteria for construction works of 70dB LAeq,1hr for the works assessed. There is potential for the assessment criteria to be exceeded at NSR1 and NSR2 when construction works are occurring at the closest boundary point so a conventional construction screening barrier at the boundary of the works site is provided for in the assessment.

It should be noted however, that in reality it is anticipated that noise levels as a result of construction works will be much lower than the predicted worst-case levels for the vast majority of the construction works. This is because all the items of machinery modelled will not typically be in operation simultaneously and they will not be located at the nearest boundary point but for the most part will be

further removed from the NSR locations. The implementation of the mitigation measures presented in Section 10.6 will ensure that the proposed noise criteria are satisfied for all construction works.

It should be noted that the construction noise levels are short-term impacts and are transient in nature and therefore the likely noise impact is considered to vary from Imperceptible to Moderate.

10.5.1.2 Predicted Impact of Construction Traffic

The traffic impact assessment has determined that staff arrivals / departures during the Construction Phase will generally be outside peak traffic hours (before 08:00 and after 18:00) and that Heavy Goods Vehicle movements for delivery / removal of materials will be spread throughout the working day. It is envisaged that peak hour heavy goods vehicle (HGV) traffic would be in the region of 1 to 2 one-way movements, depending on the construction activities active on the site when considering the worst-case construction scenario. The assessment also concluded that it was highly unlikely that the construction traffic movements would exceed the peak hour movements predicted for the operational phase.

A doubling of road traffic volume would typically result in an approximate 3dB increase in noise level at adjacent properties. The additional traffic generated as a result of the construction phase of the proposed development results in a very small increase in peak hour traffic. The magnitude of the increase means that the noise contribution from site traffic during the construction phase will not be observable and can be classified as "imperceptible". Therefore, the noise contribution from site traffic during the construction phase will be "temporary" and is classified as "not significant".

10.5.1.3 Predicted Impact of Construction Vibration

The only construction activity with the potential to generate appreciable vibration levels will be the movement of loaded HGVs moving into and out of the site. There is no blasting required and it is also envisaged that there will be no rock-breaking required during site clearance works. Therefore, considering the distance to the nearest off-site sensitive buildings, vibration levels at the closest residences are expected to be significantly lower than those presented in Table 10.6 above thus ensuring no cosmetic damage to buildings will occur. Vibration levels are also expected to be below a level that would give rise to complaint from building occupants as per Table 10.5.

10.5.2 Operational Phase

The proposed residential development will consist of private dwellings and will also include car parking spaces within the curtilage of associated dwellings, pedestrian/cycle and vehicular access together with all ancillary, infrastructure, landscaping and boundary treatments. The only predicted contributions to the noise environment in the vicinity of the site will result from increased traffic movements as a result of the increased activity in the area.

A detailed Traffic Impact Assessment has been prepared by DBFL. Information from this report has been used to determine the predicted change in noise levels in the vicinity of the roads and junctions that pass the entrance to the subject site.

For the purposes of assessing potential noise impact, the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development are considered. The traffic figures used in the assessment are taken from the Traffic Impact Assessment report. The Traffic assessment found that the increase in traffic will be less than 5% at any affected location / junction

in 2026 or 2036 and that the traffic impact would be at most Slight. The change in noise level associated with even a 5% traffic increase is less than 1dB(A) in this area and is imperceptible.

Overall, the noise climate in the area would be expected to remain very similar to the present situation as currently the predominant source of noise is passing traffic on the R4409 & R445 Roads. There is no significant change in traffic patterns predicted for the area and overall traffic volumes are predicted to remain approximately at current levels hence there is no observable change to the noise climate predicted.

In summary, the predicted change in noise levels associated with vehicles along the R409 & R445 Roads is neutral, long term and not significant.

