Appendix K

Acoustic planning review and report

Settlement City Shopping Centre – Port Macquarie
Environmental Assessment proposed Stage 1

ING REAL ESTATE

Manidis Roberts

ACOUSTIC TERMINOLOGY

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

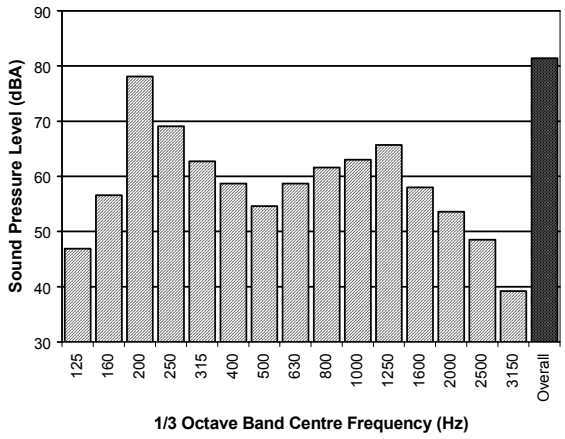
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

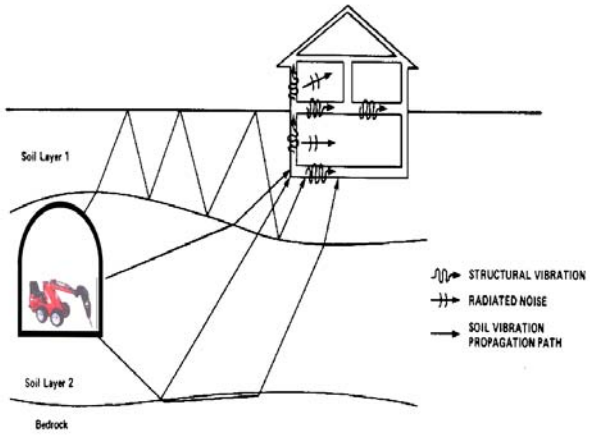
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.

HEGGIES

REPORT 10-4254-R3

Revision 1

Settlement City Shopping Centre
Port Macquarie
Proposed Retail & Commercial Expansion
DA Acoustic Assessment

PREPARED FOR

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18 AUGUST 2009

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Settlement City Shopping Centre

Port Macquarie

Proposed Retail & Commercial Expansion

DA Acoustic Assessment

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10-4254-R3	Revision 1	18 August 2009	Ian Wallbank	Howard Gwatkin	Ian Wallbank
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1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been engaged by ING Real Estate (ING) to review the acoustic issues that are pertinent to the proposed Settlement City Shopping Centre (Centre) expansion and partial redevelopment at Port Macquarie, NSW.

The objective of this report is to:

a. Review the proposed expansion and partial redevelopment and identify likely acoustic issues that may have the potential to impact on nearby noise sensitive premises; and

b. Provide planning recommendations addressing acoustic issues with respect:

- On Site Noise Sources
  - Mechanical Services
  - Carpark Activities
  - Loading Dock Activities
- Patron and Entertainment Noise.
- Off-Site Noise Sources (Traffic)
  - Shopping Centre Customers
  - Service Vehicles

This report identifies noise sources associated with the proposed project, details the relevant assessment criteria applicable to the site and presents in-principle noise control recommendations for the proposed Settlement City Shopping Centre expansion and partial redevelopment at Port Macquarie, NSW.

Figure 1 Site Map and Logger Locations

Image Courtesy Google Earth

2 NOISE SOURCES

Significant noise sources associated with the proposed commercial and retail expansion and partial redevelopment are summarised in the following sections:

2.1 On Site Noise Sources

Noise sources associated with the commercial and retail redevelopment includes:

- Mechanical Services
  - Air Conditioning and ventilation plant and equipment
  - Refrigeration plant equipment including condensers and pumps
- Carpark noise such as car movements and door slams.
- Loading dock operation.

2.2 Off-Site Noise Sources (Traffic)

Additional traffic generated by the proposed redevelopment has the potential to impact on existing residential receivers along nearby local roads. Additional traffic generated by the redevelopment of the Centre includes:

- Shopping Centre Customers and Office Employees
- Cars
- Buses
- Service Vehicles
- Delivery and pick up vans and trucks

3 AMBIENT NOISE MONITORING

Unattended environmental noise monitoring was conducted over 7 days from Tuesday 21 April 2009 to Wednesday 29 April 2009. An explanation of the acoustic terminology used is given in **Appendix A**.

The equipment used was two Acoustic Research Laboratories Environmental Noise Loggers Type EL-215 (serial numbers: 194531 and 194676) fitted with microphone windshields. Calibration of the loggers were checked prior to and following measurements using a Brüel & Kjær Electronic Calibrator Type 4230. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

3.1 Noise Monitoring Location

In order to establish the existing ambient noise, environmental noise monitoring was conducted at two locations representative of the nearest sensitive residential receivers. These locations were selected after a detailed inspection of the project area.

The monitoring locations were selected giving consideration to other noise sources which may influence the readings, the proximity of noise-sensitive locations (eg residential receivers), security issues for the noise monitoring devices and gaining permission for access from the residents or landowners.

The selected monitoring location is listed **Table 1**, and shown in **Figure 1**.

Table 1 Ambient Noise Monitoring Locations

Logger Location [1]	Description	Notes
1	11 Ballina Crescent, Port Macquarie	Used to determine ambient noise at nearby residential properties to the West of the site.
2	3 Commodore Crescent, Port Macquarie	Used to determine ambient noise at nearby residential properties to the North of the site
3	Existing Roof of Settlement City Shopping Centre - at the Southern boundary	Used to determine ambient noise at nearby primary school to the South of the site

Note 1: Refer to Figure 1 for noise monitoring locations.

3.2 Noise Monitoring Results

The results of the ambient noise surveys are presented in **Table 2** (noise levels are rounded to the nearest 1 dBA) and graphically in **Figure 2**, **Figure 3** and **Figure 4** (the median values for each of the 15-minute periods are shown).

The results of the noise monitoring have been processed in accordance with the procedures contained in the NSW Department of Environment and Climate Change's (DECC) Industrial Noise Policy (INP).

The Rating Background Noise Level (RBL) has been established. This is the background noise level used for assessment purposes at the nearest potentially affected residence. It is the median of the daily background noise levels during each assessment period, being day, evening and night.

