Environmental Impact Statement

APPENDIX D

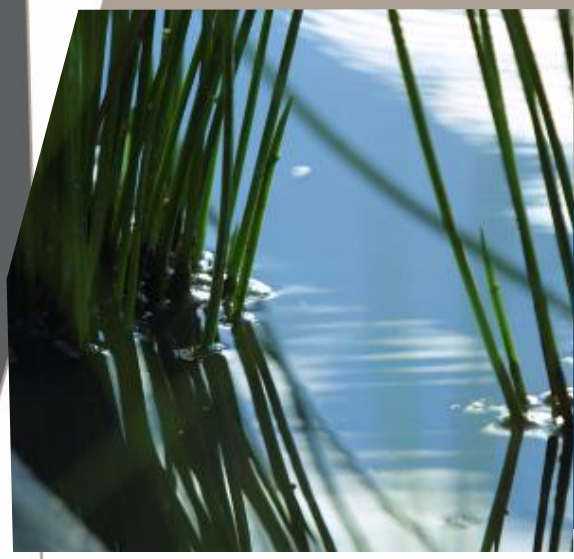
NOISE AND VIBRATION ASSESSMENT

Cardno
Shaping the Future

Noise & Vibration Impact Assessment

Waste Management Facility, Revesby

E003_59915106



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Executive Summary

This noise impact assessment has been conducted on behalf of Enviro Recycling to assess the existing and future environmental noise impacts associated with the expansion of an existing recycling facility located at 51 Violet Street, Revesby (Lots 168 and 169 DP 7866, Lot 2 DP 519053 and Lot 1 DP 734866).

The site is situated in an industrial area and was previously used for a range of manufacturing and industrial purposes, including recycling. The existing facility covers an area of approximately 11,200 m^2 which includes processing facilities, stockpile/storage and handling areas, vehicular access and manoeuvring areas. The proposed facility would expand operations to the south of the existing site incorporating 57-67 Violet Street. The expanded facility would cover an area of approximately 19,400 m^2 including processing facilities, stockpile/storage and handling areas, vehicular access and manoeuvring areas.

Secretary's Environmental Assessment Requirements (SEARs)

Secretary's Environmental Assessment Requirements (SEARs) for the preparation of the EIS were obtained by Cardno from the Department of Planning and Environment (DoPE) on 23 November 2015. The SEARs provide guidance on the environmental assessment requirements for the project.

The SEARs require the following Noise matters be considered:

SEARs Key Issue	Specific Matters To Address	Compliance
1	A quantitative assessment of potential construction, operational and transport noise and vibration impacts, including potential impacts on nearby noise and sensitive receivers.	Refer Section 6
2	Details and justification of the proposed noise mitigation and monitoring measures.	Refer Section 7

The expanded facility is located closer to sensitive receivers than the existing operations and a noise impact assessment has therefore been carried out to determine the noise impacts from the existing and proposed operations in accordance with the following policies and guidelines:

- NSW Industrial Noise Policy (INP) (EPA, 2000)
- NSW Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Assessing Vibration: A Technical Guideline (AVATG) (DEC, 2006)
- NSW Road Noise Policy (RNP) (DECCW, 2011)

Attended and unattended noise measurements were conducted in order to establish the existing ambient noise environment. Attended measurements were also taken on site and at nearby noise sensitive receivers in order to verify the noise model. The computer noise model was then used to determine typical noise impact from the existing operations as well as the likely noise impacts in the future.

Aims of the Assessment

This acoustic assessment aims to demonstrate the following:

- Model current operations of the existing facility and compare to existing measured levels at a number of nearby receivers to verify the model.

- Determine whether the proposed expansion of the existing site generates any adverse noise impacts, which exceed acceptable industrial noise criteria; and
- Determine feasible and reasonable noise and vibration mitigation measures where required to meet acceptable criteria.

Assessment Conclusions

This assessment has identified the following:

- Operational plant noise is currently complying with the INP daytime criteria at the nearest residential receivers.
- Modelling indicates that proposed operational plant and activities during the day are expected to generally comply with the INP criteria at all locations if the recommended mitigation is applied. With the mitigation measures applied, there are some small exceedances predicted for the worst case scenario when all plant is operating simultaneously. However, if the barrier and reduced source noise levels are not applied exceedances of up to 7 dB(A) are predicted at 34 locations.
- In order to reduce the noise impact from the proposed development and achieve compliance with the applicable INP noise criteria at the nearest residential receivers, a 3 metre high noise barrier is recommended along the south and south-eastern property boundary of the development as shown in Figure 10 and plant source noise and operational time limits have been recommended. The barrier could take the form of a fence or a building or a combination of both as long as the construction specifications detailed in Section 7.2 are adhered to.
- The barrier should be constructed from a material of panel mass of at least 12.5 kg/m^2 and be continuous and free from gaps.
- The number of exceedances reduces to 10 with the site boundary barrier installed, and further to 2 minimal (2 dB(A) or less) exceedances with the barrier and the recommended plant sound power limits in place.
- Provision of the time limits recommended in 0 for the three noisiest items of plant, results in general predicted compliance at all locations.
- Modelling also indicates that proposed operational plant and activities during the evening and night-time periods are also predicted to comply with the INP criteria at all locations if the recommended mitigation is applied. However, if the barrier is not applied exceedances are predicted at 2 locations.
- This assessment has identified that the maximum expected increase in L_{Aeq} noise level due to increased truck movement to and from the site is 0.6 dB(A) in the surrounding area. This is generally due to the existing high level of heavy vehicles on the local roads surrounding the site. This is significantly less than the 2 dB(A) increase nominated by the NSW Road Noise Policy as a recognised discernible increase in perceived noise level. On this basis noise from increased trucks accessing the site as a result of the proposal is not expected to impact amenity on the nearest sensitive receivers or require the implementation of mitigation measures.
- Noise levels have also been assessed to each boundary of the site which are currently bounded by industrial and / or commercial receivers. The current licence and the INP require that 70 dB(A) is complied with at each of these boundaries. Without additional mitigation 70 dB(A) was predicted to be exceeded at all of the site boundaries for worst case operation, over a small area, close to the site boundaries (refer to Appendix D for noise contour maps showing this area). However, this is only likely to occur when all plant is operating simultaneously, which is not likely to occur often.
- Extension of the noise barrier around the entire site does not provide a significant reduction in noise level at the adjacent commercial receivers except on the eastern boundary, where an extension to the recommended noise barrier has been recommended. Given the nature of the surrounding area, this is likely to be acceptable and not result in significant impacts on the adjacent industrial properties. Best practice mitigation measures should be adopted as described in Section 7.1 to minimise site noise emissions as much as possible.

- Additionally, site specific and best practice mitigation measures are recommended in Section 7.0 of this report.
- Minimal ground vibration impact from the proposed operation is expected to occur at the nearest sensitive residential receivers. However, in case of any complaints, short-term ground vibration monitoring at the nearest sensitive receivers is recommended.
- Based on this assessment, noise impacts from the proposed development are expected to generally comply with proposed noise limits provided the recommendations presented in this report are adopted.

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1.0. Introduction

This noise impact assessment has been conducted on behalf of Enviro Recycling to assess the existing and future environmental noise impacts associated with the expansion of an existing recycling facility located at 51 Violet Street, Revesby (Lots 168 and 169 DP 7866, Lot 2 DP 519053 and Lot 1 DP 734866).

The site is situated in an industrial area and was previously used for a range of manufacturing and industrial purposes, including recycling. The existing facility covers an area of approximately 11,200 m^2 which includes processing facilities, stockpile/storage and handling areas, vehicular access and manoeuvring areas. The proposed facility would expand operations to the south of the existing site incorporating 57-67 Violet Street. The expanded facility would cover an area of approximately 19,400 m^2 including processing facilities, stockpile/storage and handling areas, vehicular access and manoeuvring areas.

The expanded facility is located closer to sensitive receivers and a noise impact assessment has therefore been carried out to determine the noise impacts from the existing and proposed operations in accordance with the NSW Industrial Noise Policy.

This assessment has been carried out in accordance with the following policies and guidelines:

- NSW Industrial Noise Policy (INP) (EPA, 2000)
- NSW Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Assessing Vibration: A Technical Guideline (AVATG) (DEC, 2006)
- NSW Road Noise Policy (RNP) (DECCW, 2011)
- Australian Standard AS 1055.1:1997 – Acoustics Description and Measurement of Environmental Noise.

Attended and unattended noise measurements were conducted in order to establish the existing ambient noise environment around the site. Plant and equipment were measured on site and a 3D computer noise model was constructed.

Attended measurements were also taken on site and at nearby noise sensitive receivers in order to verify the noise logger results, and to determine the nature of the existing ambient noise environment at each nearby receiver location. The computer noise model was then used to predict the potential future noise impact from the expansion of the waste recycling facility's operations.

2.0. Site Description & Operations

Revesby Waste Management facility is located in an industrial area at 51 Violet Street, Revesby (Lots 168 and 169 DP 7866, Lot 2 DP 519053 and Lot 1 DP 734866). The existing facility located on Violet Road is bounded by industrial properties to the north, south, east and west of the site. Figure 1 below shows the location and distance of nearby residences in relation to the waste management facility.

2.1. Existing Waste Management Facility

On 12 March 2015, Enviro Recycling was granted approval by Bankstown City Council (Council) for the operation of a small scale recycling operation (30,000 tonnes) at 51 Violet Street, Revesby. The facility has been in operation since June 2015 and processes construction and demolition waste.

The existing facility covers an area of approximately 11,200 m^2 which includes processing facilities, stockpile/storage and handling areas, vehicles access and manoeuvring areas (refer Figure 2). The existing infrastructure at the existing facility includes:

- Entry and exit driveways on Violet Street;
- Steel floored weighbridge;
- Site offices;
- Two open sided process buildings and one covered area;
- Site services including power, water and sewerage;
- Stormwater management system; and
- Dust suppression system.

Figure 1: Existing Site Location & Surrounds

2.1.1. Operating Times

Times of operation are currently day time hours, typically 7am to 6 pm, week days, and 7 am to 2 pm on Saturdays.

Figure 2: Existing Site Layout

2.2. Proposed Expansion of Waste Management Facility

The proposed facility would expand operations to the south of the existing site incorporating 57-67 Violet Street. The expanded facility would cover an area of approximately 19,400 m^2 including processing facilities, stockpile/storage and handling areas, vehicular access and manoeuvring areas. A preliminary layout of the proposed facility is provided in 0. The proposed expanded facility would include the following key components:

- Material recycling facility to process up to 250,000 tonnes per year of General solid wastes (non-putrescible) as defined in Schedule 1 of the *Protection of the Environment Operations Act 1997 (POEO Act);*
- A second weighbridge for better traffic flow;
- Material Separator Machine to be located along the eastern boundary of the site to separate the materials, all undercover;
- Demolition of existing warehouse and office building at 57-67 Violet Street and likely construction of a replacement building;
- Provision of additional car parking spaces at 57-67 Violet Street;
- Provision of additional stockpile areas at 57-67 Violet Street; and
- Upgrade of stormwater and dust suppression systems at 57-67 Violet Street.

2.3. Site Location

The site is located on Violet Street and is approximately 100 metres north of the South Western Motorway (M5). Residential properties are located to the south and east of the site, but there are industrial and motorway land uses located between these properties and the site.

The nearby receiver areas have been grouped into noise catchment areas (NCAs), which are expected to have similar ambient noise levels and located a similar distance from the site. Loggers were placed at the most exposed locations within these areas to capture this information. Section 2.5 presents the location and distance of nearby residences and associated noise catchment areas in relation to the proposed resource recycling facility.

Figure 3: Site Plan and Proposed Features

2.4. Proposed Hours of Operation

General hours of operation for the waste recycling facility are proposed as follows:

- 6am – 12am midnight Monday to Saturday
- No work on Sundays and public holidays.

Processing of material is proposed between 6am and 6pm. It is noted that maintenance of equipment may occur until 10pm at night. Truck movements, associated with the loading and removal of recycled material from the facility, may be carried out until 12am midnight on occasions. Therefore deliveries could occur between 6 am and 12 am.

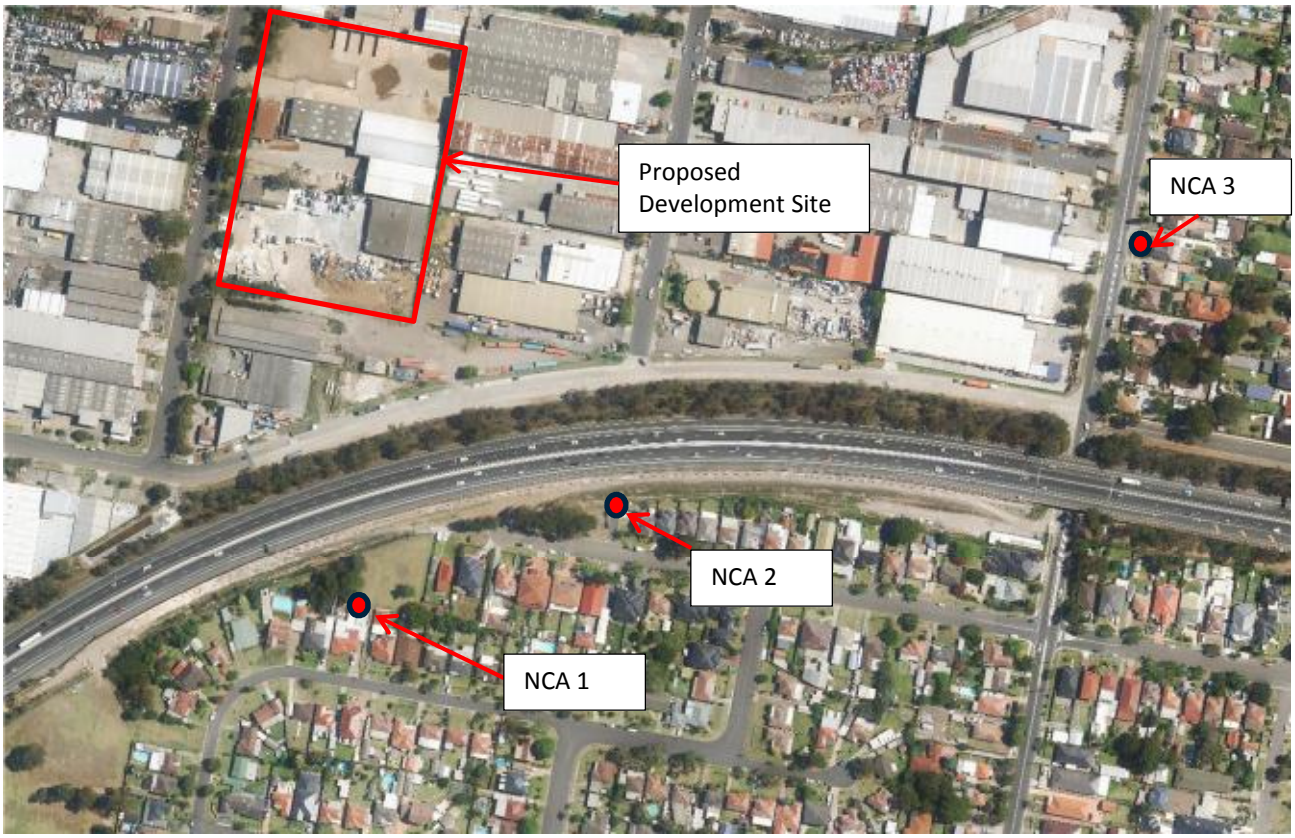
2.5. Nearby Sensitive Receivers

The following sensitive receivers are located in proximity to the existing waste management facility:

1. 21 Alliance Avenue Revesby (NCA 1) – located approximately 187m from the nearest site boundary
2. 75C Carrington Street Revesby (NCA 2) - located approximately 173 m from the nearest site boundary
3. 25 Queen Street Revesby (NCA 3) - located approximately 424 m from the nearest site boundary

The locations of the nearest sensitive receivers are shown in Figure 4.