10.6 Mitigation Measures

10.6.1 Construction Phase

Whilst the construction phase is not expected to give rise to significant negative noise impacts at sensitive receptors, the guidance on the control of noise and vibration from demolition and construction activities presented in BS 5228 will be followed. These measures include the following:

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained and avoid steep gradients;
- Use rubber linings in chutes and dumpers to reduce impact noise;
- Minimise drop height of materials;
- Start-up plant and vehicles sequentially rather than all together;
- In accordance with best practicable means, plant and activities to be employed on site will be reviewed to ensure that they are the quietest available for the required purpose;
- Where required, improved sound reduction methods, e.g. enclosures should be used;
- Site equipment should be located away from noise sensitive areas, as much as is feasible;
- Regular and effective maintenance by trained personnel should be carried out to reduce noise and/or vibration from plant and machinery;
- Limit noisy construction works to 7am to 7pm weekdays with Saturday working from 9am to 1pm unless otherwise agreed with the local authority. Relatively quiet construction activities could be carried out outside these hours, subject to controls being put in place;
- Maintain ongoing contact with local residents to ensure any complaints relating to construction phase noise for the project from local residents can be addressed. Also, prior to any particularly noisy activities, local residents should be contacted in order to minimise the perceived noise impact;
- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations for comparison with limits and background levels; If there is a requirement to undertake vibration monitoring, the following guidance on vibration monitoring (monitoring of peak particle velocity) should be followed; The instrumentation should monitor three orthogonal components

of peak particle velocity (p.p.v) and the trigger values / limits are set based on the maximum of these (the peak component particle velocity) as follows:

- Warning Level = 7.5 mm/s (Operatives should be notified if this level is reached; work may continue but with caution – review of working method should be considered).
- Stop Level = 10 mm/s: work should be stopped if this level is reached and working method reviewed; revised method of working to be agreed prior to works proceeding again; Site Foreman & Operatives to be notified immediately.
- Visible & audible alarms should form part of the monitoring system so that it is easily established when the trigger / alarm levels are reached.

The contractor shall erect construction site hoarding along noise sensitive boundaries, particularly where no existing screening such as boundary walls are in place at the nearest NSRs. This will be particularly required along the eastern and southern boundaries of the proposed site.

It is recommended that the site contractor will prepare a Noise and Vibration Management Plan (NVMP) which will deal specifically with onsite activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the construction works. The NVMP should specify the noise and vibration monitoring and reporting that will be carried out.

In addition, the contractor should appoint a community relations officer who will deal on a one-to-one basis with local stakeholders and will notify them before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The community relations officer shall also distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

10.6.2 Operational Phase

There are no adverse noise impacts associated with the operational phase of the development and consequently there are no mitigation measures proposed.

10.7 Residual Impacts

During the construction phase of the proposed development there will be some noise impacts experienced at the nearest receptors to the subject site. It is predicted that the mitigation measures proposed will ensure that noise and vibration impacts are kept to a minimum. The predicted noise and vibration impacts on the receiving environment during the construction phase are considered to be moderate and temporary and only affecting a small number of properties over a short time-period.

The potential for noise generation during the operational phase of the proposed development is limited to additional vehicles on the surrounding road network. The change in vehicle numbers predicted is not significant in an overall context. The predicted noise and vibration impacts on the receiving environment during the operational phase are considered to be not significant.

10.8 Human health impacts

Human health impacts are assessed by considering compliance with the various Limits and Standards for the Construction and Operational Phases of the proposed Project. Construction noise is temporary

in nature and is usually experienced over a short- to medium-term period. This characteristic requires it to be considered differently to other longer-term noises. Although construction activities will inevitably result in noise being generated, the predicted noise levels associated with each phase of construction works are all well below the assessment criteria at the closest Noise Sensitive Receptor (NSR) locations. NSRs that are much further removed than the named NSRs will experience a lower noise impact than those named. Since all relevant standards are complied with, the assessed effect on human health is an Imperceptible impact. Similarly, the human health impact of operational phase noise is also assessed as imperceptible.

10.9 Interactions Arising

The main interactions with noise are in relation to human beings and flora and fauna. The impact of noise on human beings living in the area of the proposed development has been addressed above for both the construction and operational phase of the proposed development. The impact assessment shows that the noise impacts that will be experienced by human beings in the vicinity of the proposed development are all within the prescribed criteria. This interaction is described as negative for the construction phase and neutral for the operational phase and is quantified as Not Significant for both phases.

In relation to the interaction of noise from the proposed development with flora and fauna, the noise generated by the development will not have a significant adverse impact on the local birdlife and wildlife. Local birdlife and wildlife will quickly accustom to any change in the noise climate of the area as typically occurs for projects of this type. This interaction is described as neutral and quantified as Not Significant

10.10 References

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