Table 2 Measured Residential Ambient Noise Levels

Logger Location	Noise Level – dBA re 20 µPa					
	Daytime 0700 hrs – 1800 hrs		Evening 1800 hrs – 2200 hrs		Night-time 2200 hrs – 0700 hrs	
	RBL [1]	LAeq [2]	RBL	LAeq	RBL	LAeq
Location 1	39	51	37	46	32	43
Location 2	43	58	42	48	43	48
Location 3	46	55	40	51	36	47

Note 1: The RBL noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

Note 2: The LAeq is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Table 3 Measured Existing Bay Street Road Traffic Noise Levels

Descriptor	Period	Measured Noise Levels
		Location 3 Roof of Settlement City Shopping Centre
LAeq	Day 1-hour (7.00 am to 10.00 pm)	54 dBA
	Night 1-hour (10.00 pm to 7.00 am)	47 dBA

Figure 2 11 Ballina Crescent, Port Macquarie - Long-Term Statistical Noise Levels

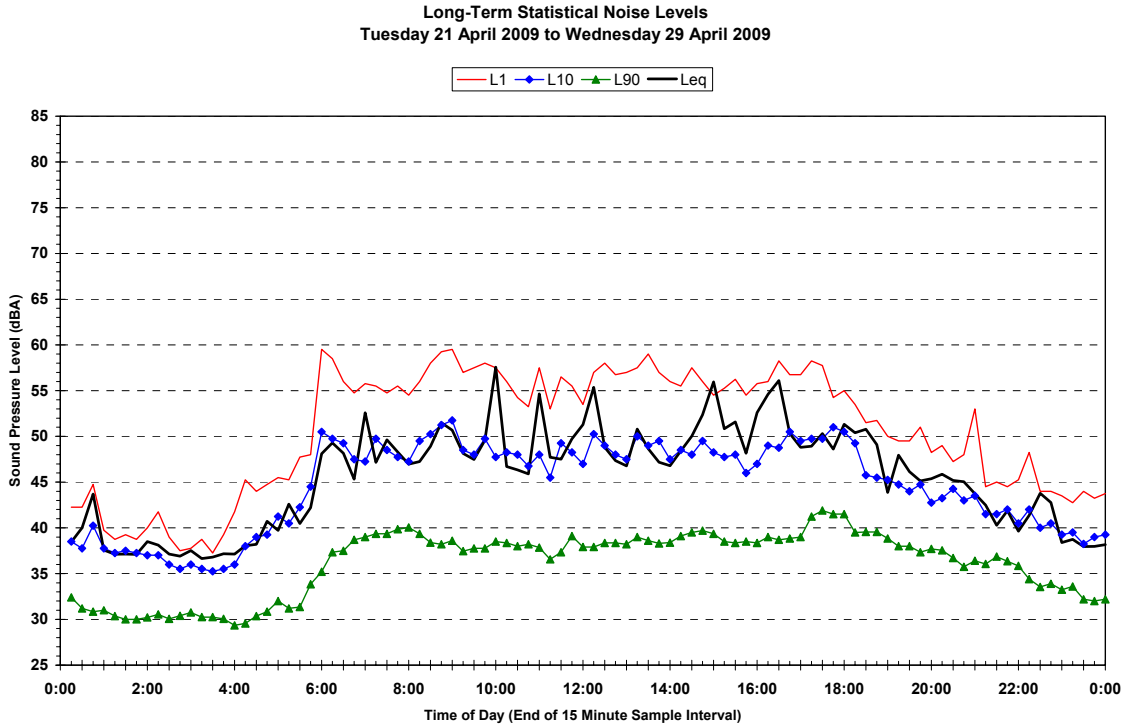


Figure 3 3 Commodore Crescent, Port Macquarie - Long-Term Statistical Noise Levels

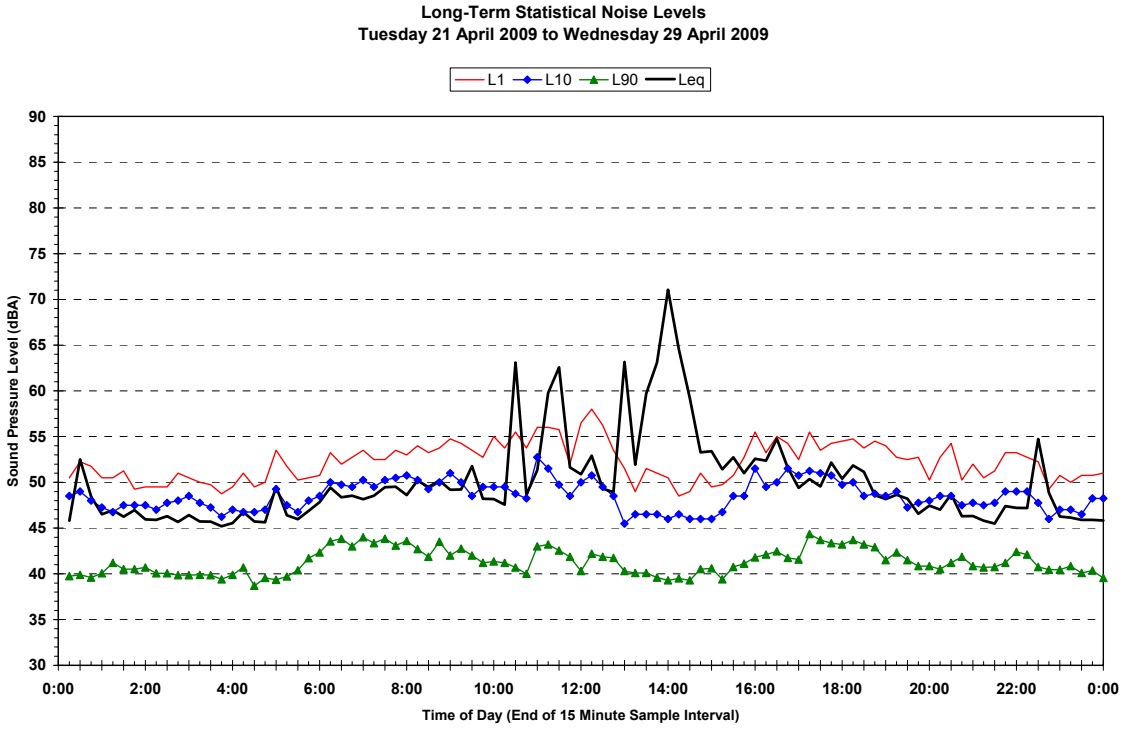
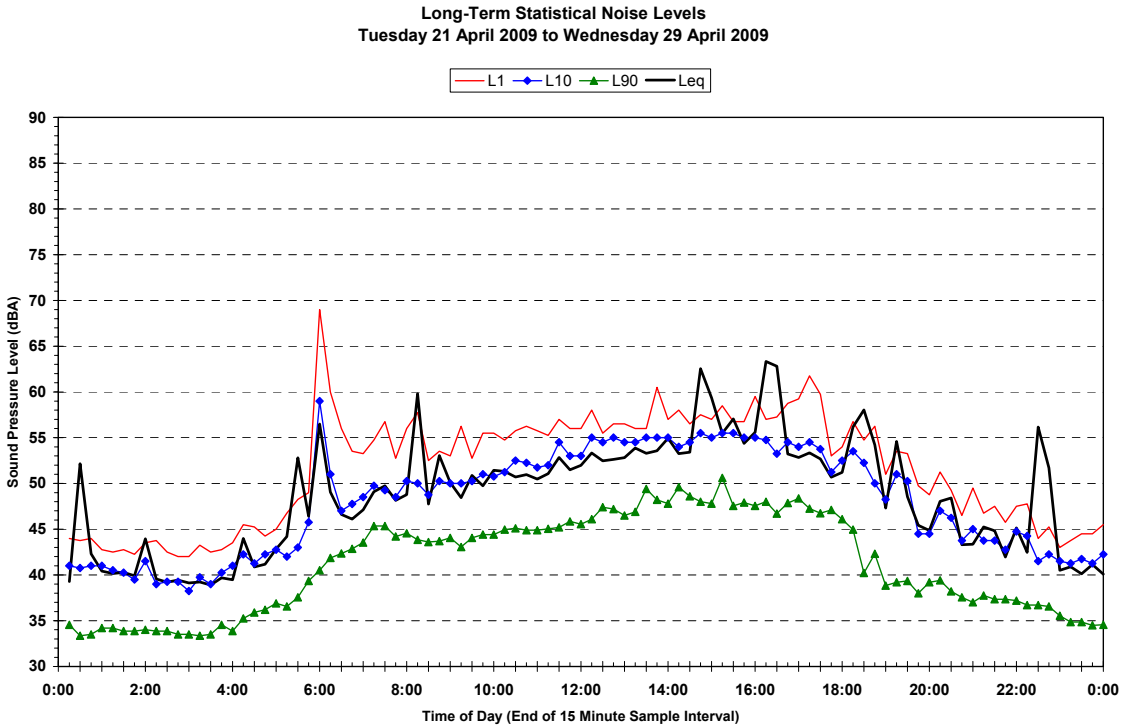