Figure 4: Location of Selected Noise Sensitive Areas (NCA)



3.0. Existing Noise Environment

3.1. Ambient Noise Monitoring Methodology

Unattended noise monitors were installed at the following three locations to measure ambient (i.e. background) noise levels for a period of 8 days. Noise monitors were configured to measure 15-minute statistics, between the 17 and 24 November 2015.

- **Logger 1:** 51 Violet Street, Revesby (in front of the weighbridge office)
- **Logger 2:** Adjacent to 58 Tracey Street, Revesby
- **Logger 3:** At the end of Carrington Street, Revesby

Monitoring results from Logger 1 were used to verify the noise model and noise monitoring results from Logger 2 and 3 were used to determine the appropriate noise criteria for the receiver areas to the south and east of the site.

Noise monitoring was carried out using the equipment listed in Table 1.

Table 1: Noise Monitoring Equipment

Location	Logger Type	Serial Number
1	Rion NL-21	00365349
2	Rion NL-42	00333694
3	Rion NL-42	00333695

Figure 5: Noise Logger Locations

3.2. Equipment Calibration

Calibration of the sound monitoring equipment was conducted before and after the measurement period, with a variance of less than + / - 0.2 dB recorded.

3.3. Meteorological Monitoring Conditions

A summary of the environmental conditions noted during the measurement period were as follows (source BOM weather station located at Bankstown approximately 5km from the site:

Conditions: Fine

Daytime Wind: 1-10 m/s predominantly from a SW to NW direction

Daytime Humidity: 47 - 93%

Temperature: 14.9 – 25.7^{o}C

Detailed weather information recorded at the site during the monitoring period is detailed in Appendix B. The data was reviewed to determine time periods that were affected by adverse weather as described in the following extract from the INP.

Figure B1. Data exclusion rule

1. For every 4 consecutive values (-) there should be no more than 2 samples missing (x), for e.g.:

   Single invalid 15-minute samples: - - - x - - - x - - - x - - - or

   - - x - - x - - x - - x - - or

   - x - x - x - x - x - x -

   Double invalid 15-minute samples: - - x x - - x x - - x x - -
2. Where the maximum number of invalid samples (x) is greater than 8, 2 or 4 for day, evening and night respectively, then the corresponding period (day/evening/night) should be monitored again.
3. Where there are more than two consecutive invalid (x) samples, only one occurrence of the following pattern is allowed before re-monitoring is required.

   Triple invalid 15-minute samples: - - - x x x - - -

NSW industrial noise policy

Please note that BOM wind speed was recorded at 7 metres above the ground and that the ground level wind speed is significantly less. Adjustments have been made for this in Appendix B. As shown in Appendix B, adjusted wind speed of more than 5 m/s was observed on occasions. However, these exceedances occurred for a short period of time and did not affect the monitored noise levels on-site. As such, no data was removed from the monitoring results.

3.4. Measurement Parameters

As environmental noise varies with time, the use of statistical descriptors is necessary to understand and describe these variations. For road traffic noise these descriptors are further classified for day time (7 am – 10 pm) and night time (10 pm – 7 am).

For environmental noise, the assessment period for day time is further split into day (7 am – 6 pm) and evening (6 pm – 10 pm). A-weighted statistical levels are used to describe ambient noise levels. The common descriptors used to describe environmental noise are described as follows:

$L_{Amax:}$ the A-weighted maximum noise level measured during the measurement period.

L_{A1}: the A-weighted noise level exceeded for 1% of the measurement period.

L_{A10}: the noise A-weighted level exceeded for 10% of the measurement period, generally referred to as the average maximum sound pressure level.

L_{A90} : the A-weighted noise level exceeded for 90% of the measurement period, generally referred to as the background noise level (refer AS 1055.1 – 1997).

L_{Aeq} : the equivalent continuous noise level over the measurement period, generally referred to as the energetically average sound pressure level over the measurement period.

3.5. Measured Noise Levels

Measured noise levels at each logger location were observed to be affected by the following:

Table 2: Observed Existing Noise Environment

Logger	Location	Observed Noise Environment
1	51 Violet Street, Revesby	The primary source of noise was trucks entering and leaving the site, along with some traffic on Violet Street, and plant noise from the northern part of the site.
2	Adjacent to 58 Tracey Street, Revesby	Traffic on the M5 Motorway, some birds and insects.
3	Opposite 98 Carrington Street, Revesby	Traffic on the M5 Motorway, some local traffic, some birds and insects.

The rating background noise levels measured during the monitoring period (17 to 24 November 2015) are as follows. Refer to Appendix B for noise monitoring graphs.

Table 3: Measured Ambient Noise Levels

Parameter	Measurement Description	Measured Noise Level, dB(A)		
		07:00-18:00	18:00-22:00	22:00-07:00
51 Violet Street, Revesby (on-site) – Logger 1				
-	Rating Background Noise Level	50	49	49
L_{Aeq}	Existing Industrial Noise Level	75	57	69
L_{A10}	Approx. Average of the Maximums	72	56	60
Adjacent to 58 Tracey Street Revesby – Logger 2				
-	Rating Background Noise Level	49	46	44
L_{Aeq}	Existing Industrial Noise Level	57	52	53
L_{A10}	Approx. Average of the Maximums	58	53	53
Opposite 98 Carrington Street – Logger 3				
-	Rating Background Noise Level	52	48	45
L_{Aeq}	Existing Industrial Noise Level	60	55	56

Parameter	Measurement Description	Measured Noise Level, dB(A)		
		07:00-18:00	18:00-22:00	22:00-07:00
L_{A10}	Approx. Average of the Maximums	60	57	57

4.0. Statutory Noise & Vibration Criteria

4.1. Site Environmental Protection Licence 20607

The site currently operates under an EPA licence that states the following with respect to noise emissions:

L3 Noise Limits

L3.1 Noise from the premises shall not exceed 70 dB(A) from the nearest industrial boundary.

4.2. Bankstown Council

Additional Consultation was carried out with Bankstown Council and on 4 March 2016, Council advised of the following additional Noise Impact matters to be considered as part of the EIS preparation.

Table 4: Bankstown Council Noise Assessment Requirements

Noise Impact Issue	Compliance
22. Prepare an acoustic report to include potential noise impacts associated with the use of all machinery and equipment such as metal crusher onsite.	Addressed in Section 6.

4.3. Secretary's Environmental Assessment Requirements (SEARs)

Secretary's Environmental Assessment Requirements (SEARs) for the preparation of the EIS were obtained by Cardno from the Department of Planning and Environment (DoPE) on 23 November 2015. The SEARs provide guidance on the environmental assessment requirements for the project.

The SEARs for the project, contain the following requirements with regard to noise:

SEARs Key Issue	Specific Matters To Address	Compliance
1	A quantitative assessment of potential construction, operational and transport noise and vibration impacts, including potential impacts on nearby noise and sensitive receivers.	Addressed in Section 6
2	Details and justification of the proposed noise mitigation and monitoring measures.	Addressed in Section 7

4.4. NSW Industrial Noise Policy

In assessing the noise impacts from industrial sources, the NSW Industrial Noise Policy (INP) requires the consideration of two separate criteria in developing the project specific criteria. These are the intrusiveness criteria and the amenity criteria. The application of these criteria are summarised below:

4.4.1. Intrusiveness Criteria

The Intrusiveness Criteria is used to evaluate the extent to which a noise intrudes above the background, particularly where the receiver is a dwelling. The NSW INP considers that the $L_{Aeq,\ 15\text{-}minute}$ level associated with a broad-band industrial noise source may be up to 5 dB(A) above the rating background noise level (L_{A90}) at a receiver without being considered offensive.

The rating background noise level is similar to the 10th percentile background L_{A90} however uses a different sampling technique to determine the value.

Where a noise source contains certain characteristics, such as tonality, intermittency, impulsiveness, irregularity or low-frequency dominance, correction factors may need to be applied to the noise annoyance.

4.4.2. Amenity Criteria

The NSW INP also considers that there is a community expectation for a certain level of environmental noise amenity, depending on the type of area in which the noise sensitive receiver is located. The NSW INP provides a table of recommended L_{Aeq} noise levels that, subject to the type of area and time of day, are considered desirable.

Depending on the level of existing industrial or commercial noise, these desirable levels are adjusted so as to require progressively more stringent amenity compliance levels. The objective of this approach is to prevent the background noise level from continually increasing as a result of each progressive new development.

For an 'urban' amenity area, the NSW INP proposes that the L_{Aeq} noise emission level should not exceed the following acceptable noise emission levels:

- Daytime (7 am to 6 pm): 60 dB(A);
- Evening (6 pm to 10 pm): 50 dB(A); and
- Night (10 pm to 7 am): 45 dB(A).

For an industrial premises an acceptable L_{Aeq} noise level of 70dB(A) applies at the most affected point on the property boundary of the site, when the site is in use.

4.5. NSW Road Noise Policy

The NSW Road Noise Policy (DECCW, 2011) (NSW RNP) is a guideline for use in planning approvals by local councils and licenses issued by the Environmental Protection Authority (NSW EPA).

The NSW Road Noise Policy contains strategies to address the issue of road traffic noise from traffic-generating developments.

Quantitative criteria stated in the RNP associated with road traffic noise have now been superseded by those detailed in the RMS Noise Criteria Guideline (RMS, 2014). However, section 3.4.1 of the RNP does state the following in reation to the consideration of feasible and reasonable pplication of mitigation, relvant to assessment of this project:

"*Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.*

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person."

4.6. The RTA Environmental Noise Management Manual (ENMM)

Whilst many sections of the ENMM have been superseded by the RMS Noise Criteria Guideline, the ENMM provides additional guidelines with respect sleep disturbance.

4.6.1. Sleep Disturbance Criteria

The RNP also requires maximum noise levels during the night-time period (10pm–7am) to be assessed to determine potential impacts on sleep.

The ENMM states that this maximum noise assessment should be used as a tool to help prioritise and rank mitigation strategies, but should not be applied as a decisive criterion in itself.

At locations where road traffic is continuous rather than intermittent, the ENMM states that the $L_{Aeq,9hr}$ (night) target noise levels should sufficiently account for sleep disturbance impacts.

However, where $L_{Amax} - L_{Aeq,1hr} \geq 15$ dB(A); the $L_{Aeq,9hr}$ criteria may not sufficiently account for sleep disturbance impacts.

In addition the NSW ICNG defines the assessment of sleep disturbance as follows:

"Where construction works are planned to extend over more than two consecutive nights, and a quantitative assessment method is used, the analysis should cover the maximum noise level, and the extent and the number of times that the maximum noise level exceeds the RBL.

The NSW Environmental Noise Management Manual (NSW ENMM) discusses a number of methodologies with respect to sleep disturbance. In general, the methodologies address sleep disturbance due to continuous noise (expressed in terms of a LAeq (T)) and the affect multiple short duration noise events (expressed as a L_{AMax}).

In addition to the night time noise criteria specified in Section 4.4 (which addresses the continuous noise component generated by operational activities), the application of a noise criteria addressing the maximum noise level from operational activities is appropriate when works are planned to extend over more than two consecutive nights. The NSW ENMM draws the following conclusions with respect to noise limits for sleep disturbance:

"Considering all of the foregoing information the following conclusions can be drawn:

- Maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly."

4.7. Operational Vibration

Vibration from activities associated with the project could potentially impact on the amenity of the occupants of dwellings or buildings located close to the site. Generally, vibration impact can be summarised into two categories:

- Effect on human comfort; and
- Structural or cosmetic damage to buildings.

Vibration criteria is addressed in the NSW ICNG and refers to Section 2.5 of the document Assessing Vibration: A Technical Guideline (NSW AV:ATG) issued by DEC (2006). The NSW AV:ATG outlines vibration limits in relation to human comfort. Criteria in this guideline are based on the British Standard BS6472-1992 Evaluation of human exposure to vibration in buildings (1-80Hz).

In relation to structural damage, there is currently no Australian Standard that provides criteria for the assessment of structural damage to buildings. However, the British Standard BS7385 Part 2 can be used to assess structural damage to buildings. It defines damage in several categories including, for example, "cosmetic", "minor" and "major" damage. Alternatively, the German Standard DIN4150 Part 3 provides maximum vibration levels, which are assessed over a frequency range. These criteria are summarised in Section 5.0, in Table 10.

4.8. Construction Noise

It is understood that no long term construction works are proposed to facilitate the expanded operations and that construction sources are similar to those assessed for the operational phase of the project.

The NSW Office of Environment & Heritage (OEH) provides guidance for assessing construction noise impacts in the Interim Construction Noise Guideline (DECC, 2009) (NSW ICNG).

The level of noise impact and the requirement for mitigation measures is generally determined by the timing and duration of the noise emissions and the perceived impact of the noise above existing background noise levels.

It is important to note that the guideline distinguishes between qualitative and quantitative noise assessments based on the type and duration of construction activities. For example, a qualitative assessment is warranted for road maintenance type works of short duration, whereas a quantitative assessment is preferred for major infrastructure works.

Section 4 of the guideline outlines the quantitative assessment method, which establishes noise limits and assessment requirements for proposed construction activities over three weeks duration.

The noise criterion for potentially affected residential properties, as taken from Section 4.2 of the guideline, is detailed in Table 5.

Table 5: Noise at Residences Using Quantitative Assessment (Source: DECC, 2009)

Time of day	Management level $L_{Aeq\ (15\ min)}$*	How to apply
Recommended standard hours: Monday to Friday: 7am to 6pm Saturday 8am to 1pm: No work on Sundays or public holidays	Noise affected RBL + 10 dB	▪ The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	▪ A strong justification would typically be required for works outside the recommended standard hours.

Time of day	Management level $L_{Aeq\ (15\ min)}$*	How to apply
		▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. ▪ For guidance on negotiating agreements see section 7.2.2.

A strong justification would typically be required for works outside the recommended standard hours (see Table 5). The proponent should apply all feasible and reasonable work practices to meet the noise affected level. The definition of feasible and reasonable work practices is outlined in Section 1.4 of the NSW ICNG, with the following excerpts providing a brief description:

"A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements."

"Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure."

A number of factors may be considered in selecting reasonable measures, including the level of impact, the number of people affected, and the order of treatments applied to previous, similar projects. Where all feasible and reasonable practices have been applied and noise remains more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community on suitable mitigation measures. For guidance on negotiating agreements see section 7.2.2 of the NSW ICNG.

4.9. Australian Standards

The following Australian Standards provide criteria and methodologies that have been adopted in this assessment.

- Australian Standard AS1055: Acoustics – Description and measurement of environmental noise.
- Australian Standard AS 2702 – 1984, Methods for the Measurement of Road Traffic Noise.

5.0. Design Benchmarks

5.1. Operational Noise

5.1.1. Intrusiveness Criteria

The NSW INP criteria for intrusivness used to determine the project specific noise level (PSNL) for the project are summarised below in Table 6.

Table 6: Intrusiveness Criteria, LAeq 15-minute dB(A)

Time of Day	Rating Background Noise Level (RBL)	Intrusivness Criteria
NCA 1:		
Day (0700-1800)	49	54
Evening (1800-2200)	45	51
Night (2200-0700)	44	49
NCA 2:		
Day (0700-1800)	52	57
Evening (1800-2200)	48	53
Night (2200-0700)	45	50
NCA 3:		
Day (0700-1800)	52	57
Evening (1800-2200)	48	53
Night (2200-0700)	45	50

Background noise data for logger 2 was adopted for NCA3, as it was not possible to install a noise logger at an appropriate location in Queen Street due to a number of dwellings undergoing construction / renovation at this location.

5.1.2. Amenity Criteria

Based on site inspection and aerial image, the surrounding sensitive residential receivers are located within an 'Urban' area. For an urban area, the INP proposes that the L_{eq} noise emission levels should not exceed 60dB(A) in the daytime (7am to 6pm), 50dB(A) in the evening (6pm to 10pm) and 45dB(A) during the night (10pm to 7am).