Figure 4 Roof of Settlement City Shopping Centre - Long-Term Statistical Noise Levels



4 NOISE CRITERIA

The following sections detail relevant criteria that should be applied to the site:

4.1 On Site Noise Criteria

4.1.1 Mechanical Services, Carpark and Loading Dock

Noise criteria relating to operational noise emissions at nearby residential areas are contained in the Department of Environment and Climate Change's (DECC) Industrial Noise Policy (INP). The policy is applicable to commercial and industrial facilities. The policy has the following broad objectives:

- Controlling intrusive noise impacts.
- Maintaining noise level amenity for particular land uses over the medium to long-term.

Intrusiveness Criterion

In setting an "Intrusive" noise criterion, a statistically rigorous estimate of the ambient (background) L_{A90} noise level, termed the RBL, needs to be established at the nearest sensitive receivers. Normally, an "RBL plus 5 dBA" criterion is then applied to the 15-minute L_{Aeq} noise emissions of the noise source in question (usually at the property boundary of the receivers of interest). The exception to this is given in *Section 3.1* of the INP, where it is recommended that if the RBL is found to be below 30 dBA, the intrusive noise criterion is set at 30 dBA.

In this instance, the Intrusive Design Criterion becomes $\leq$ RBL + 5 dBA ($L_{Aeq(15minute)}$)

Amenity Criterion

The "Amenity" noise goal seeks to place a limit on noise emissions according to how existing industrial /commercial related noise levels relate to recommended noise levels for the type of area involved, ie rural, urban, etc.

The resulting amenity criterion placed upon noise emissions of a new facility then depends upon whether existing industrial /commercial-related $L_{Aeq(period)}$ levels are lower or higher than the recommended amenity level.

In areas where existing industrial /commercial-related noise levels are already high, the amenity noise criterion acts to limit new industrial noise emissions so that the cumulative industrial /commercial noise emission levels do not increase.

Conversely, in areas where there is no existing industrial /commercial noise, the amenity noise criterion would be set at a level which allows new industrial /commercial noise emissions up to the recommended amenity level for the area.

The DECC's recommended "acceptable noise levels" (ANLs) for residential premises located in "Suburban" area are given in **Table 4**.

Project-Specific Noise Criteria

The intrusive and amenity criteria for nearby residential premises are presented in **Table 4**. These criteria are nominated for the purpose of assessing potential noise impacts from the operation of the proposed development.

For each assessment period, the lower (ie, the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in **Table 4.**

Table 4 Noise Criteria for Residences Surrounding the Development Site

Location	Time of Day	ANL [1] LAeq(period)	Measured RBL [2] LA90(15minute)	Measured LAeq(period) Noise Level)	Criteria for New Sources	
					Intrusive LA90(15minute)	Amenity [3] LAeq(period)
1	Day	60	39	51	**44**	60
	Evening	50	37	46	**42**	48
	Night	45	32	43	**37**	41
2	Day	60	43	58	**48**	56
	Evening	50	42	48	47	**46**
	Night	45	43	48	48	**38**

Note 1: ANL = "Acceptable Noise Level" for residences in an Urban Areas.

Note 2: RBL = "Rating Background Level".

Note 3: Assuming existing road traffic noise levels are unlikely to decrease in the future.

Noise criteria derived from logger location 1 are to be used for assessing noise impact on the nearby residences located west of the site. While noise criteria derived from logger location 2 are to be used to assess noise impact on the nearby residences located north of the site.

Table 5 Noise Criteria for School and Commercial/Industrial Premises to the South and East of Site

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise Level	
			Acceptable	Recommended Maximum
School Classroom – Internal	All	Noisiest 1-hour period when in use	35 dBA	40 dBA
Commercial premises	All	When in use	65 dBA	70 dBA
Industrial premises	All	When in use	70 dBA	75 dBA

4.1.2 Sleep Disturbance

The DECC's Environmental Noise Control Manual (ENCM) contains a guideline in relation to sleep disturbance. This provides a useful assessment tool for short duration, high noise level events which may not be assessed or controlled sufficiently by the INP's long-term-noise assessment procedures.

In order to minimise the potential for sleep disturbance due to transient (short-term) sounds, the DECC's ENCM recommends that:

The $L_{A1(60second)}$ noise level outside a bedroom window should not exceed the L_{A90} background noise level by more than 15 dBA.

This criterion is applicable only during the night time period (i.e. 10.00 pm to 7.00 am).

The $L_{A1(60second)}$ noise level may conservatively be estimated as the typical maximum level of the event being considered.

For planning purposes the assumed level of background noise for the night-time period is taken to be the night-time Rating Background Level, as given in **Table 2** (and **Table 4**) – resulting in a sleep disturbance criterion of:

- $L_{A1(60second)}$ **52 dBA** for residences in Location 1.
- $L_{A1(60second)}$ **53 dBA** for residences in Location 2.

4.2 Off-Site Noise Criteria (Traffic)

The NSW DECC's *"Environmental Criteria for Road Traffic Noise"* (ECRTN, May 1999) sets noise goals for road traffic noise. The policy document provides road traffic noise criteria for proposed road or commercial land use developments as well as noise goals for other sensitive land uses. The relevant criteria relating to land use developments with potential to create additional traffic on "*existing local roads"* roads is summarised in **Table 6**.

Table 6 DECC's Guidelines for Road Traffic Noise at Residences

Type of Development	**Criteria**		
	Day (7am to 10pm)	**Night (10pm to 7am)**	**Where Criteria are Already Exceeded**
Land use developments with potential to create additional traffic on existing local roads	$L_{Aeq(1hr)}$ 55 dBA	$L_{Aeq(1hr)}$ 50 dBA	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

Definitions: Land use development with potential to create additional traffic on existing roads implies increases to the magnitude of the traffic flow and/or changes to the traffic mix brought about by new land use developments or significant alterations to existing land use developments, which may not involve any construction to the road. This category does not cover minor changes that are not subject to either development consent or amendment to an EPA licence.

4.3 Construction Noise and Vibration Criteria

4.3.1 Construction Noise Criteria

The NSW DECC recognises that higher levels of noise are likely to be tolerated by people during relatively short periods of construction works. Guidelines are contained in the *"Environmental Noise Control Manual"* (ENCM).

The DECC recommends that the $L_{A10(15minute)}$ noise levels arising from a construction site and measured within the curtilage of an occupied noise-sensitive premises (ie at the boundary or within 30 m of dwelling, whichever is the lesser) should not exceed the levels indicated in **Table 7**. These noise goals are consistent with community reaction to construction noise.

Table 7 Recommended DECC Noise Goals for Construction Works

Period of Noise Exposure	**$L_{A10(15minute)}$ Construction Noise Goal**		
	Location 1	**Location 2**	**Location 3**
Cumulative noise exposure period not exceeding 4 weeks ($L_{A90(15minute)}$ plus 20 dBA =)	(39 dBA + 20 dBA =) 59 dBA	(43 dBA +20 dBA =) 63 dBA	(46 dBA + 20 dBA =) 66 dBA
Cumulative noise exposure period of between 4 weeks and 26 weeks ($L_{A90(15minute)}$ plus 10 dBA =)	(39 dBA + 10 dBA =) 49 dBA	(43 dBA + 10 dBA =) 53 dBA	(46 dBA + 10 dBA =) 56 dBA
Cumulative noise exposure period longer than 26 weeks ($L_{A90(15minute)}$ plus 5 dBA =)	(39 dBA + 5 dBA =) 44 dBA	(43 dBA + 5 dBA =) 48 dBA	(46 dBA + 5 dBA =) 51 dBA

4.3.2 Construction Vibration Criteria

Human Comfort Criteria for Continuous Vibration

Guidance in relation to assessing potential disturbance from ground-borne vibration is set out in Chapter 174 of the DECC's Environmental Noise Control Manual. These criteria are in turn based on British Standard 6472-1992 "*Evaluation of Human Exposure to vibration in Buildings (1 Hz to 80 Hz)*". This standard defines levels of building vibration associated with a "*low probability of adverse comment*" from occupants. The applicable limiting vertical vibration levels for daytime activities are shown in **Table 8**.

Table 8 Vertical Vibration Levels with "Low Probability of Adverse Comment" (8 Hz to 80 Hz)

Building Type	**Peak Floor Vibration (Daytime)**
Residential	0.3 mm/s - 0.6 mm/s
Offices	0.6 mm/s
Workshops	1.2 mm/s

Structural Damage

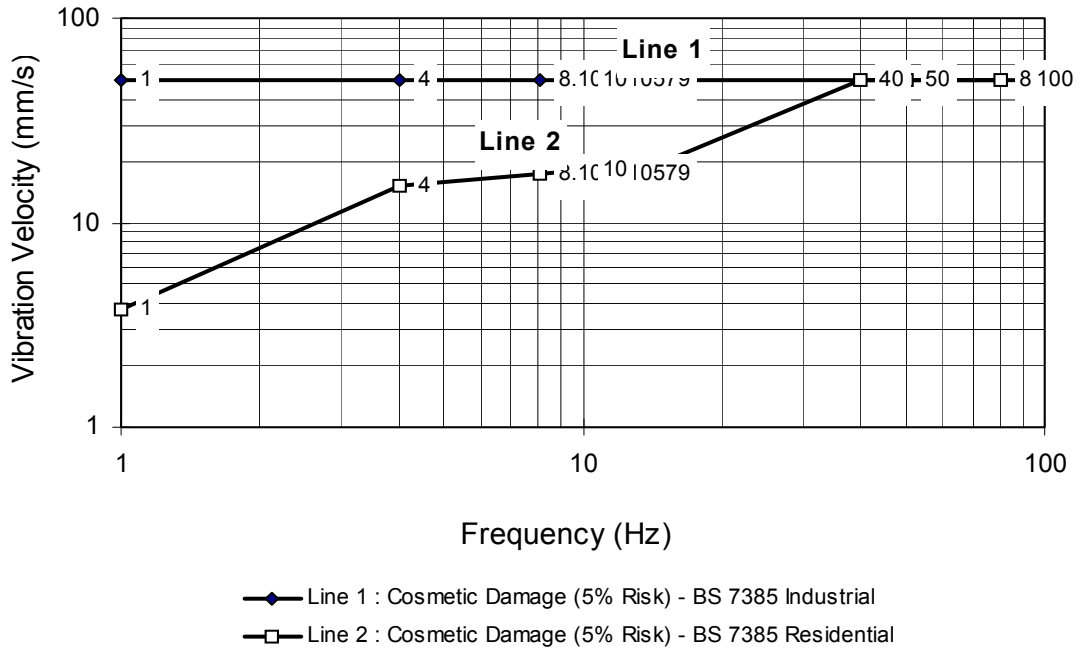
In terms of relevant vibration damage criteria, British Standard 7385:Part 2-1993 is a definitive standard against which the likelihood of building damage from ground vibration can be assessed.