For an industrial premises an acceptable noise level of L_{eq} 70dB(A) applies at the most affected point on the property boundary of the site, when in use.

The project specific amenity criteria is summarised below in Table 7.

Table 7: NSW INP Amenity Criteria Leq, dB(A).

Logger Location	Location Descriptor	Assessment Period	Acceptable Noise Level (INP Table 2.2)	Average Existing Noise Level (LAeq)	Amenity Criteria (INP Table 2.2)
1	NCA 1	Day (0700-1800)	60	57	57
		Evening (1800-2200)	50	52	42

Logger Location	Location Descriptor	Assessment Period	Acceptable Noise Level (INP Table 2.2)	Average Existing Noise Level (LAeq)	Amenity Criteria (INP Table 2.2)
		Night (2200-0700)	45	53	43
2 & 3	NCA 2; NCA 3	Day (0700-1800)	60	60	52
		Evening (1800-2200)	50	55	45
		Night (2200-0700)	45	56	46

5.1.3. Project Specific Noise Criteria

The project specific noise levels (PSNL) for the development are determined as the most stringent of the intrusiveness and amenity criteria. The criteria relevant to the proposed resource recycling facility are summarised in Table 8.

Table 8: NSW INP Project Specific Noise Criteria Leq, dB(A).

Time of Day	Intrusiveness Criteria	Amenity Criteria	Project Specific Noise Level (PSNL)
NCA 1:			
Day (0700-1800)	54	57	54
Evening (1800-2200)	51	42	42
Night (2200-0700)	49	43	43
NCA 2: NCA 3: 25 Queen Street Revesby			
Day (0700-1800)	57	52	52
Evening (1800-2200)	53	45	45
Night (2200-0700)	50	46	46

Given that the noise limits are quite similar at all locations, the most conservative noise limit for each time period has been adopted to provide a conservative assessment as follows:

- Day (0700-1800) – Leq, 52 dB(A)
- Evening (1800-2200) - Leq, 42 dB(A)
- Night (2200-0700) - Leq, 43 dB(A).

For an industrial premises an acceptable noise level of L_{eq} 70dB(A) applies at the most affected point on the property boundary of the site, when in use.

5.2. Road Traffic Noise (Increased Truck Movements)

Based on a review of statutory noise criteria, the proposed number of trucks accessing the site, and the existing traffic volumes on surrounding roads, a summary of the design benchmarks applicable to this project for noise from trucks travelling to and from the site on local surrounding rads are provided in Table 9 below.

Table 9: Summary of Traffic Noise Criteria

Applicable Assessment Criteria	Assessment Criteria — dB(A)	
	Day (7 AM–10 PM)	Night (10 PM–7 AM)
(1)Significant Increase Criteria	"without project" road traffic noise level + 2.0 dB(A)	
Sleep Disturbance Criteria	LAmax > LAeq+15 dB(A)	

5.3. Operational Vibration

The following vibration criteria (generally adopted for assessment of construction vibration) have been adopted for operational vibration impacts associated with plant operations at the proposed site.

Table 10: Vibration Limit Criteria (mm/s)

Applicable Assessment Criteria	Assessment Criteria — dB(A)	
	Vibration Limits	Standard
Disturbance to Persons (Day) 0.28 – 0.56 peak BS6472	0.28 – 0.56 peak	BS6472
Disturbance to Persons (Night)	0.20 - 0.40 peak	BS6472
Damage to Dwellings	5 (rms) at 1-10Hz 5 to 15 (rms) at 10-50Hz 15 to 20 (rms) at 50-100Hz	German Standard DIN 4150
Damage to Heritage Buildings	3 (rms) at 1-10Hz 3 (rms) to 8 at 10-50Hz 8 to 10 (rms) at 50-100Hz	German Standard DIN 4150

5.4. Construction Noise & Vibration

The following construction methodology is proposed for the expansion:

5.4.1. Proposed Construction Stages

The construction stages of the proposed Waste Recycling Facility may be generally summarised as follows:

1. Site establishment – installation of site fencing, environmental controls and traffic management;
2. Slab demolition – demolition of slabs to create of new staff carpark;
3. Site fitout – and assembly of the new materials separating machine; and
4. Site restoration – removal of all construction materials and equipment from the site, and removal of temporary works, restoration and landscaping, as required.

5.4.2. Proposed Construction Hours

The construction works are proposed to be undertaken during standard working hours (Monday to Friday 7:00 am to 6:00 pm, Saturdays 8:00 am to 1:00 pm, with no construction work on Sundays or Public Holidays).

5.4.3. Expected Construction Noise Impacts

Detailed plant and equipment lists for each phase were not available at the time of preparation of this report. However, predicted noise impacts during Phases 1 to 3 are expected to be similar to the operational impacts given that the operational plant is similar to that which would be used on site during site establishment and building demolition and construction. The ICNG criteria for construction noise impacts during standard hours will range from 59 to 62 dB(A). Given that the operational criteria is 10 dB (A) below this level, general construction noise is expected to comply with the ICNG criteria provided the recommendations in Section 7.0 of this report are adopted. This assumption is on the basis that very noisy and / or impulsive noise is not likely to occur during the construction stages of this project, such as piling or rock hammering. If these activities are proposed, impacts should be addressed in more detail as part of the construction noise management plan for the project.

A Construction Environmental Management Plan (CEMP) should be prepared once detailed construction schedules and plant and equipment lists are available to detail appropriate mitigation measures for the proposed range of construction activities. It is recommended that the noise barrier recommended for control of operational noise to residential areas to the south of the M5 (NCA1 & NCA2) is constructed as part of the early works to provide noise mitigation for further construction stages as well as operational noise sources.

6.0. Operational Noise & Vibration Impacts

6.1. Operational Noise

6.1.1. Assessment Methodology

SoundPLAN 7.4 3D noise modelling software was used to predict the noise impact from both the existing facility and from the proposed expansion on to the nearest sensitive receivers. A noise model was constructed to predict noise levels for plant sources associated with the existing site operations, based on site topography and existing plant sources.

The noise model for the existing situation was verified against measurements carried out at and in the area surrounding the existing facility. Details of the model verification are presented in Section 6.1.3

A prediction model to include the expansion for the proposed operational scenario, was then constructed, and proposed operations added. The noise model was designed to represent a worst case scenario, based on the supplied information. This was achieved by assuming that all items of plant will operate simultaneously and assessing the noise at the closest receiver location to the site within the noise catchment area.

The locations of the noise catchment receiver areas (NCA) adopted for the modelling are shown in Figure 4.

6.1.2. Noise Modelling Inputs

The following modelling inputs and assumptions were made for the modelling:

Table 11: Noise Model Input Assumptions

Modelling Element	Input / Assumption . Source Reference
Ground Elevation Geometry	Provided by Cardno
Ground Absoprtion	50% over soft ground
Methodology	Industrial Noise Impact: ISO 9613.2_1996 – "Acoustics – Attenuation of Sound During Propagation Outdoors".
Weather Conditions	Calm Conditions
Receiver Height	Assumed to be 1.8 & 4.6 metres above ground for ground and first floors respectively.
Existing Noise Barriers	Based on site inspection and aerial image, 3m high noise barriers along the South-Western Motorway (M5) have been modelled.
Source Sound Power Levels (SWL)	• Refer to 0 for plant SWLs associated with the existing operations • Refer to 0 for plant SWLs associated with the proposed operations

6.1.2.1. Modelled Scenarios

A scenario was modelled to evaluate the noise impact of each of the existing and proposed operations associated with the facility. The list of modelled scenarios is presented in Table 12.

Table 12: Modelled Scenarios

Model Scenario		Details
1	Existing Operations	Based on existing topography and operations. Constructed and compared to the measured site levels for model verification.
2	Proposed operations (Day) – No Mitigation	Based on the expanded site and proposed operations for day time, with no proposed noise mitigation measures included.
3a	Proposed operations (Day) – With Barrier	Based on the expanded site and proposed operations for day time, with recommended barrier included.
3b	Proposed operations (Day) – With Barrier & Reduced Source Noise Levels	Based on the expanded site and proposed operations for day time, with recommended barrier and plant source noise mitigation measures included.
4	Proposed Operations (Night) – No Mitigation	Based on the expanded site and proposed operations for night time, with no mitigation measures included.
5	Proposed operations (Night) – With Mitigation	Based on the expanded site and proposed operations for night time, with recommended noise mitigation measures included.

6.1.2.2. Source Sound Power Levels – Existing Scenario (1) - Daytime

The type and quantity of plant to be utilised on site was provided by Enviro Recycling. Equipment Sound Power Levels have been sourced from measurements, conducted by Cardno, of current equipment on site and supplemented with noise data supplied by Enviro Recycling and values referenced from Australian Standard AS 2436:2010 – "Guide to noise and vibration control on construction, demolition and maintenance sites" for standard earth moving equipment etc.

Attended measurements were conducted on 17 November 2015 to measure the existing operational plant noise on-site. Based on the measurements, existing operating plant and associated calculated sound power levels are presented in Table 13. The plant was modelled at the locations shown in Figure 6.

Table 13: Existing Plant Sound Power Levels

Source	Number of Plant	SWL dB(A)	Height above Ground (m)
Sources Outside the Covered Area			
Large Excavator	1	106	2
Large Sorter	1	108	2
Trucks (up to 13 Trucks Per Hour)	1	105	1
Water Truck (1 Truck Every 2 Hours)	1	94	1
Sources Under the Covered Area			
Excavator	2	105	2
Small Sorter / Windsifter	2	108	2

Figure 6: Location of Existing Plant

6.1.2.3. Source Sound Power Levels – Proposed Operation – Daytime (Scenarios (2) and (3))

A list of equipment/plant for the proposed expansion of operation was provided by Enviro Recycling on 15 January 2016. Based on the provided information and supplemented library noise levels, sound power levels for plant / equipment associated with proposed operation are presented in Table 14. These sound power levels were entered into the computer model at the locations shown in Figure 7 to predict the noise impact from the proposed operation at the nearest sensitive receivers.

Table 14: Proposed Plant Sound Power Levels - Daytime

Source	Number of Plant	SWL dB(A)	Height above Ground (m)
Concrete Crusher	1	115	2
L580 Wheel Loader	2	105	2
VB750 Shredder	1	116	2
Terex Finlay 694	1	111	2
Forklift	1	92	2
R950 Excavator	1	106	2
Rotochopper (Wood Chipper)	1	116	2
R922 Excavator	1	101	2
LH22 Material Handler	1	100	2
Existing Operations	Refer to 0 and 0 for details		

Figure 7: Modelled Location of Plant for Proposed Daytime Operations

6.1.2.4. Source Sound Power Levels – Proposed Operation – Evening and Night-time (Scenarios (4) & (5))

We understand that limited operations are proposed for the facility during the evening and night time period. It is noted that processing of material and maintenance of equipment may occur until 10 pm at night. Truck movements, associated with the loading and removal of recycled material from the facility, may be carried out until 12 am midnight on occasions.

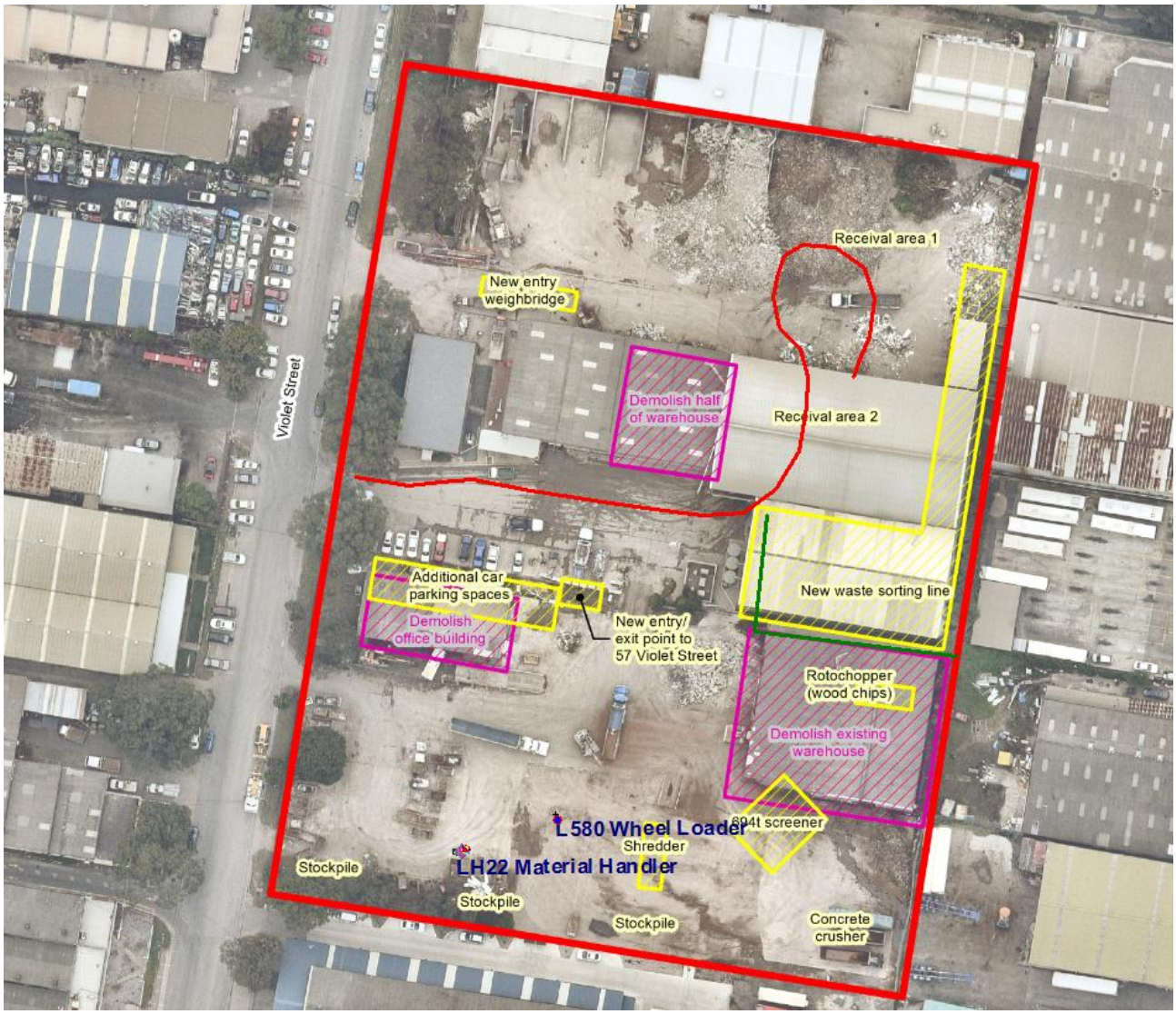
On this basis, a separate scenario was modelled to assess the predicted impact of the facility during the evening and night time period. Proposed operations and associated sound power levels for evening and night time operation are presented below in Table 15. These sound power levels were entered in the computer model at the locations shown in Figure 8 to predict the noise impact from the proposed operations at the nearest sensitive receivers during evening and night period.

Table 15: Proposed Plant Sound Power Levels – Evening & Night-time

Source	Number of Plant/Equipment	SWL dB(A)	Height above Ground (m)
L580 Wheel Loader	1	105	2
LH22 Material Handler	1	100	2
Trucks (up to 2 Trucks Per Hour)	1	97	2

Source	Number of Plant/Equipment	SWL dB(A)	Height above Ground (m)
Forklift	1	92	2
Excavator	1	101	2

Figure 8: Location of Plant/Equipment for Proposed Evening & Night Time Operation



6.1.3. Model Verification

Once the verification model was complete, spot receiver calculations were run for the verification location (logger location 1) and were compared against measured noise levels at the same location. A comparison of the measured and modelled values is shown in Table 16.