The guide values from this standard for transient vibration judged to result in a minimal risk (ie 95% likelihood of no damage) if damage to residential buildings and industrial buildings are presented numerically in **Table 9** and graphically in **Figure 5**

Table 9 Transient Vibration Guide Values for Cosmetic Damage

Line	**Type of Building**	**Peak Component Particle Velocity in Frequency Range of Predominant Pulse**	
		4 Hz to 15 Hz	**15 Hz and above**
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Figure 5 Graph of Transient Vibration Guide Values for Cosmetic Damage



Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in **Table 9** may need to be reduced by up to 50%.

Clearly, for the subject construction works the appropriate vibration criterion will depend upon the type of building adjacent to the works at any given time.

Regenerated Noise

Regenerated noise levels associated with continuous vibration operations, such as rockbreaking, are to be assessed in accordance with the noise levels given in AS/NZS 2107:2000 *"Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors,"* in the absence of any criteria nominated by the DECC.

5 ACOUSTIC ASSESSMENT

5.1 External Plant Noise to Nearby Residences

Mechanical plant associated with the shopping centre has the potential to adversely impact on nearby residential properties.

Apart from motor vehicle noise, the above sources are controllable by common engineering methods. There are no unusual plant or equipment items proposed for the development.

It is likely that the air conditioning plant will require noise control treatments, using standard engineering treatment methods involving silencers, in order to comply with the site specific noise criteria for plant noise presented in **Section 4.1.1**.

The selected mechanical equipment must be reviewed and assessed for conformance with established criteria at the detailed design stage of the project when specific plant selection and location is determined. At this stage of the project appropriate noise control measures can be determined.

5.2 Loading Dock Noise Emissions

It is our understanding that the existing loading dock within the Settlement City Shopping Centre is to remain unchanged. Therefore, loading dock noise from the Centre does not need to be assessed.

5.3 Operational Road Traffic Noise

Section 4.2 set out the ECRTN road traffic noise criteria relevant to the closest residential receivers to the proposed development, namely the residences located immediately to the west of the Centre on Bay Street and to the north of the Centre on Park Street.

5.3.1 Bay Street Residences (West of Centre)

The ambient noise monitoring carried out along Bay Street (refer summary values given in **Table 3**) indicates that current daytime noise level of 54 dBA are within the ECRTN daytime criterion of 55 dBA (refer **Table 6**).

In this instance, it is expected that, at a minimum, traffic arising from the proposed redevelopment should be within the traffic noise levels of $L_{Aeq\ (1hour)}$ 55 dBA during the daytime period between 7:00 am and 10:00 pm at the nearby residences on Bay Street to the west of the Centre.

Based on the traffic report prepared by Transport and Traffic Planning Associates (Report Reference 08300, dated February 2009), the Existing afternoon peak hour traffic flow west of the Centre along Bay Street is in the order of 867 vehicle trips. The report predicted the Future afternoon peak hour traffic flow west of the Centre along Bay Street is in the order of 959 vehicle trips due to the redevelopment of the Centre.

On this basis, it is expected that the additional road traffic noise generated by the upgraded Centre on Bay Street, west of the site, would add just less than 0.5 dBA to existing noise levels.

Such an increase is within ECRTN guidelines (ie not more than 55 dBA) and, furthermore, would be imperceptible to all nearby residents on Bay Street.

5.3.2 Park Street Residences (North of Centre)

Ambient noise monitoring has not been carried out along Park Street. However, the existing traffic volumes presented in the traffic report prepared by Transport and Traffic Planning Associates (Report Reference, dated February 2009) indicates that the traffic volume on Park Street, west of the Centre is much lower compared to Bay Street. Therefore, the traffic noise level at the residences to the north of the Centre on Park Street will definitely lower than 54 dBA and within the ECRTN daytime traffic noise criterion of 55 dBA (refer **Table 6**).

In this instance, it is expected that, at a minimum, traffic arising from the proposed redevelopment should be within the traffic noise levels of $L_{Aeq\ (1hour)}$ 55 dBA during the daytime period between 7:00 am and 10:00 pm at the nearby residences on Park Street to the north of the Centre.

Based on the traffic report, the Existing afternoon peak hour traffic flow north of the Centre along Park Street is in the order of 212 vehicle trips. The report predicted the Future afternoon peak hour traffic flow north of the Centre along Park Street is in the order of 226 vehicle trips due to the redevelopment of the Centre.

On this basis, it is expected that the additional road traffic noise generated by the upgraded Centre on Park Street, north of the Centre, would add just less than 0.3 dBA to existing noise levels.

Such an increase is within ECRTN guidelines (ie not more than 55 dBA) and, furthermore, would be imperceptible to all nearby residences on Park Street.

5.4 Car Park Noise

It is understood that under the proposed scheme additional car parking to the retail centre is to be provided. From information provided it would appear that there will be provision of an additional 325 car parking spaces from the existing provision of approximately 1190 spaces. In general terms, when considering road traffic noise levels from a road, this level of increase in traffic volume results is only a marginal increase in noise level. Whilst not directly comparable, as usage patterns in car park areas will fluctuate between peak usage times, it is our opinion that the additional car parking provision in this instance, is unlikely to have any acoustically measurable impact on the nearest noise sensitive receivers.

5.5 Construction Noise and Vibration to Nearby Residences

Equipment and plant associated with the construction of the Settlement City Shopping Centre have yet to be selected at this stage of the project.

It is likely that the construction equipment and plant will require noise and vibration mitigation, using standard engineering treatment methods such as temporary barriers, enclosures and silencers, in order to comply with the site specific construction noise and vibration criteria presented in **Section 4.3**.

Construction equipment and plant have the potential to adversely impact on nearby residential properties. The selected construction equipment and plant should be reviewed and assessed for conformance with established criteria at the detailed design stage of the project when specific equipment and plant selection and location are determined. At this stage of the project appropriate noise control measures can be determined.

A Construction Noise Management Plan should also be prepared to ensure that construction noise and vibration emissions are adequately managed in order to maintain the amenity levels currently enjoyed by the surrounding residences.

5.6 Future Noise Assessments

We understand that due to the phasing of the detailed design of the proposed development, specific detailed information on operational elements is not available at this stage. We recommend that, as and when detailed operational information becomes available, applicable noise assessments shall be undertaken to identify any potential noise impacts and to advise upon mitigation methods which may or may not be required to ensure that relevant noise criteria are achieved.

It is likely the relevant assessment criteria will be (but may not be limited to) the INP and the ENCM.

6 CONCLUSION

Heggies have assessed the noise impact on the surrounding residential environs associated with the proposed expansion and redevelopment of the Settlement City Shopping Centre in Port Macquarie. In addition acoustic issues associated with traffic have been reviewed.

Appropriate noise criteria for the project have been established based on NSW Department of Environment and Climate Change noise guidelines.

Specific plant selection has not been made at this stage of the project. Therefore it is recommended that this issue be reviewed at the detailed design stage to ensure that compliance with this criterion is achieved at all residential receivers. It is our opinion that compliance with noise criterion can be achieved at all residential receivers

It is concluded that with the adoption of standard engineering treatments to the rooftop mechanical plant the proposed commercial development will not adversely impact on acoustic amenity of surrounding residences.

ACOUSTIC TERMINOLOGY

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quie
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB.

3 Sound Power Level

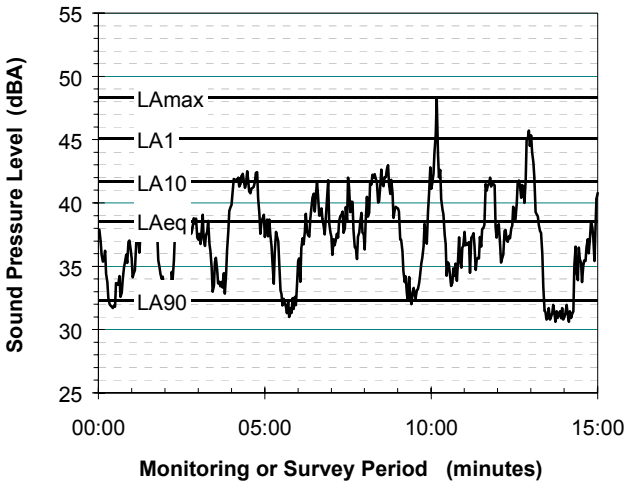
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 1E-12 W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

HEGGIES

REPORT 10-4254-R2

Revision 1

Settlement City Shopping Centre
Port Macquarie
Acoustic Planning Review
Project Plan Application

PREPARED FOR

ING Real Estate Pty Ltd
Level 11, 345 George Street
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23 FEBRUARY 2009

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Settlement City Shopping Centre

Port Macquarie

Acoustic Planning Review

Project Plan Application

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1 INTRODUCTION

Heggies Pty Ltd has been engaged by ING Real Estate (ING) to review the acoustic issues that are pertinent to the proposed Settlement City Shopping Centre expansion and partial redevelopment at Port Macquarie, NSW.

The objective of this report is to:

1. Review the proposed expansion and partial redevelopment and identify likely acoustic issues that may have the potential to impact on nearby noise sensitive; and
2. Provide planning recommendations addressing acoustic and vibration issues with respect:
    - On Site Noise Sources
        - Mechanical Services
        - Carpark Activities
        - Loading Dock Activities
    - Patron and Entertainment Noise.
    - Off-Site Noise Sources (Traffic)
        - Shopping Centre Customers
        - Service Vehicles
    - Construction Noise and Vibration Activities.

This report identifies noise sources associated with the proposed project, details the relevant assessment criteria applicable to the site and presents in-principle noise control recommendations for the proposed Settlement City Shopping Centre expansion and partial redevelopment at Port Macquarie, NSW.

2 SUBJECT SITE

The proposed expansion and partial redevelopment will be situated on an existing waterfront mixed-use site and will include the construction and refurbishment of:

- Commercial Offices of 2787 m^2.
- New Leisure/Gym/Health Spa of 2300 m^2.
- Multiple smaller retail stores lining the mall passageways.
- Panthers Entertainment club fronting Hastings River (To be redeveloped during stage 2 of the project).
- Cinemas and Bowling of 4942 m^2.
- Specialty Retail of 7148 m^2.

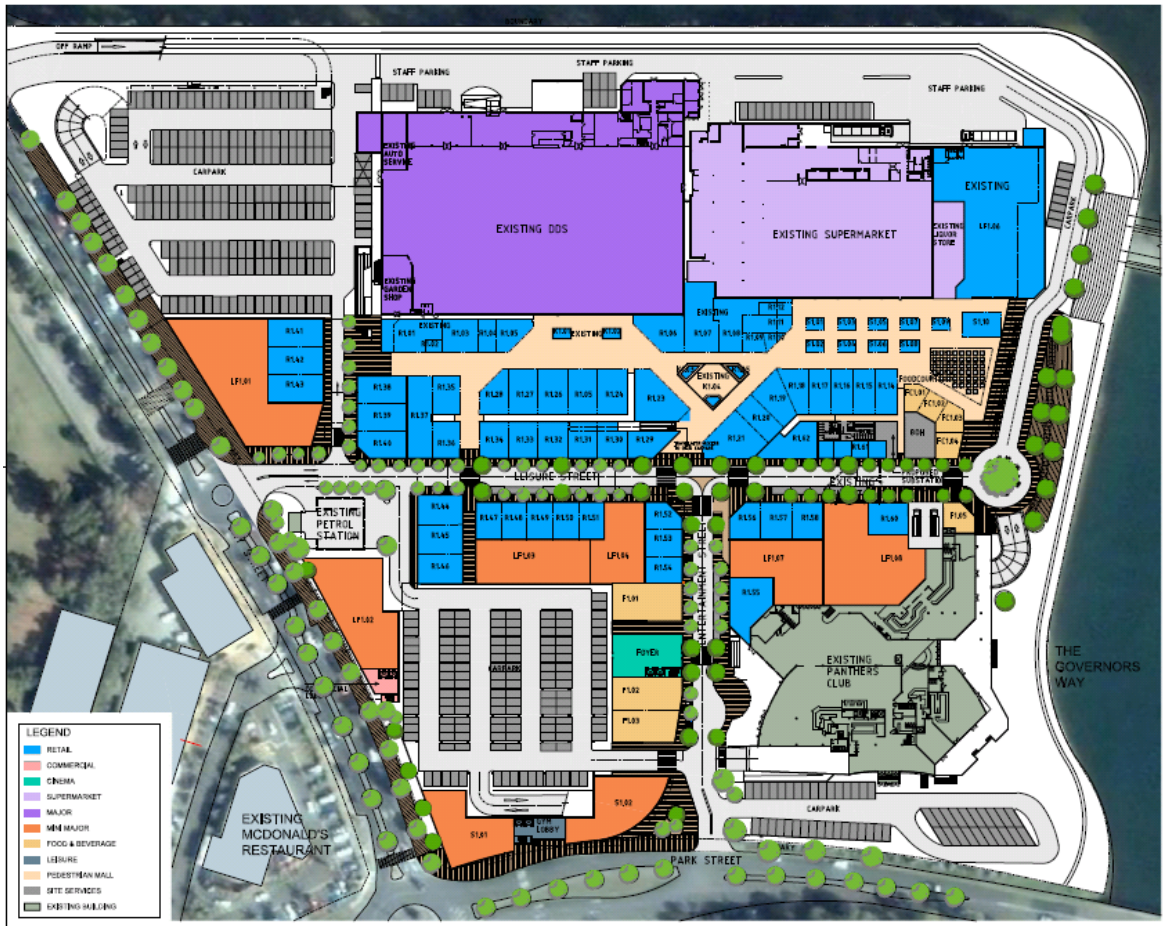
The following buildings will be retained