Table 16: Comparison of Modelled and Measured Site Noise Levels

Monitoring Location		Measurement Parameter	Measured Daytime Noise Level dB(A)	Modelled Daytime Noise Level dB(A)	Accuracy (Modelled-Measured), dB(A)
1	51 Violet Street Revesby	L_{Aeq}	74.7	75.7	**+1.0**

Generally model tolerances should be less than ± 2 dB(A) to provide an adequate level of prediction accuracy. As shown in Table 16, the predicted noise level was +1.0 dB(A) over the measured noise level. As such, the computer noise model is considered conservative and valid.

6.1.4. Predicted Noise Levels – Residential Receivers

6.1.4.1. Noise Modelling Predictions – Current Operations with No Mitigation – Daytime – Modelled Scenarios (2) & (3)

The predicted results for the current operations are shown below in Table 17.

Table 17: Existing Operations - Modelled Plant Noise Impacts - Daytime, LAeq

Receiver	Obj. No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With Mitigation (Noise Barriers), dB(A)	Exceedance of INP Criteria, With Mitigation (Noise Barriers), dB(A)
1 Alliance Ave	43	GF	W	52	37	-	37	-
3 Alliance Ave	42	GF	W	52	40	-	40	-
5 Alliance Ave	41	GF	W	52	35	-	35	-
7 Alliance Ave	40	GF	W	52	42	-	42	-
9 Alliance Ave	39	GF	W	52	40	-	40	-
11 Alliance Ave	38	GF	W	52	41	-	41	-
15 Alliance Ave	37	GF	NW	52	39	-	39	-
17 Alliance Ave	36	GF	NE	52	44	-	44	-
17 Alliance Ave	36	F 1	NE	52	48	-	48	-
19 Alliance Ave	35	GF	NW	52	45	-	45	-
21 Alliance Ave	34	GF	N	52	43	-	43	-
23 Alliance Ave	33	GF	N	52	45	-	45	-
25 Alliance Ave	32	GF	N	52	45	-	45	-
27 Alliance Ave	31	GF	N	52	46	-	46	-
29 Alliance Ave	30	GF	N	52	46	-	46	-
31 Alliance Ave	29	GF	N	52	45	-	45	-
35 Alliance Ave	28	GF	N	52	45	-	44	-
37 Alliance Ave	27	GF	N	52	44	-	44	-
55 Carrington St	3	GF	N	52	40	-	40	-
57 Carrington St	4	GF	N	52	40	-	40	-
59 Carrington St	5	GF	N	52	40	-	40	-
61 Carrington St	6	GF	N	52	39	-	39	-

Receiver	Obj. No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With Mitigation (Noise Barriers), dB(A)	Exceedance of INP Criteria, With Mitigation (Noise Barriers), dB(A)
63 Carrington St	7	GF	N	52	36	-	36	-
65 Carrington St	8	GF	N	52	38	-	38	-
67 Carrington St	9	GF	N	52	41	-	41	-
69 Carrington St	10	GF	N	52	40	-	40	-
71 Carrington St	11	GF	N	52	39	-	39	-
73 Carrington St	12	GF	N	52	39	-	39	-
75 Carrington St	13	GF	N	52	39	-	39	-
75 Carrington St	13	F 1	N	52	42	-	42	-
75A Carrington St	15	GF	N	52	38	-	38	-
75A Carrington St	15	F 1	N	52	41	-	41	-
75B Carrington St	14	GF	N	52	39	-	39	-
75B Carrington St	14	F 1	N	52	42	-	42	-
75C Carrington St	16	GF	N	52	38	-	38	-
75C Carrington St	16	F 1	N	52	41	-	41	-
84/86 Carrington St	25	GF	N	52	42	-	42	-
84/86 Carrington St	25	F 1	N	52	44	-	44	-
88 Carrington St	24	GF	N	52	42	-	42	-
90 Carrington St	23	GF	N	52	42	-	42	-
92 Carrington St	22	GF	N	52	43	-	43	-
94 Carrington St	21	GF	N	52	43	-	43	-
96A Carrington St	20	GF	N	52	43	-	43	-
98 Carrington St	19	GF	N	52	43	-	43	-
100 Carrington St	18	GF	N	52	45	-	45	-
100 Carrington St	18	F 1	N	52	48	-	48	-
102 Carrington St	17	GF	N	52	43	-	43	-
102 Carrington St	17	F 1	N	52	47	-	47	-
31/33 Greenway Pde	26	GF	N	52	42	-	42	-
31/33 Greenway Pde	26	F 1	N	52	44	-	44	-
70 Milperra Rd	63	GF	S	52	38	-	38	-
72 Milperra Rd	62	GF	W	52	38	-	38	-
1 Queen St	61	GF	W	52	39	-	39	-
3 Queen St	60	GF	W	52	39	-	39	-
5 Queen St	59	GF	W	52	39	-	39	-
7 Queen St	58	GF	W	52	39	-	39	-
9 Queen St	57	GF	W	52	39	-	39	-
11 Queen St	56	GF	W	52	39	-	39	-
13 Queen St	55	GF	W	52	39	-	39	-
15 Queen St	54	GF	W	52	40	-	40	-
17 Queen St	53	GF	W	52	40	-	40	-
19 Queen St	52	GF	W	52	38	-	38	-
21 Queen St	51	GF	W	52	38	-	38	-

Receiver	Obj. No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With Mitigation (Noise Barriers), dB(A)	Exceedance of INP Criteria, With Mitigation (Noise Barriers), dB(A)
23 Queen St	50	GF	W	52	38	-	38	-
25 Queen St	49	GF	W	52	39	-	39	-
27 Queen St	48	GF	W	52	45	-	45	-
29 Queen St	47	GF	W	52	41	-	41	-
31 Queen St	82	GF	W	52	39	-	39	-
33 Queen St	46	GF	W	52	40	-	40	-
35 Queen St	45	GF	W	52	38	-	38	-
37 Queen St	44	GF	W	52	39	-	39	-
62 Queen St	1	GF	W	52	40	-	40	-
64 Queen St	2	GF	W	52	37	-	37	-
46 Tracey St	81	GF	W	52	37	-	37	-
48 Tracey St	80	GF	N	52	44	-	43	-
50 Tracey St	79	GF	N	52	47	-	47	-
52 Tracey St	78	GF	N	52	47	-	47	-
54 Tracey St	77	GF	N	52	47	-	47	-
56 Tracey St	76	GF	N	52	47	-	47	-
58 Tracey St	75	GF	N	52	47	-	47	-
60 Tracey St	74	GF	N	52	47	-	47	-
62 Tracey St	73	GF	N	52	47	-	47	-
64 Tracey St	72	GF	N	52	47	-	47	-
66 Tracey St	71	GF	N	52	46	-	46	-
67 Tracey St	67	GF	NW	52	41	-	41	-
68 Tracey St	70	GF	N	52	46	-	46	-
69 Tracey St	68	GF	NW	52	45	-	45	-
70 Tracey St	69	GF	NW	52	45	-	45	-

6.1.4.2. Noise Modelling Predictions – Proposed Operations - Daytime

To determine the current level of impact on the surrounding area the model was run to include all of the nearby receivers. The modelled noise contours are shown in Appendix D.

The predicted results for the proposed operation compared to the day-time noise limits are shown below in Table 18. Non-compliance with INP criteria was predicted at nearby locations.

Therefore, mitigation measures were designed to achieve compliance at these receivers and are detailed in Section 7.0 of this report.

The predicted noise levels were then modelled with the recommended mitigation measures included. These results have also been included below in Table 18 to present the expected benefit from provision of the recommended measures.

Table 18: Proposed Operations - Modelled Plant Noise Impacts - Daytime, LAeq

Receiver	Object No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With 3m Site Barrier, dB(A)	Exceedance of INP Criteria, With 3m Site Barrier, dB(A)
1 Alliance Ave	43	GF	W	52	46	-	46	-
3 Alliance Ave	42	GF	W	52	48	-	48	-
5 Alliance Ave	41	GF	W	52	42	-	42	-
7 Alliance Ave	40	GF	W	52	48	-	47	-
9 Alliance Ave	39	GF	W	52	46	-	46	-
11 Alliance Ave	38	GF	W	52	47	-	47	-
15 Alliance Ave	37	GF	NW	52	47	-	47	-
17 Alliance Ave	36	GF	NE	52	50	-	50	-
17 Alliance Ave	36	F 1	NE	52	55	3	54	2
19 Alliance Ave	35	GF	NW	52	55	3	52	-
21 Alliance Ave	34	GF	N	52	52	-	49	-
23 Alliance Ave	33	GF	N	52	54	2	52	-
25 Alliance Ave	32	GF	N	52	55	3	53	1
27 Alliance Ave	31	GF	N	52	56	4	53	1
29 Alliance Ave	30	GF	N	52	56	4	53	1
31 Alliance Ave	29	GF	N	52	56	4	54	2
35 Alliance Ave	28	GF	N	52	55	3	53	1
37 Alliance Ave	27	GF	N	52	54	2	52	-
55 Carrington St	3	GF	N	52	54	2	50	-
57 Carrington St	4	GF	N	52	54	2	50	-
59 Carrington St	5	GF	N	52	49	-	47	-
61 Carrington St	6	GF	N	52	47	-	46	-
63 Carrington St	7	GF	N	52	44	-	44	-
65 Carrington St	8	GF	N	52	51	-	47	-
67 Carrington St	9	GF	N	52	54	**2**	51	-
69 Carrington St	10	GF	N	52	54	**2**	50	-
71 Carrington St	11	GF	N	52	51	-	48	-
73 Carrington St	12	GF	N	52	51	-	48	-
75 Carrington St	13	GF	N	52	51	-	48	-
75 Carrington St	13	F 1	N	52	54	**2**	51	-
84/86 Carrington St	25	GF	N	52	50	-	48	-
84/86 Carrington St	25	F 1	N	52	53	**1**	51	-
88 Carrington St	24	GF	N	52	51	-	49	-
90 Carrington St	23	GF	N	52	54	**2**	52	-
92 Carrington St	22	GF	N	52	50	-	48	-
94 Carrington St	21	GF	N	52	53	**1**	51	-
96A Carrington St	20	GF	N	52	55	**3**	51	-
98 Carrington St	19	GF	N	52	56	**4**	53	**1**
100 Carrington St	18	GF	N	52	54	**2**	50	-
100 Carrington St	18	F 1	N	52	54	**2**	51	-

Receiver	Object No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With 3m Site Barrier, dB(A)	Exceedance of INP Criteria, With 3m Site Barrier, dB(A)
102 Carrington St	17	GF	N	52	55	**3**	50	-
102 Carrington St	17	F 1	N	52	55	**3**	51	-
75A Carrington St	15	GF	N	52	56	**4**	51	-
75A Carrington St	15	F 1	N	52	56	**4**	51	-
75B Carrington St	14	GF	N	52	56	**4**	53	**1**
75B Carrington St	14	F 1	N	52	59	**7**	56	**4**
75C Carrington St	16	GF	N	52	56	**4**	52	-
75C Carrington St	16	F 1	N	52	59	**7**	55	**3**
31/33 Greenway Pde	26	GF	N	52	53	**1**	50	-
31/33 Greenway Pde	26	F 1	N	52	55	**3**	52	-
70 Milperra Rd	63	GF	S	52	49	-	48	-
72 Milperra Rd	62	GF	W	52	49	-	49	-
1 Queen St	61	GF	W	52	49	-	48	-
3 Queen St	60	GF	W	52	49	-	48	-
5 Queen St	59	GF	W	52	49	-	48	-
7 Queen St	58	GF	W	52	49	-	48	-
9 Queen St	57	GF	W	52	49	-	47	-
11 Queen St	56	GF	W	52	49	-	47	-
13 Queen St	55	GF	W	52	48	-	47	-
15 Queen St	54	GF	W	52	47	-	47	-
17 Queen St	53	GF	W	52	46	-	46	-
19 Queen St	52	GF	W	52	45	-	45	-
21 Queen St	51	GF	W	52	45	-	45	-
23 Queen St	50	GF	W	52	45	-	44	-
25 Queen St	49	GF	W	52	44	-	44	-
27 Queen St	48	GF	W	52	47	-	47	-
29 Queen St	47	GF	W	52	45	-	45	-
31 Queen St	82	GF	W	52	44	-	44	-
33 Queen St	46	GF	W	52	45	-	45	-
35 Queen St	45	GF	W	52	45	-	45	-
37 Queen St	44	GF	W	52	47	-	47	-
62 Queen St	1	GF	W	52	51	-	48	-
64 Queen St	2	GF	W	52	45	-	44	-
46 Tracey St	81	GF	W	52	44	-	44	-
48 Tracey St	80	GF	N	52	49	-	49	-
50 Tracey St	79	GF	N	52	52	-	51	-
52 Tracey St	78	GF	N	52	54	**2**	52	-
54 Tracey St	77	GF	N	52	53	**1**	51	-
56 Tracey St	76	GF	N	52	53	**1**	51	-
58 Tracey St	75	GF	N	52	52	-	51	-
60 Tracey St	74	GF	N	52	52	-	52	-

Receiver	Object No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With 3m Site Barrier, dB(A)	Exceedance of INP Criteria, With 3m Site Barrier, dB(A)
62 Tracey St	73	GF	N	52	52	-	52	-
64 Tracey St	72	GF	N	52	52	-	52	-
66 Tracey St	71	GF	N	52	52	**2**	51	-
67 Tracey St	67	GF	NW	52	46	-	46	-
68 Tracey St	70	GF	N	52	51	**1**	51	-
69 Tracey St	68	GF	NW	52	51	-	51	-
70 Tracey St	69	GF	NW	52	51	-	51	-

6.1.4.3. Noise Modelling Predictions – Proposed Operations– Evening & Night-time – Modelled Scenarios (4) & (5).

To determine the current level of impact on the surrounding area for night-time operations, the model was run for the proposed night-time noise sources. The modelled noise contour maps for these scenarios are shown in Appendix D.

The predicted results for the proposed evening and night-time operations compared to the relevant noise limits are shown below in Table 19. Non-compliance with INP criteria was predicted at a small number of nearby locations if no mitigation is included in the proposed site layout. The barrier designed to allow compliance for daytime operations at the nearest receivers was found to provide adequate attenuation to reduce expected night-time noise levels to comply with the INP noise criteria.

The predicted noise levels were modelled with the recommended mitigation measures included. These results have also been included below in Table 19 to present the expected benefit from provision of the recommended measures.

Table 19: Proposed Operations – Predicted Noise Levels – Evening / Night, LAeq

Receiver	Object No.	Flr	Façade	INP Criteria dB(A) Evening / Night	Predicted Evening / Night-time Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Evening / Night-time Noise Level, With Mitigation (Noise Barriers), dB(A)	Exceedance of INP Criteria, With Mitigation (Noise Barriers), dB(A)
1 Alliance Ave	43	GF	W	42	27	-	27	-
3 Alliance Ave	42	GF	W	42	30	-	30	-
5 Alliance Ave	41	GF	W	42	27	-	27	-
7 Alliance Ave	40	GF	W	42	32	-	32	-
9 Alliance Ave	39	GF	W	42	32	-	32	-
11 Alliance Ave	38	GF	W	42	32	-	32	-
15 Alliance Ave	37	GF	NW	42	30	-	30	-
17 Alliance Ave	36	GF	NE	42	36	-	36	-
17 Alliance Ave	36	F 1	NE	42	38	-	38	-
19 Alliance Ave	35	GF	NW	42	34	-	34	-
21 Alliance Ave	34	GF	N	42	34	-	34	-

Receiver	Object No.	Flr	Façade	INP Criteria dB(A) Evening / Night	Predicted Evening / Night-time Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Evening / Night-time Noise Level, With Mitigation (Noise Barriers), dB(A)	Exceedance of INP Criteria, With Mitigation (Noise Barriers), dB(A)
23 Alliance Ave	33	GF	N	42	35	-	35	-
25 Alliance Ave	32	GF	N	42	35	-	35	-
27 Alliance Ave	31	GF	N	42	36	-	36	-
29 Alliance Ave	30	GF	N	42	36	-	36	-
31 Alliance Ave	29	GF	N	42	37	-	37	-
35 Alliance Ave	28	GF	N	42	36	-	36	-
37 Alliance Ave	27	GF	N	42	36	-	36	-
55 Carrington St	3	GF	N	42	43	**1**	39	-
57 Carrington St	4	GF	N	42	41	-	37	-
59 Carrington St	5	GF	N	42	37	-	35	-
61 Carrington St	6	GF	N	42	33	-	32	-
63 Carrington St	7	GF	N	42	31	-	31	-
65 Carrington St	8	GF	N	42	40	-	35	-
67 Carrington St	9	GF	N	42	42	-	37	-
69 Carrington St	10	GF	N	42	41	-	36	-
71 Carrington St	11	GF	N	42	40	-	35	-
73 Carrington St	12	GF	N	42	38	-	34	-
75 Carrington St	13	GF	N	42	37	-	34	-
75 Carrington St	13	F 1	N	42	41	-	38	-
75A Carrington St	15	GF	N	42	37	-	34	-
75A Carrington St	15	F 1	N	42	36	-	37	-
75B Carrington St	14	GF	N	42	36	-	34	-
75B Carrington St	14	F 1	N	42	39	-	38	-
75C Carrington St	16	GF	N	42	36	-	34	-
75C Carrington St	16	F 1	N	42	38	-	38	-
84/86 Carrington St	25	GF	N	42	38	-	37	-
84/86 Carrington St	25	F 1	N	42	42	-	38	-
88 Carrington St	24	GF	N	42	39	-	34	-
90 Carrington St	23	GF	N	42	42	-	37	-
92 Carrington St	22	GF	N	42	39	-	36	-
94 Carrington St	21	GF	N	42	42	-	37	-
96A Carrington St	20	GF	N	42	37	-	37	-
98 Carrington St	19	GF	N	42	38	-	36	-
100 Carrington St	18	GF	N	42	34	-	36	-
100 Carrington St	18	F 1	N	42	37	-	39	-
102 Carrington St	17	GF	N	42	37	-	36	-
102 Carrington St	17	F 1	N	42	37	-	38	-
31/33 Greenway Pde	26	GF	N	42	42	-	38	-
31/33 Greenway Pde	26	F 1	N	42	44	**2**	40	-

Receiver	Object No.	Flr	Façade	INP Criteria dB(A) Evening / Night	Predicted Evening / Night-time Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Evening / Night-time Noise Level, With Mitigation (Noise Barriers), dB(A)	Exceedance of INP Criteria, With Mitigation (Noise Barriers), dB(A)
70 Milperra Rd	63	GF	S	42	41	-	40	-
72 Milperra Rd	62	GF	W	42	41	-	41	-
1 Queen St	61	GF	W	42	41	-	41	-
3 Queen St	60	GF	W	42	38	-	38	-
5 Queen St	59	GF	W	42	37	-	37	-
7 Queen St	58	GF	W	42	36	-	36	-
9 Queen St	57	GF	W	42	36	-	36	-
11 Queen St	56	GF	W	42	36	-	36	-
13 Queen St	55	GF	W	42	35	-	35	-
15 Queen St	54	GF	W	42	34	-	34	-
17 Queen St	53	GF	W	42	33	-	33	-
19 Queen St	52	GF	W	42	32	-	32	-
21 Queen St	51	GF	W	42	32	-	32	-
23 Queen St	50	GF	W	42	32	-	32	-
25 Queen St	49	GF	W	42	32	-	32	-
27 Queen St	48	GF	W	42	33	-	32	-
29 Queen St	47	GF	W	42	32	-	32	-
31 Queen St	82	GF	W	42	32	-	32	-
33 Queen St	46	GF	W	42	32	-	32	-
35 Queen St	45	GF	W	42	33	-	33	-
37 Queen St	44	GF	W	42	38	-	38	-
62 Queen St	1	GF	W	42	42	-	37	-
64 Queen St	2	GF	W	42	33	-	31	-
46 Tracey St	81	GF	W	42	27	-	27	-
48 Tracey St	80	GF	N	42	32	-	32	-
50 Tracey St	79	GF	N	42	34	-	34	-
52 Tracey St	78	GF	N	42	34	-	34	-
54 Tracey St	77	GF	N	42	34	-	34	-
56 Tracey St	76	GF	N	42	34	-	34	-
58 Tracey St	75	GF	N	42	34	-	34	-
60 Tracey St	74	GF	N	42	35	-	34	-
62 Tracey St	73	GF	N	42	34	-	34	-
64 Tracey	72	GF	N	42	34	-	34	-
66 Tracey St	71	GF	N	42	34	-	34	-
67 Tracey St	67	GF	NW	42	28	-	28	-
68 Tracey St	70	GF	N	42	33	-	33	-
69 Tracey St	68	GF	NW	42	30	-	30	-
70 Tracey St	69	GF	NW	42	30	-	30	-

6.1.5. Predicted Noise Levels – Road Traffic Noise

6.1.5.1. Traffic Noise Volumes With & Without the Development

The following existing traffic volumes for the roads surrounding the site were provided by the Cardno traffic team:

Table 20: Existing & Site Generated Traffic Volumes

Road Section	Existing							Generated			Existing + Development				
	Light			Heavy			AADT	Light			Heavy	AADT	Light	Heavy	AADT
	AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily		AM Peak	PM Peak	Daily	Daily				
Milperra Road west of Marigold Street	3115	3252	54200	303	173	5050	59250	4	4	8	85	93	54208	5135	59343
Milperra Road between Marigold Street and Violet Street	3066	3306	55100	292	173	4867	59967	0	3	3	85	88	55103	4952	60055
Milperra Road between Violet Street and Edgar Street	3036	3287	54783	303	179	5050	59833	9	0	9	85	94	54793	5135	59928
Milperra Road east of Edgar Street	2624	2899	48317	350	178	5833	54150	3	4	6	85	91	48323	5918	54241
Marigold Street between Milperra Road and Carrington Street	811	652	13517	127	58	2117	15633	4	1	5	85	90	13522	2202	15724
Marigold Street south of Carrington Street	547	463	9117	46	21	767	9883	2	2	4	0	4	9121	767	9887
Violet Street between Milperra Road and Carrington Street	57	57	950	16	6	267	1217	25	25	50	170	220	1000	437	1437
Edgar Street north of Milperra Road	1917	2006	33433	153	90	2550	35983	7	7	14	0	14	33447	2550	35997
Edgar Street between Milperra Road and Carrington Street	1211	1350	22500	83	42	1383	23883	0	11	11	0	11	22511	1383	23894
Queen Street	1345	1366	22767	49	24	817	23583	10	8	17	0	17	22784	817	23601
Green Street	28	25	467	5	0	83	550	0	0	0	0	0	467	83	550
Carrington Street between Marigold Street and Violet Street*	274	317	5283	42	26	700	5983	6	3	9	85	94	5293	785	6078
Carrington Street between Violet Street and Edgar Street*	274	317	5283	42	26	700	5983	10	19	28	0	28	5312	700	6012
Gordon Parker Street	92	155	2583	3	0	50	2633	0	1	1	0	1	2584	50	2634

6.1.5.2. Predicted Site Generated Traffic Increases

The Calculation of Road traffic Noise (CoRTN 1988 UK Department of Transport Welsh Office) calculation methodology was adopted to determine the effect of increasing the heavy vehicles on roads surrounding the site as a percentage of the total vehicles on each road segment near to the site. The predictions assume that half of the traffic will travel north to and from the site and half will travel south.

Based on the above information, Table 21 details the assumed increases in heavy vehicles due to the proposal and the associated predicted increase in traffic noise level:

Table 21: % Increase in Truck Volumes due to the Proposal

Road Section	Existing All Vehicles (AADT)	Increase in Light Vehicle Due to Proposal	Existing % Heavy Vehicles	% Heavy Vehicles With Proposal	Expected % Increase in Heavy Vehicles	Predicted Increase in Traffic Noise Level, dB(A)
Milperra Road west of Marigold Street	59250	8	8.5	8.7	0.2	0.1
Milperra Road between Marigold Street and Violet Street	59967	3	8.1	8.3	0.2	0.0
Milperra Road between Violet Street and Edgar Street	59833	9	8.4	8.6	0.2	0.0
Milperra Road east of Edgar Street	54150	6	10.8	11.0	0.2	0.0
Marigold Street between Milperra Road and Carrington Street	15633	5	13.5	14.1	0.6	0.0
Marigold Street south of Carrington Street	9883	4	7.8	7.8	0	0.0
Violet Street between Milperra Road and Carrington Street	1217	50	21.9	26.0	4.1	0.6
Edgar Street north of Milperra Road	35983	14	7.1	7.1	0	0.0
Edgar Street between Milperra Road and Carrington Street	23883	11	5.8	5.8	0	0.0
Queen Street	23583	17	3.5	3.5	0	0.0
Green Street	550	0	15.2	15.2	0	0.0
Carrington Street between Marigold Street and Violet Street*	5983	9	11.7	13.3	1.6	0.3
Carrington Street between Violet Street and Edgar Street*	59250	28	11.7	11.6	0	0.0
Gordon Parker Street	59967		1.9	1.9	0	0.0

The above predicted noise levels indicate that the maximum expected increase in L_{Aeq} noise level due to increased truck movement to and from the site is 0.6 dB(A) in the surrounding area. This is generally due to the existing high level of heavy vehicles on the local roads surrounding the site. This is significantly less than the 2 dB(A) increase nominated by the RNP as a recognised discernible increase in perceived noise level. On this basis noise from increased trucks accessing the site as a result of the proposal is not expected to impact amenity on the nearest sensitive receivers or require the implementation of mitigation measures.

6.1.5.3. Sleep Disturbance

A detailed predictive assessment of L_{Amax} impact has not been carried out for this assessment as there is not enough input information available in terms of predicted maximum road traffic noise levels from the project, or existing data for day and night, to determine the predicted L_{Amax} noise level incident on the receivers accurately at night-time. However,

given that the predicted truck movements are likely to be less than two per hour, and that existing heavy vehicles movements are likely to be higher than this (based on the AADT figures above) and site truck movements will not generally occur after 12am, sleep disturbance is not likely to occur.

6.1.6. Predicted Noise Level – Commercial Receivers

Noise levels have also been assessed to each boundary of the site which are currently bounded by industrial and / or commercial receivers. The current site EPA licence and INP industrial criteria of 70 dB(A) was predicted to be exceeded at all of the site boundaries for worst case operation, near to the site boundaries.

Noise contour maps showing the predicted noise levels with the recommended noise barrier to control noise to residential receivers) and with a full perimeter noise barrier are shown in Appendix D.

It should be noted that this assessment provides the worst case scenario and this level of impact is only likely to occur occasionally.

On this basis extension of the noise barrier around the entire site is not recommended. However, a reasonable level of benefit is likely to be gained from extending the barrier along the eastern boundary as shown below in Figure 10. This is recommended to provide a practical mitigation solution.

Given the nature of the surrounding area, this is likely to be acceptable and not result in significant impacts on the adjacent industrial properties. Best practice mitigation measures should be adopted as described in Section 7.1 to minimise site noise emissions as much as possible.

6.2. Vibration Assessment

6.2.1. Vibration Assessment Methodology

As per Figure 9, generally, plant with the potential to generate significant vibration includes:

- Vibratory rollers
- Rock hammers
- Bored Piling.

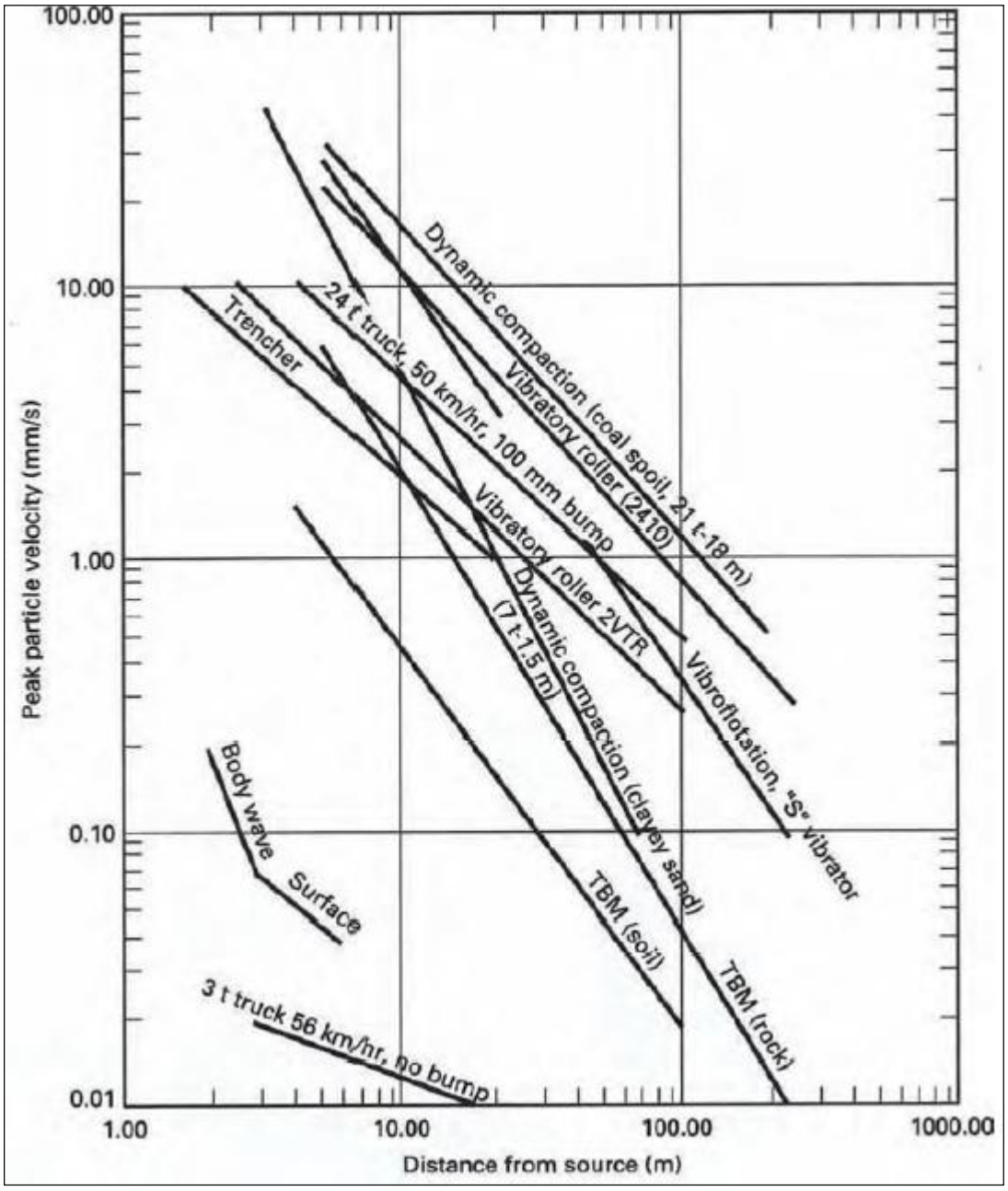
Vibration levels vary depending on the distance from the equipment in use, the energy level imparted to the ground by the construction process, and the bedrock type. We understand that none of the plant mentioned above is proposed for the project. However, the concrete crusher, wheel loaders, shredder and excavators may generate some vibration external to the site depending on their mounting and isolation. These sources are considered to provide intermittent vibration.

On this basis the following section provides an assessment of potential for operation vibration impact at the nearest sensitive receivers, on the basis that crushing and loading vibration levels would be similar to those emitted by vibratory rollers.