- Woolworths Supermarket of 4253 m^2.
- Discount Department Store of 6618 m^2.
- Mini Major of 996 m^2.
- Specialty Retail of 5941 m^2.

The site is presented in **Figure 1**. The site is bounded by Park Street to the east, Bay Street to the south and the Hastings River canal surrounding the western and northern perimeter of the site. Other uses surrounding the site include residential zones to the north and west, a hotel and marina to the northeast and two schools located to the east.

Port Macquarie offers infrastructure to support growing population levels, with new facilities such as the Base Hospital, two large regional shopping centres (including Settlement City), a number of schools (including St Josephs to the south of the site), TAFE college and a campus of Southern Cross University. As a significant piece of Port Macquarie infrastructure the Settlement City expansion will be important in terms of its overall service provision for Port Macquarie as a whole.

Figure 1 Layout of the proposed Settlement City Expansion and Partial Redevelopment



3 NOISE SOURCES

Significant noise sources associated with the proposed commercial and retail expansion and partial redevelopment are summarised in the following sections:

3.1 On Site Noise Sources

Noise sources associated with the commercial and retail redevelopment includes:

- Mechanical Services
  - Air Conditioning and ventilation plant and equipment
  - Refrigeration plant equipment including condensers and pumps
- Carpark noise such as car movements and door slams.
- Loading dock operation.

3.2 Off-Site Noise Sources (Traffic)

Additional traffic generated by the proposed redevelopment has the potential to impact on existing residential receivers along nearby local roads. Additional traffic generated by the redevelopment includes:

- Shopping Centre Customers and Office Employees
  - Cars
  - Buses
- Service Vehicles
  - Delivery and pick up vans and trucks

3.3 Construction Noise and Vibration

Noise and vibration associated with construction equipment such as bulldozers, compactors, cranes, hand tools, compressors, etc.

4 NOISE CRITERIA

The following sections detail relevant criteria that should be applied to the site:

4.1 On Site Noise Criteria

4.1.1 Mechanical Services

On site noise levels associated with continuous noise sources (ie ventilation, air conditioning and refrigeration plant and equipment) should be controlled by noise criteria based on the Department of Environment and Climate Change's (DECC) Industrial Noise Policy (INP) requirements.

4.1.2 Loading Docks

In order to limit the potential impact from a specific source, the DECC recommends that the L_{Aeq} noise level should not exceed the background noise (RBL) level by more than 5 dBA.

4.1.3 Sleep Disturbance

Intermittent noises due to activities such as patrons talking, cars/trucks starting or car doors closing and loading dock activities during the night-time period affecting nearby residences are not directly addressed by the Industrial Noise Policy. In order to minimise the risk of sleep disturbance at nearby residences resulting from noise emission from these types of activities before 7:00 am and after 10:00 pm, the DECC's *Environmental Noise Control Manual* (1994) recommends that the $L_{A1(60second)}$ noise level outside a bedroom window should not exceed the background noise level by more than 15 dBA.

4.2 Off-Site Noise Criteria (Traffic)

The NSW DECC's *"Environmental Criteria for Road Traffic Noise"* (ECRTN, May 1999) sets noise goals for road traffic noise. The policy document provides road traffic noise criteria for proposed road or commercial land use developments as well as noise goals for other sensitive land uses. The relevant criteria relating to land use developments with potential to create additional traffic on "*existing local roads"* roads is summarised in **Table 1**.

Table 1 DECC's Guidelines for Road Traffic Noise at Residences

Type of Development	**Criteria**		
	Day (7am to 10pm)	**Night (10pm to 7am)**	**Where Criteria are Already Exceeded**
Land use developments with potential to create additional traffic on existing local roads	$L_{Aeq(1hr)}$ 55 dBA	$L_{Aeq(1hr)}$ 50 dBA	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

Definitions: Land use development with potential to create additional traffic on existing roads implies increases to the magnitude of the traffic flow and/or changes to the traffic mix brought about by new land use developments or significant alterations to existing land use developments, which may not involve any construction to the road. This category does not cover minor changes that are not subject to either development consent or amendment to an EPA licence.

4.3 Construction Noise and Vibration Criteria

4.3.1 Construction Noise Criteria

The NSW DECC recognises that higher levels of noise are likely to be tolerated by people during relatively short periods of construction works. Guidelines are contained in the *"Environmental Noise Control Manual"* (ENCM).

The DECC recommends that the $L_{A10(15minute)}$ noise levels arising from a construction site and measured within the curtilage of an occupied noise-sensitive premises (ie at the boundary or within 30 m of dwelling, whichever is the lesser) should not exceed the levels indicated in **Table 2**. These noise goals are consistent with community reaction to construction noise.

Table 2 Recommended DECC Noise Goals for Construction Works

Period of Noise Exposure	**$L_{A10(15minute)}$ Construction Noise Goal**
Cumulative noise exposure period not exceeding 4 weeks	$L_{A90(15minute)}$ plus 20 dBA
Cumulative noise exposure period of between 4 weeks and 26 weeks	$L_{A90(15minute)}$ plus 10 dBA
Cumulative noise exposure period longer than 26 weeks	$L_{A90(15minute)}$ plus 5 dBA

4.3.2 Construction Vibration Criteria

In terms of the most recent relevant vibration damage criteria, British Standard 7385: Part 2-1993 is a definitive standard against which the likelihood of building damage from ground vibration can be assessed.