When assessing intermittent vibration DECCW recommends using the vibration dose value (VDV). The screening method outlined in Assessing Vibration: a Technical Guideline (DEC 2006) was used to evaluate the likely vibration at 140 metres from the site (the closest residences from the site, identified as 102 Carrington Street).

Typical levels measured during construction activities are shown in Figure 9.

Figure 9: Estimates of Vibration Levels Generated by Common Construction Activities/Equipment at Various Distances (DEC, 2006)



The nearest receiver is located approximately 140 metres from the southern boundary of the proposed development. On this basis, ground vibration levels at 140 metres from the operation activities are expected to range between approximately 0 mm/second and approximately 0.4 mm/second.

Based on this, the estimated vibration level at all dwellings near to the proposed facility is likely to comply with both the human comfort and building damage criteria adopted for this project.

7.0. Recommended Mitigation Measures

7.1. Best Practice Measures

The following best practice construction noise and vibration mitigation measures are based on recommendations provided within the NSW ICNG and Australian Standard AS 2436-1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites. Whilst significant construction is not proposed for the site, the following best practice measures apply to the proposed operational sources which are similar in nature.

Construction noise and vibration should be minimised as far as is practically possible using methods such as:

- Development and implementation of all reasonable and feasible site specific mitigation measures to meet noise criteria applicable to the proposal.
- Use of noise attenuating controls at the source, such as mufflers, acoustic screens, etc.
- Keeping plant and equipment well maintained.
- Locating concentrated areas of noise such as the crushers as remotely as possible from noise sensitive receivers.
- Adopt hours of operation which minimise potential impacts as far as is practically feasible.
- Conducting noise monitoring during operations for the purposes of assisting in noise mitigation and to verify the findings of this noise assessment, if complaints are received or proposed activities and number of plant exceed those assumed in this assessment.
- Use of noise barriers where practical.
- Use of broadband reversing alarms, or “quackers”, on mobile equipment in accordance with the relevant health and safety regulations.
- Modification of work activities where noise or vibration is found to cause unacceptable impact.
- Should operations be required outside daytime hours, all reasonable and feasible efforts should be undertaken to ensure noise levels will not exceed the INP Noise criteria stated in Table 8 of this assessment.
- Implementing a procedure for dealing with complaints to ensure that all complaints are registered and dealt with appropriately.

An operational Noise and Vibration Management Plan should be prepared for the project, to include, but not be limited to, the above measures.

7.2. Site Specific Measures

The following site specific mitigation measures are recommended:

7.2.1. Recommended Mitigation Measures – Daytime Operation

- A 3 metre high noise barrier is recommended along the south and south-eastern site boundary as shown in Figure 10. The barrier should be constructed from a material of at least 12.5 kg/m^2 and should be continuous and free from gaps.
- Adoption of maximum sound power levels for some plant items is recommended. The maximum sound power levels, and number of equipment/plant to be used during proposed daytime operation should not exceed the sound power levels presented in Table 22.
- Trucks should be restricted to 13 trucks per hour during the daytime (7am to 6pm) period.

- Water truck movement should be restricted to 1 water truck circuit in every 2 hours during the daytime (7am to 6pm) period, and none at night.
- Provide local temporary barriers around the Rotochopper and the Concrete Crusher to a height of 3 metres. Details of an example of the proposed temporary barriers are included in Appendix E.

Figure 10: Location of Recommended 3 metre High Noise Barrier

Table 22: Maximum Allowable Sound Power Levels – Daytime Operations

Source	No. of Plant	Maximum Plant Sound Power Levels, dB(A)		Recommendations
		Modelled (with no mitigation)	Assumed with Reduced Operation	
Concrete Crusher	1	115	115	-
Rotochopper	1	116	**112**	Assumes that the Rotochopper only operates 40% of the time.
L580 Wheel Loader	2	105	105	-

Source	No. of Plant	Maximum Plant Sound Power Levels, dB(A)		Recommendations
		Modelled (with no mitigation)	Assumed with Reduced Operation	
VB750 Shredder	1	116	**112**	Assumes that the Shredder only operates 40% of the time
Terex Finlay 694	1	111	**108**	Assumes that this machine operates only 50% of the time.
Forklift	1	92	92	-
R950 Excavator	1	106	106	-
R922 Excavator	1	101	101	-
LH22 Material Handler	1	100	100	-

7.2.1.1. Noise Modelling Predictions – With Additional Mitigation Measures

To determine the resultant level of impact on the surrounding area, with all of the above recommendations implemented, the model was run to include all of the nearby receivers, the recommended 3 metre high noise barrier, and the plant with the reduced sound power levels are detailed above in Table 22. The modelled noise contours are shown in Appendix D.

The predicted results for this scenario compared to the day-time noise limits are shown below in Table 23

The modelled levels with the barrier and recommended reduced source noise levels are shown below. Some minor exceedances are still predicted but given that the existing L_{Aeq} in the residential receiver areas ranges between 52 and 55 dB(A) during the day, and the proximity of the nearby M5, noise from the proposed site is unlikely to be audible during daytime hours, and these minor exceedances re likely to be acceptable.

Table 23: Proposed Operations With Barrier & Reduced Source Noise Levels- Modelled Plant Noise Impacts - Daytime, LAeq

Receiver	Object No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With Mitigation, dB(A)	Exceedance of INP Criteria, With Mitigation, dB(A)
1 Alliance Ave	43	GF	W	52	46	-	44	-
3 Alliance Ave	42	GF	W	52	48	-	46	-
5 Alliance Ave	41	GF	W	52	42	-	41	-
7 Alliance Ave	40	GF	W	52	48	-	46	-
9 Alliance Ave	39	GF	W	52	46	-	45	-
11 Alliance Ave	38	GF	W	52	47	-	46	-
15 Alliance Ave	37	GF	NW	52	47	-	46	-
17 Alliance Ave	36	GF	NE	52	50	-	49	-
17 Alliance Ave	36	F 1	NE	52	55	**3**	52	-
19 Alliance Ave	35	GF	NW	52	55	**3**	51	-
21 Alliance Ave	34	GF	N	52	52	-	48	-
23 Alliance Ave	33	GF	N	52	54	**2**	49	-

Receiver	Object No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With Mitigation, dB(A)	Exceedance of INP Criteria, With Mitigation, dB(A)
25 Alliance Ave	32	GF	N	52	55	**3**	50	-
27 Alliance Ave	31	GF	N	52	56	**4**	50	-
29 Alliance Ave	30	GF	N	52	56	**4**	51	-
31 Alliance Ave	29	GF	N	52	56	**4**	51	-
35 Alliance Ave	28	GF	N	52	55	**3**	51	-
37 Alliance Ave	27	GF	N	52	54	**2**	51	-
55 Carrington St	3	GF	N	52	54	**2**	48	-
57 Carrington St	4	GF	N	52	54	**2**	48	-
59 Carrington St	5	GF	N	52	49	-	45	-
61 Carrington St	6	GF	N	52	47	-	44	-
63 Carrington St	7	GF	N	52	44	-	42	-
65 Carrington St	8	GF	N	52	51	-	45	-
67 Carrington St	9	GF	N	52	54	**2**	48	-
69 Carrington St	10	GF	N	52	54	**2**	48	-
71 Carrington St	11	GF	N	52	51	-	46	-
73 Carrington St	12	GF	N	52	51	-	45	-
75 Carrington St	13	GF	N	52	51	-	45	-
75 Carrington St	13	F 1	N	52	54	**2**	48	-
75A Carrington St	15	GF	N	52	50	-	45	-
75A Carrington St	15	F 1	N	52	53	**1**	48	-
75B Carrington St	14	GF	N	52	51	-	46	-
75B Carrington St	14	F 1	N	52	54	**2**	49	-
75C Carrington St	16	GF	N	52	50	-	46	-
75C Carrington St	16	F 1	N	52	53	**1**	49	-
84/86 Carrington St	25	GF	N	52	55	**3**	49	-
84/86 Carrington St	25	F 1	N	52	56	**4**	51	-
88 Carrington St	24	GF	N	52	54	**2**	49	-
90 Carrington St	23	GF	N	52	54	**2**	49	-
92 Carrington St	22	GF	N	52	55	**3**	49	-
94 Carrington St	21	GF	N	52	55	**3**	50	-
96A Carrington St	20	GF	N	52	56	**4**	51	-
98 Carrington St	19	GF	N	52	56	**4**	50	-
100 Carrington St	18	GF	N	52	56	**4**	51	-
100 Carrington St	18	F 1	N	52	59	**7**	54	**2**
102 Carrington St	17	GF	N	52	56	**4**	51	-
102 Carrington St	17	F 1	N	52	59	**7**	54	**2**
31/33 Greenway Pde	26	GF	N	52	53	**1**	48	-
31/33 Greenway Pde	26	F 1	N	52	55	**3**	50	-
70 Milperra Rd	63	GF	S	52	49	-	46	-

Receiver	Object No.	Flr.	Façade	INP Criteria dB(A) Daytime	Predicted Daytime Noise Level, No Mitigation, dB(A)	Exceedance of INP Criteria, No Mitigation, dB(A)	Predicted Daytime Noise Level, With Mitigation, dB(A)	Exceedance of INP Criteria, With Mitigation, dB(A)
72 Milperra Rd	62	GF	W	52	49	-	46	-
1 Queen St	61	GF	W	52	49	-	46	-
3 Queen St	60	GF	W	52	49	-	46	-
5 Queen St	59	GF	W	52	49	-	46	-
7 Queen St	58	GF	W	52	49	-	46	-
9 Queen St	57	GF	W	52	49	-	45	-
11 Queen St	56	GF	W	52	49	-	45	-
13 Queen St	55	GF	W	52	48	-	45	-
15 Queen St	54	GF	W	52	47	-	44	-
17 Queen St	53	GF	W	52	46	-	44	-
19 Queen St	52	GF	W	52	45	-	42	-
21 Queen St	51	GF	W	52	45	-	41	-
23 Queen St	50	GF	W	52	45	-	42	-
25 Queen St	49	GF	W	52	44	-	42	-
27 Queen St	48	GF	W	52	47	-	44	-
29 Queen St	47	GF	W	52	45	-	42	-
31 Queen St	82	GF	W	52	44	-	41	-
33 Queen St	46	GF	W	52	45	-	42	-
35 Queen St	45	GF	W	52	45	-	42	-
37 Queen St	44	GF	W	52	47	-	45	-
62 Queen St	1	GF	W	52	51	-	45	-
64 Queen St	2	GF	W	52	45	-	42	-
46 Tracey St	81	GF	W	52	44	-	42	-
48 Tracey St	80	GF	N	52	49	-	47	-
50 Tracey St	79	GF	N	52	52	-	49	-
52 Tracey St	78	GF	N	52	54	**2**	50	-
54 Tracey St	77	GF	N	52	53	**1**	49	-
56 Tracey St	76	GF	N	52	53	**1**	49	-
58 Tracey St	75	GF	N	52	52	-	49	-
60 Tracey St	74	GF	N	52	52	-	49	-
62 Tracey St	73	GF	N	52	52	-	49	-
64 Tracey St	72	GF	N	52	52	-	49	-
66 Tracey St	71	GF	N	52	52	**2**	49	-
67 Tracey St	67	GF	NW	52	46	-	44	-
68 Tracey St	70	GF	N	52	51	**1**	49	-
69 Tracey St	68	GF	NW	52	51	-	48	-
70 Tracey St	69	GF	NW	52	51	-	48	-

Note: the predicted noise levels above represent the plant operating simultaneously, but with certain items at the reduced operational times described in Table 22, reflected of expected use. This is expected to be the worst case.

7.2.2. Recommended Mitigation Measures – Evening/Night-time Operation

- A 3 metre high noise barrier is recommended along the south and south-eastern site boundary as shown in 0. The barrier shall be constructed from a material of at least 12.5 kg/m^2 panel mass and shall be continuous and free from gaps.
- Truck movement shall be restricted to 2 trucks per hour during evening (6pm to 10pm) and night-time (10pm to 7am) period.
- Water truck movement shall not occur at night.
- Maximum allowable sound power levels and number of equipment/plant during the proposed evening and night-time operations shall be as per the equipment list and sound power levels presented in Table 24.

Table 24: Maximum Allowable Sound Power Levels – Evening & Night-time

Source	Number of Plant/Equipment	SWL dB(A)	Height above Ground (m)
L580 Wheel Loader	1	105	2
LH22 Material Handler	1	100	2
Trucks (2 trucks entering and leaving per hour)	1	97	1
Forklift	1	92	2
Excavator	1	101	2

7.2.3. Management of Hours of Operation

- Carrying out "proposed daytime" works within daytime hours as follows:
  - 7:00 am to 6:00 pm Monday to Friday and 7:00 am to 2:00 pm on Saturdays
- Evening and night-time operation shall be limited to 2 trucks per hour, for material handling and loading/unloading activities only. The recommended maximum number of plant/equipment and associated sound power levels for these activities are presented in Table 22.

7.2.4. Management and Behaviour Controls

- Investigate whether "at plant" mitigation or muffled plant is available. This may not be practical for some of the plant given the nature of crushers and screeners, and the openness of the conveyors etc. However, provision of insulation lined steel enclosures around the stationery plant, and damping material applied to the areas impacted by dumping can significantly reduce noise emissions. Local noise barriers have also proven to be effective for similar facilities.
- Keep all plant and equipment well maintained.
- Use of broadband reversing alarms, or "quackers", on mobile equipment in accordance with the relevant health and safety regulations.
- Preference should be for electric powered plant over combustion engine powered plant.
- Preference should be for hydraulic or electric powered plant over pneumatic powered plant.
- Avoid metal to metal contact on equipment to reduce impulsive or scraping noise.
- Ensure that managers effectively communicate acceptable and unacceptable work practices for the site, through staff site inductions, notice boards, and prestart meetings.

- Avoid the need for reversing in the new area by creating a loop road or similar.
- Avoid dropping materials from height.
- Workers should avoid shouting, minimise talking loudly, and avoid slamming vehicle doors.

8.0. Conclusions

This assessment has identified the following:

- Operational plant noise is currently complying with the INP daytime criteria at the nearest residential receivers.
- Modelling indicates that proposed operational plant and activities during the day are expected to generally comply with the INP criteria at all locations if the recommended mitigation is applied. With the mitigation measures applied, there are some small exceedances predicted for the worst case scenario when all plant is operating simultaneously. However, if the barrier and reduced source noise levels are not applied exceedances of up to 7 dB(A) are predicted at 34 locations.
- In order to reduce the noise impact from the proposed development and achieve compliance with the applicable INP noise criteria at the nearest residential receivers, a 3 metre high noise barrier is recommended along the south and south-eastern property boundary of the development as shown in Figure 10 and plant source noise and operational time limits have been recommended. The barrier could take the form of a fence or a building or a combination of both as long as the construction specifications detailed in section 7.2 are adhered to.
- The number of exceedances drops to 10 with the site boundary barrier installed, and further to 2 minimal (2 dB(A) or less) exceedances with the barrier and the recommended plant sound power limits in place.
- Provision of the time limits recommended in Table 22 for the three noisiest items of plant, results in general predicted compliance at all locations.
- Modelling also indicates that proposed operational plant and activities during the evening and night-time periods are also predicted to comply with the INP criteria at all locations if the recommended mitigation is applied. However, if the barrier is not applied exceedances are predicted at 2 locations.
- This assessment has identified that the maximum expected increase in L_{Aeq} noise level due to increased truck movement to and from the site is 0.6 dB(A) in the surrounding area. This is generally due to the existing high level of heavy vehicles on the local roads surrounding the site. This is significantly less than the 2 dB(A) increase nominated by the NSW Road Noise Policy as a recognised discernible increase in perceived noise level. On this basis noise from increased trucks accessing the site as a result of the proposal is not expected to impact amenity on the nearest sensitive receivers or require the implementation of mitigation measures.
- Noise levels have also been assessed to each boundary of the site which are currently bounded by industrial and / or commercial receivers. The current licence and the INP require that 70 dB(A) is complied with at each of these boundaries. Without additional mitigation 70 dB(A) was predicted to be exceeded at all of the site boundaries for worst case operation, over a small area, close to the site boundaries (refer to Appendix D for noise contour maps showing this area). However, this is only likely to occur when all plant is operating simultaneously, which is not likely to occur often.
- Extension of the noise barrier around the entire site does not provide a significant reduction in noise level at the adjacent commercial receivers except on the eastern boundary, where an extension to the recommended noise barrier has been recommended. Given the nature of the surrounding area, this is likely to be acceptable and not result in significant impacts on the adjacent industrial properties. Best practice mitigation measures should be adopted as described in Section 7.1 to minimise site noise emissions as much as possible.
- Additionally, site specific and best practice mitigation measures are recommended in Section 7.0 of this report.
- Minimal ground vibration impact from the proposed operation is expected to occur at the nearest sensitive residential receivers. However, in case of any complaints, short-term ground vibration monitoring at the nearest sensitive receivers is recommended.
- Based on this assessment, noise impacts from the proposed development are expected to generally comply with proposed noise limits provided the recommendations presented in this report are adopted.