5 ACOUSTIC PLANNING REVIEW

The following section is a review of acoustic issues associated with identified noise sources and general planning recommendations are outlined for consideration by the project team. A detail acoustic assessment will need to be conducted in support of the Construction Certificate submission.

A review of the area surrounding the site indicates that the area is predominantly residential to the north and west with very little industry or commercial premises. There are no major traffic routes in the area and we anticipate that the background noise levels during the night-time period would be relatively low 30-40 dBA. On site and off site noise sources have the potential to impact on nearby noise sensitive receivers therefore careful consideration needs to be given to the location of noise generating sources.

5.1 On Site Noise Sources

5.1.1 Mechanical Plant

Details are as yet unavailable as to the precise mechanical plant which will be specified for the site. However, based on our experience on similar retail/commercial developments:

- Refrigeration units will operate 24 hrs per day 7 days a week.
- Roof mounted condenser platforms can present acoustic issues.

General Recommendations:

The following noise mitigation measures can be adopted to minimise the risk of acoustic impact to nearby noise sensitive receivers.

- Noise generating equipment should be located away from noise sensitive receivers.
- Existing and new building structures (eg parapets) should be used to shield plant from residences and mall areas.
- Where possible locate equipment within plant rooms inside the carpark.
- Judicious selection of low-noise equipment is encouraged.
- Use of acoustic barrier / enclosures.
- Diverting duct openings away from residential receivers.
- Where practical, all roof exhaust fans should be mounted as close as possible to the roofline.
- Use of timers on plant equipment, 2 speed or variable speed fans on major plant particularly refrigeration condensers.

5.1.2 Carpark and Loading Docks

Carparks and loading dock activities generate significant noise levels. Sources associated with these noises are:

Carparks

- Cars accelerating and braking.
- Cars driving over speed humps.
- Doors closing and engine starting.
- The voices of patrons talking or calling out.

Loading Docks

- The noise sources associated with loading/unloading activities, those associated with trucks, trolleys and roller doors tend to produce the highest noise levels. The rumbling and impact noise occur for periods of approximately ten seconds at a time.
- Reversing alarm and engine noise occur at the beginning and end of loading dock activities. The entire loading/unloading procedure usually lasts less than half an hour.

Night-time background noise levels adjacent to the Park Street loading dock are expected to be relatively low, therefore loading dock activities during the night-time have the potential to impact adversely on nearby residential receivers. Without noise control measures exceedance of the night-time criteria is anticipated (in particular truck and reversing alarms).

It is our understanding that the existing loading dock is to remain unchanged during the expansion and partial redevelopment of the Shopping Centre. However, noise emission levels from the loading dock will need to assess using the INP. The INP states in Section 1.4.2 that "*the application of the criteria to existing sources if noise would occur where significant modifications are made to existing development…*".

General Recommendations:

The following general noise mitigation measures can be adopted to minimise the risk of acoustic impact to nearby noise sensitive receivers.

- Where possible, restriction of loading dock hours to outside the night-time period (10.00 pm to 7.00 am) is recommended.
- Where possible, the scheduling of vehicles using the loading dock should be restricted or minimised during the night-time period (after 10:00 pm and before 7:00 am), and if possible, restricted to coincide with peak traffic periods.
- Design the loading dock manoeuvring area to minimise the need for reversing manoeuvres.
- Noise control measures in the form of barriers and enclosures may need to be considered during the design stage of the project.
- Install a damping material to the underside of the metal dock levellers. This material will reduce noise generated by trolleys in the loading dock area.
- Install thick rubber matting to any areas where impact is likely to occur.
- Restrict the idling of all vehicles using the loading dock during unexpected delays, (issue instructions and place visible notices for the idling of all vehicles using the loading dock).
- The metal grates on the paved entry areas of the carpark and loading dock should be supported on rubber and clamped vertically so that vehicles passing over cannot dislodge the grates and generate "rattling" sounds.

5.1.3 Sleep Disturbance

Noise associated with the existing loading dock on Park Street has the potential to impact on nearby residential receivers.

Consideration will need to be given to restricting loading activities to outside the night-time period and/or the adoption of noise control measures. As outlined above.

5.2 Off-Site Noise Sources (Traffic)

The major road route for vehicles to and from the proposed redevelopment site would be along local roads. Therefore, additional traffic generated by the proposed expansion and partial redevelopment has the potential to impact on nearby residential receivers.

- Encourage the use of public transport.
- The surrounding topography is relatively flat, therefore shopping patrons should be encouraged to walk or use bicycles to access the site. Provide walk/bicycle ways and bicycle racks in the shopping centre.
- In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

It is not anticipated that additional traffic generated by the proposed redevelopment will lead to an increase in existing noise levels of more than 2 dB.

5.3 Construction Noise and Vibration

5.3.1 Construction Noise

At this early stage of the project, construction equipment has not been selected and a construction program has not been established. However, without mitigation, it is possible that noise levels from construction activities will exceed the nominal construction noise design goals at nearest sensitive receivers at some time during the construction phase. It is also important that construction activities do not adversely impact on the continuing operation of the shopping centre.

It is also noted that the criteria nominated in the ENCM are *"noise design goals"*. Where these goals cannot be achieved in practice, the DECC recommends the use of best practical measures in order to minimise the risk of potential noise impacts.

The essence of the ENCM approach is:

- The potential for residential (and other receiver) disturbance should firstly be established, regardless of the practicality of achieving the noise goals in specific instances.
- Once potential exceedances are identified, all possible reasonable and feasible measures should be investigated to minimise the risk of adverse impacts.

5.3.2 Construction Vibration

It is not anticipated that blasting will be required for the project. The major potential sources of construction vibration include bulldozers ripping rock strata, rockbreakers, impact piling and vibratory rollers.

Based on the offset distance between the proposed redevelopment and residences (greater than 50 m) predicted vibration levels during construction activities are expected to be negligible.

6 CONCLUSION

Heggies Pty Ltd has been engaged by ING Real Estate (ING) to review the acoustic issues pertinent to the proposed Settlement City Shopping Centre expansion and partial redevelopment at Port Macquarie, NSW.

Noise sources associated with the proposed redevelopment have been identified and the appropriate criteria to the site have been outlined.

The acoustic planning review has identified noise sources with the potential to impact on noise sensitive receivers. In principle noise control measures are presented in this report to minimise the risk of adverse acoustic impact on nearby noise sensitive receivers.