* * * * *

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APPENDIX A
TECHNICAL TERMS DEFINITIONS

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Table 25: Glossary & Abbreviations

Term	Definition
A-weighted Level	As per dB(A) defined below.
Ambient Sound	Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far.
Background Sound Level	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources.
Decibel, dB	Unit of acoustic measurement. Measurements of power, pressure and intensity may be expressed in dB relative to standard reference levels.
dB(A)	Unit of acoustic measurement electronically weighted to approximate the sensitivity of human hearing to sound frequency.
L_{90}, L_{10} etc.	A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, i.e. L_{90} is the level which is exceeded for 90 percent of an observation period. L_{90} is commonly referred to as a basis for measuring the background sound level.
$L_{Abg, T}$	The A-weighted background sound level measured over a time interval T.
$L_{Aeq, T}$	Equivalent continuous A-weighted sound pressure level. This is the value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.
RBL	Relative Background Level
Sound Pressure Level, Lp, dB, of a sound	A measurement directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 microPascals.
Sound Power Level, Lw, dB of a source	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power level is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt.
ISO 9613	International standard – Acoustics – Attenuation of Sound During Propagation Outdoors

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APPENDIX B

7 DAY NOISE MONITORING CHARTS

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Figure 11: Site Noise Levels Measured Between 17 and 24 November 2015 (Logger 1)

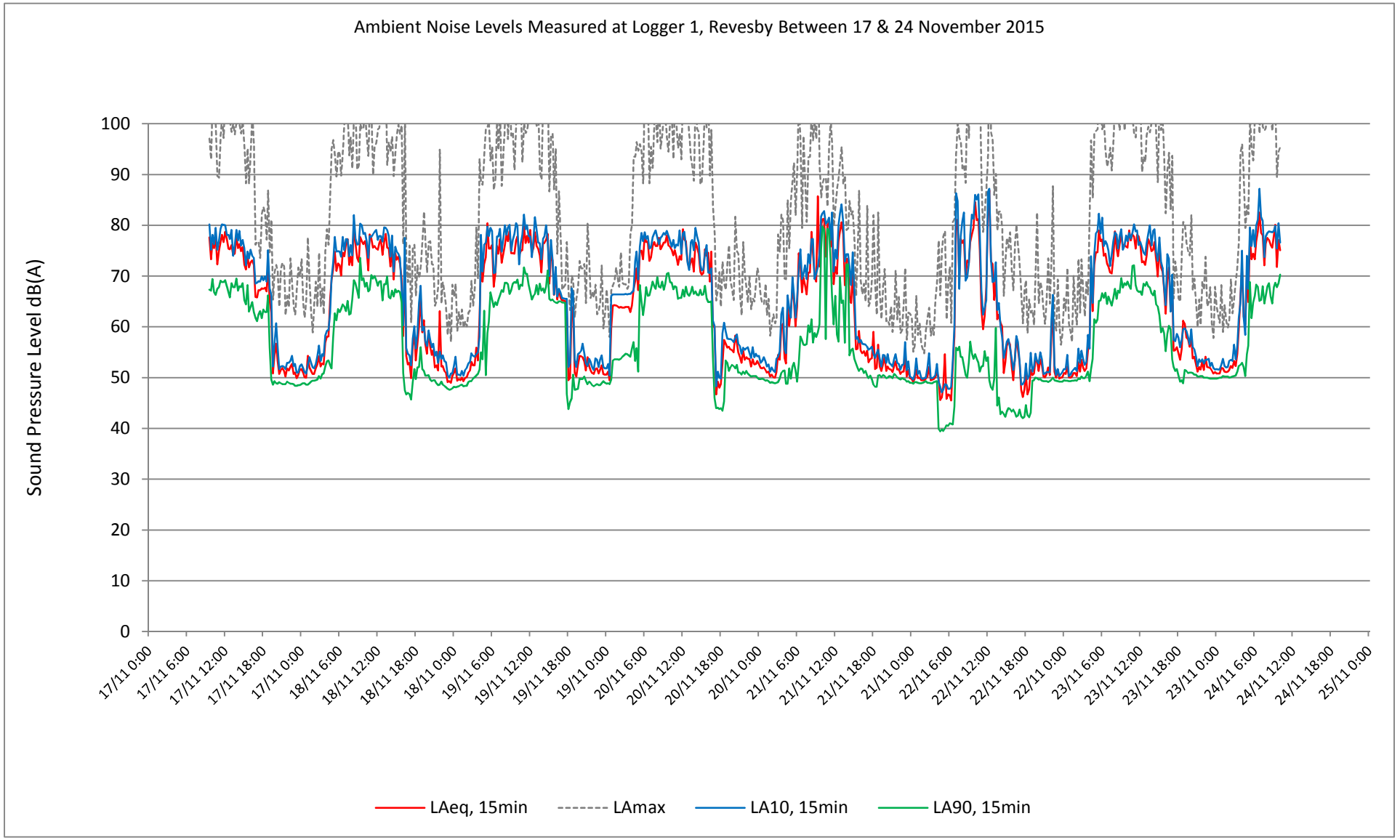


Figure 12: Ambient Noise Levels Measured Between 17 and 24 November 2015 (Logger 2)

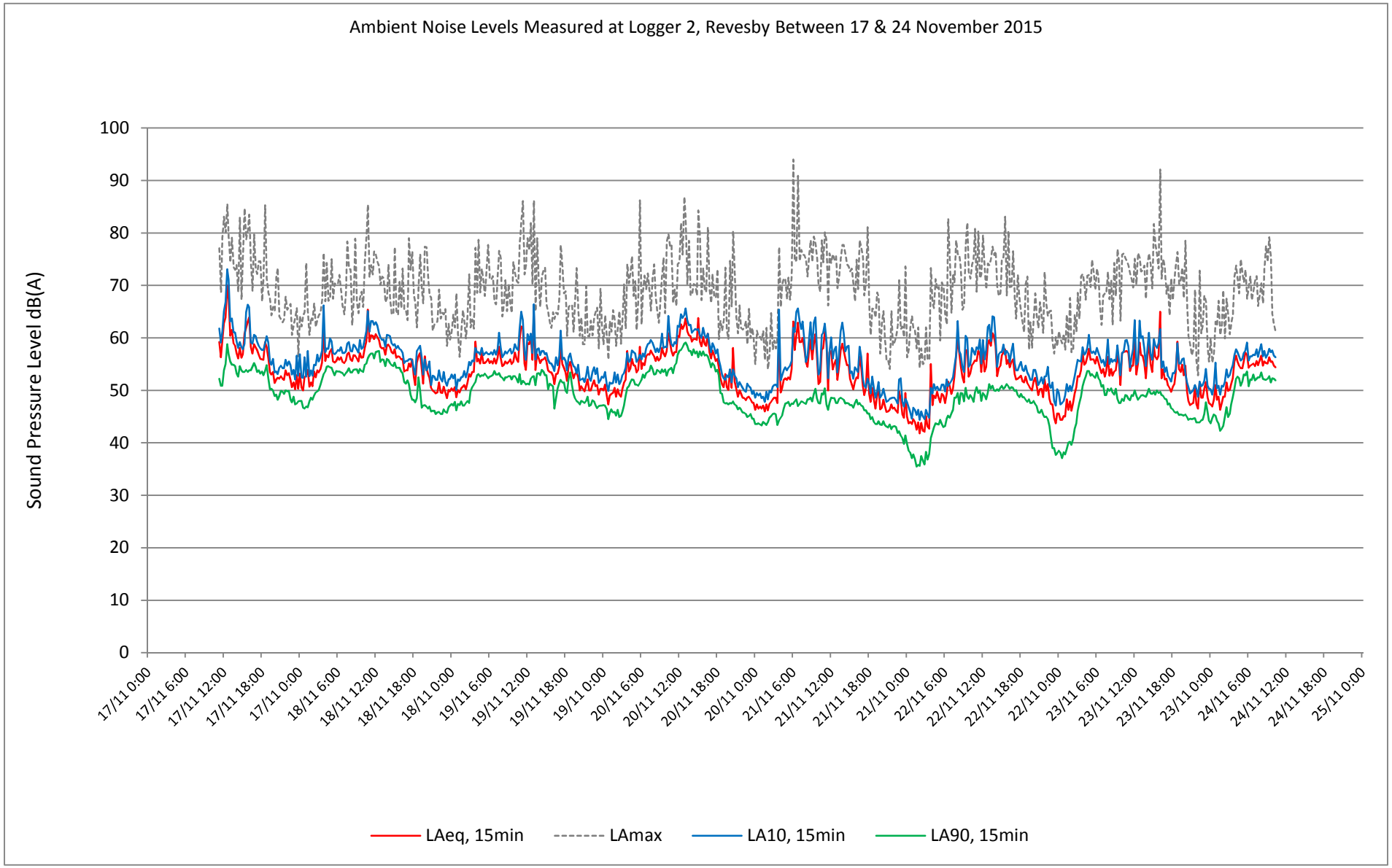
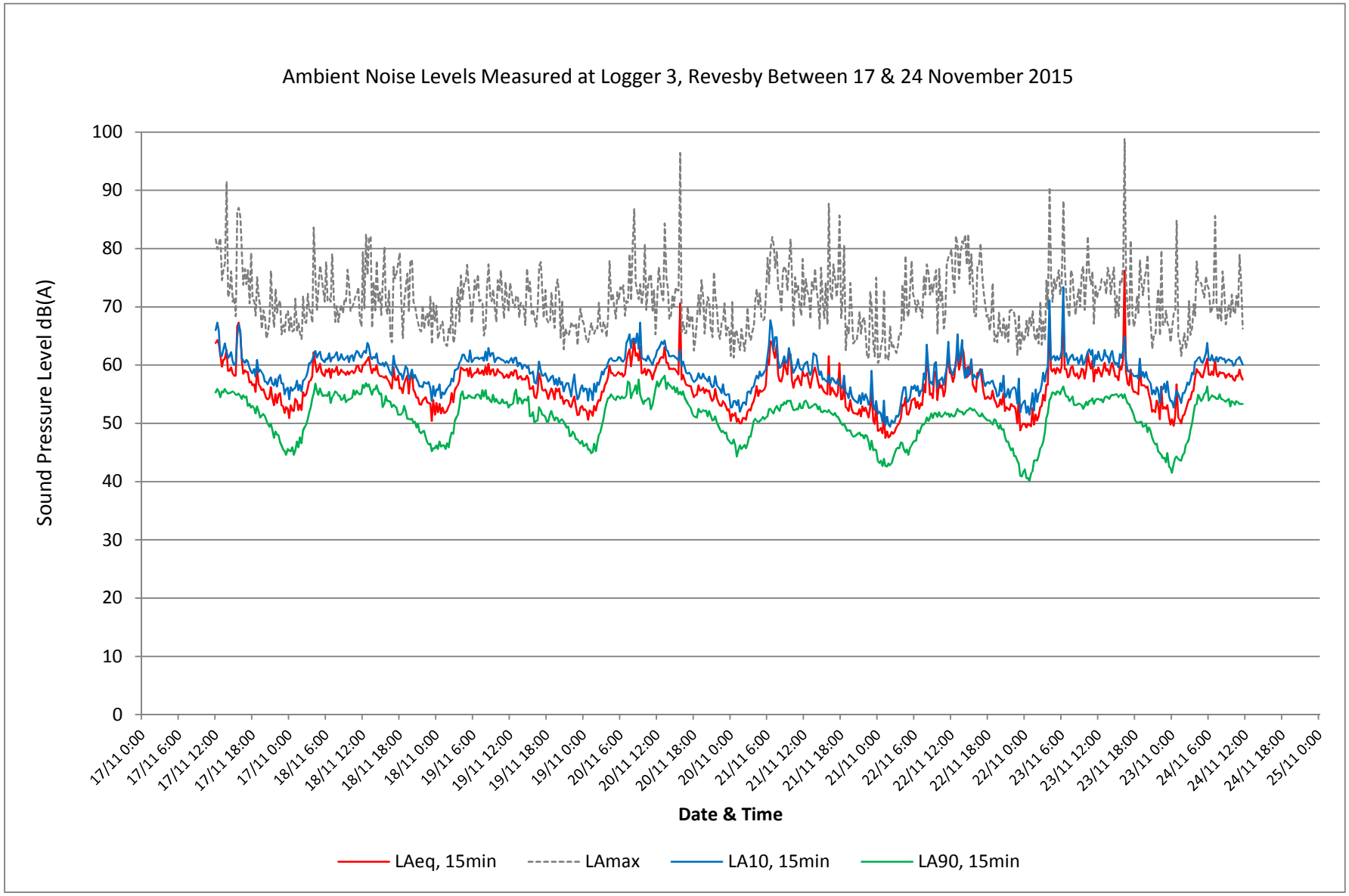


Figure 13: Ambient Noise Levels Measured Between 17 and 24 November 2015 (Logger 3)



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APPENDIX C

WEATHER DATA NOISE MONITORING PERIOD

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The following weather conditions occurred during the monitoring period.

Note: where weather conditions were noted to exceed the limits for adverse weatehr as defined in the INP, these entires have been highlighted in the following table for information.

Table 26: Weather Conditions During the Monitoring Period

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
17/11/2015 0:00	14	78	0.0	-	0
17/11/2015 0:30	14	77	0.0	-	0
17/11/2015 1:00	13.7	77	0.0	-	0
17/11/2015 1:30	13.4	79	0.0	-	0
17/11/2015 2:00	13.5	79	0.0	-	0
17/11/2015 2:30	12.7	79	0.0	-	0
17/11/2015 3:00	12.8	81	0.0	-	0
17/11/2015 3:30	13.2	82	0.0	-	0
17/11/2015 4:00	11.9	82	0.0	-	0
17/11/2015 4:30	11.9	84	0.0	-	0
17/11/2015 5:00	12	85	0.0	-	0
17/11/2015 5:30	11.7	85	0.0	-	0
17/11/2015 6:00	11.7	85	0.0	-	0
17/11/2015 6:30	12.5	85	0.0	-	0
17/11/2015 7:00	13.4	81	0.0	-	0
17/11/2015 7:30	14.8	75	0.0	-	0
17/11/2015 8:00	16.4	67	0.4	SW	0
17/11/2015 8:30	17.5	63	1.6	WNW	0
17/11/2015 9:00	18.6	60	1.6	NW	0
17/11/2015 9:30	20	54	1.6	W	0
17/11/2015 10:00	21.5	48	1.2	NW	0
17/11/2015 10:30	22.4	42	1.2	NNE	0
17/11/2015 11:00	23.3	35	1.9	NNE	0
17/11/2015 11:30	23.9	35	2.3	N	0
17/11/2015 12:00	24.8	30	1.6	NNE	0
17/11/2015 12:30	25.4	32	1.6	N	0
17/11/2015 13:00	25.9	30	1.9	WNW	0
17/11/2015 13:30	26.2	33	3.3	NE	0
17/11/2015 14:00	27	33	3.3	E	0
17/11/2015 14:30	26.3	34	3.9	ENE	0
17/11/2015 15:00	26.3	33	3.9	NE	0
17/11/2015 15:30	27.2	31	3.5	NE	0
17/11/2015 16:00	26.8	34	3.9	ENE	0
17/11/2015 16:30	26.3	34	3.5	ENE	0
17/11/2015 17:00	26	35	3.5	NE	0
17/11/2015 17:30	25.9	36	3.9	NE	0
17/11/2015 18:00	25.3	37	3.9	NE	0
17/11/2015 18:30	25.1	40	3.5	NE	0
17/11/2015 19:00	24.3	42	2.3	NE	0
17/11/2015 19:30	23.4	47	2.6	NE	0
17/11/2015 20:00	22.5	51	1.9	NNE	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
17/11/2015 20:30	22.1	53	1.6	NNE	0
17/11/2015 21:00	21.8	55	1.6	NE	0
17/11/2015 21:30	21.5	56	1.1	NNE	0
17/11/2015 22:00	21.3	57	1.2	NE	0
17/11/2015 22:30	20.6	58	0.7	NE	0
17/11/2015 23:00	19.6	62	0.7	NE	0
17/11/2015 23:30	18.5	69	0.0	-	0
18/11/2015 0:00	18	71	0.0	-	0
18/11/2015 0:30	18	76	0.0	-	0
18/11/2015 1:00	16.7	80	0.4	NE	0
18/11/2015 1:30	16.3	81	0.4	NE	0
18/11/2015 2:00	16.7	82	0.0	-	0
18/11/2015 2:30	16.5	82	0.4	N	0
18/11/2015 3:00	15.7	83	0.0	-	0
18/11/2015 3:30	15.4	84	0.0	-	0
18/11/2015 4:00	15.1	85	0.0	-	0
18/11/2015 4:30	14.8	85	0.0	-	0
18/11/2015 5:00	14.7	85	0.0	-	0
18/11/2015 5:30	14.3	85	0.0	-	0
18/11/2015 6:00	15.3	87	0.0	-	0
18/11/2015 6:30	15.7	86	1.1	N	0
18/11/2015 7:00	17.1	84	0.0	-	0
18/11/2015 7:30	18.6	74	0.4	W	0
18/11/2015 8:00	20.2	62	1.9	W	0
18/11/2015 8:30	21.8	50	1.6	WNW	0
18/11/2015 9:00	23.7	45	1.9	WNW	0
18/11/2015 9:30	25	36	2.3	WNW	0
18/11/2015 10:00	27	32	2.3	WNW	0
18/11/2015 10:30	28.7	31	2.3	NW	0
18/11/2015 11:00	29.9	28	2.6	WNW	0
18/11/2015 11:30	31.1	23	3.3	NW	0
18/11/2015 12:00	32.7	20	3.0	NW	0
18/11/2015 12:30	33.5	17	3.5	WNW	0
18/11/2015 13:00	34.1	16	4.2	NW	0
18/11/2015 13:30			0.0		
18/11/2015 14:00	34.9	15	4.2	WNW	0
18/11/2015 14:30	35	14	4.2	W	0
18/11/2015 15:00	35.2	13	3.9	W	0
18/11/2015 15:30	36	10	5.3	W	0
18/11/2015 16:00	35.6	11	3.5	WNW	0
18/11/2015 16:30	35.3	11	4.2	WNW	0
18/11/2015 17:00	36	14	3.0	W	0
18/11/2015 17:30	35.6	10	3.0	WNW	0
18/11/2015 18:00	35.3	10	3.9	W	0
18/11/2015 18:30	34.9	10	2.6	W	0
18/11/2015 19:00	32	16	5.3	SSE	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
18/11/2015 19:30	28.4	30	4.9	SE	0
18/11/2015 20:00	26.4	39	4.2	SE	0
18/11/2015 20:30	24.1	49	3.3	SE	0
18/11/2015 21:00	23.4	55	3.9	SE	0
18/11/2015 21:30	22.6	60	3.0	SSE	0
18/11/2015 22:00	22.3	62	3.0	SE	0
18/11/2015 22:30	20.8	68	1.9	S	0
18/11/2015 23:00	20.3	73	0.0	S	0
18/11/2015 23:30	20.1	74	0.0	S	0
19/11/2015 0:00	20.1	73	1.2	S	0
19/11/2015 0:30	19.8	74	1.2	S	0
19/11/2015 1:00	19	77	1.1	S	0
19/11/2015 1:30	18.1	79	1.1	S	0
19/11/2015 2:00	18	81	1.1	S	0
19/11/2015 2:30	18	82	0.0	-	0
19/11/2015 3:00	18.3	82	1.2	S	0
19/11/2015 3:30	16.9	81	1.1	S	0
19/11/2015 4:00	17.3	84	0.0	-	0
19/11/2015 4:30	17.4	84	0.0	-	0
19/11/2015 5:00	16.7	82	0.0	-	0
19/11/2015 5:30	16.5	84	0.0	-	0
19/11/2015 6:00	16.7	85	0.0	-	0
19/11/2015 6:30	16.8	85	0.0	-	0
19/11/2015 7:00	18.1	84	0.0	-	0
19/11/2015 7:30	19	77	0.0	-	0
19/11/2015 8:00	20.1	70	0.4	SSW	0
19/11/2015 8:30	21.4	64	1.2	WNW	0
19/11/2015 9:00	22.4	62	1.2	WNW	0
19/11/2015 9:30	23.1	58	1.2	WNW	0
19/11/2015 10:00	24.8	54	1.6	NW	0
19/11/2015 10:30	26.2	46	1.6	NNW	-
19/11/2015 11:00	27.8	40	1.9	WNW	-
19/11/2015 11:30	29.4	36	1.2	NW	-
19/11/2015 12:00	30.6	35	1.1	NNW	0
19/11/2015 12:30	32	30	1.1	WSW	0
19/11/2015 13:00	33.4	27	1.1	N	0
19/11/2015 13:30	34.1	26	1.2	SW	0
19/11/2015 14:00	35.6	15	1.2	WNW	0
19/11/2015 14:30	36.3	12	1.6	WNW	0
19/11/2015 15:00	36.7	15	2.3	WNW	0
19/11/2015 15:30	37.7	13	2.3	W	0
19/11/2015 16:00	37.9	12	1.9	NW	0
19/11/2015 16:30	37.6	13	2.3	NNW	0
19/11/2015 17:00	38.2	12	2.3	NW	0
19/11/2015 17:30	38.4	13	2.3	W	0
19/11/2015 18:00	38	15	1.6	SW	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
19/11/2015 18:30	37.8	11	1.2	W	0
19/11/2015 19:00	35.2	24	2.3	NNE	0
19/11/2015 19:30	34.2	20	2.3	NNE	0
19/11/2015 20:00	32.1	26	1.2	N	0
19/11/2015 20:30	29.6	35	0.4	NNE	0
19/11/2015 21:00	30.5	35	1.6	SE	0
19/11/2015 21:30	29	42	2.6	ESE	0
19/11/2015 22:00	26.6	49	2.3	SE	0
19/11/2015 22:30	25.4	62	2.6	SE	0
19/11/2015 23:00	24.6	66	1.2	SSE	0
19/11/2015 23:30	24.1	67	1.6	SE	0
20/11/2015 0:00	23.2	70	0.0	-	0
20/11/2015 0:30	23.3	71	1.6	SE	0
20/11/2015 1:00	22.1	72	1.1	SSE	0
20/11/2015 1:30	21.4	79	0.7	SSE	0
20/11/2015 2:00	21.6	79	0.0	-	0
20/11/2015 2:30	22.7	75	1.9	ESE	0
20/11/2015 3:00	22.9	70	1.9	E	0
20/11/2015 3:30	22.2	72	1.6	ESE	0
20/11/2015 4:00	22.3	76	2.3	ESE	0
20/11/2015 4:30	22.2	76	1.9	E	0
20/11/2015 5:00	22	76	1.1	ESE	0
20/11/2015 5:30	21.8	76	1.6	E	0
20/11/2015 6:00	20.7	76	0.0	-	0
20/11/2015 6:30	21.4	78	0.0	-	0
20/11/2015 7:00	22.5	75	1.2	ENE	0
20/11/2015 7:30	22.8	70	0.4	SE	0
20/11/2015 8:00	23.7	68	0.0	-	0
20/11/2015 8:30	25	67	1.1	NNW	0
20/11/2015 9:00	25.4	64	1.2	WNW	0
20/11/2015 9:30	26.9	58	2.3	WNW	0
20/11/2015 10:00	28.9	50	2.3	W	0
20/11/2015 10:30	30.4	48	1.6	NW	0
20/11/2015 11:00	32.4	36	2.3	NW	0
20/11/2015 11:30	33.6	35	1.9	NW	0
20/11/2015 12:00	35.6	26	2.6	NNW	0
20/11/2015 12:30	37.7	17	3.0	NNW	0
20/11/2015 12:40	38.4	22	3.5	NW	-
20/11/2015 12:50	38.8	19	5.3	WNW	-
20/11/2015 13:00	39.6	13	6.5	WNW	0
20/11/2015 13:30	40.4	7	5.8	WNW	0
20/11/2015 14:00	40.3	6	6.2	WNW	0
20/11/2015 14:30	40.5	7	5.8	WNW	0
20/11/2015 15:00	40.6	6	6.5	WNW	0
20/11/2015 15:30	40.3	6	6.5	WNW	0
20/11/2015 16:00	40.2	6	5.4	WNW	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
20/11/2015 16:30	40	7	6.2	WNW	0
20/11/2015 17:00	40	7	4.6	NW	0
20/11/2015 17:30	39.7	6	4.2	NW	0
20/11/2015 18:00	39.5	7	3.3	WNW	0
20/11/2015 18:30	38.5	8	2.3	NW	0
20/11/2015 19:00	37.5	8	3.5	NW	0
20/11/2015 19:30	36.1	10	5.4	NNW	0
20/11/2015 20:00	32.5	24	4.2	ESE	0
20/11/2015 20:30	25.2	52	4.6	ESE	0
20/11/2015 21:00	24.9	51	4.2	ESE	0
20/11/2015 21:30	24.8	47	3.9	SE	0
20/11/2015 22:00	24.2	47	3.9	SE	0
20/11/2015 22:30	23.7	49	4.2	SE	0
21/11/2015 0:00	22.3	58	3.5	SSE	0
21/11/2015 0:30	21.6	63	3.5	S	0
21/11/2015 1:00	21.2	59	3.0	S	0
21/11/2015 1:30	21.2	48	3.3	S	0
21/11/2015 2:00	20.9	51	3.9	S	0
21/11/2015 2:30	20.5	56	3.3	S	0
21/11/2015 3:00	19.8	62	2.6	S	0
21/11/2015 3:30	19.4	63	1.9	S	0
21/11/2015 4:00	19.1	65	1.2	S	0
21/11/2015 4:30	18.7	66	1.1	S	0
21/11/2015 5:00	18.7	68	1.6	S	0
21/11/2015 5:30	19.2	68	1.9	S	0
21/11/2015 6:00	18.8	67	1.6	S	0
21/11/2015 6:30	18.9	69	1.6	S	0
21/11/2015 7:00	19.4	66	1.2	S	0
21/11/2015 7:30	20.1	65	1.6	S	0
21/11/2015 8:00	21.1	62	1.9	SE	0
21/11/2015 8:30	20.9	60	3.0	SSE	0
21/11/2015 9:00	21	62	3.3	SE	0
21/11/2015 9:30	20.7	60	3.5	SSE	0
21/11/2015 10:00	20.9	57	3.9	SE	0
21/11/2015 10:30	20.5	55	4.2	SE	0
21/11/2015 11:00	20.2	58	4.9	SE	0
21/11/2015 11:30	21	60	3.9	SE	0
21/11/2015 12:00	20.8	57	3.9	ESE	0
21/11/2015 12:30	22.1	53	4.2	SE	0
21/11/2015 13:00	21.6	54	3.9	ESE	0
21/11/2015 13:30	21.4	50	5.3	SE	0
21/11/2015 14:00	20.3	50	5.3	ESE	0
21/11/2015 14:30	20.8	48	4.6	ESE	0
21/11/2015 15:00	20.8	48	4.9	SE	0
21/11/2015 15:30	21.2	47	5.3	SE	0
21/11/2015 16:00	20.7	48	5.3	SE	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
21/11/2015 16:30	20.7	46	4.2	ESE	0
21/11/2015 17:00	20.7	45	4.6	ESE	0
21/11/2015 17:30	20.5	47	4.2	ESE	0
21/11/2015 18:00	20.3	48	4.2	ESE	0
21/11/2015 18:30	20.1	49	3.9	SE	0
21/11/2015 19:00	20.1	48	3.5	ESE	0
21/11/2015 19:30	19.8	49	3.5	ESE	0
21/11/2015 20:00	20	49	3.3	SE	0
21/11/2015 20:30	19.9	50	3.0	SE	0
21/11/2015 21:00	19.9	50	2.6	ESE	0
21/11/2015 21:30	19.9	51	3.0	ESE	0
21/11/2015 22:00	19.8	50	3.0	ESE	0
21/11/2015 22:30	19.8	50	2.3	E	0
21/11/2015 23:00	19.8	50	1.9	ESE	0
21/11/2015 23:30	19.8	50	3.0	ESE	0
22/11/2015 0:00	19.8	51	2.6	ESE	0
22/11/2015 0:30	19.3	54	1.9	ESE	0
22/11/2015 1:00	19.4	53	1.2	ENE	0
22/11/2015 1:30	19.1	55	1.2	NE	0
22/11/2015 2:00	18.2	63	1.2	SSE	0
22/11/2015 2:30	17.6	70	1.6	S	0
22/11/2015 3:00	17.5	72	1.1	S	0
22/11/2015 3:30	17.6	72	0.0	-	0
22/11/2015 4:00	17.5	73	0.0	-	0
22/11/2015 4:30	17.4	74	0.0	-	0
22/11/2015 5:00	17.4	76	0.0	-	0
22/11/2015 5:30	17.2	77	1.1	S	0
22/11/2015 6:00	16.7	76	0.0	-	0
22/11/2015 6:30	17.4	76	0.0	-	0
22/11/2015 7:00	17.9	72	0.0	-	0
22/11/2015 7:30	19.2	63	0.7	S	0
22/11/2015 8:00	19.8	60	0.0	-	0
22/11/2015 8:30	20.2	54	0.4	ESE	0
22/11/2015 9:00	20	53	1.6	N	0
22/11/2015 9:30	20.1	52	1.9	NE	0
22/11/2015 10:00	19.2	58	3.3	NNE	0
22/11/2015 10:30	19.7	54	2.3	NE	0
22/11/2015 11:00	19.9	54	1.6	ENE	0
22/11/2015 11:30	20.1	50	1.9	NE	0
22/11/2015 12:00	20.1	49	1.9	NE	0
22/11/2015 12:30	20.4	48	2.3	NNE	0
22/11/2015 13:00	20.6	49	2.3	ENE	0
22/11/2015 13:30	20.6	48	2.3	NE	0
22/11/2015 14:00	20.5	50	2.6	NNE	0
22/11/2015 14:30	20.1	52	2.6	NE	0
22/11/2015 15:00	20.7	52	2.3	N	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
22/11/2015 15:30	20.7	51	2.6	NE	0
22/11/2015 16:00	20.9	48	2.3	NNE	0
22/11/2015 16:30	21.3	47	3.0	NNE	0
22/11/2015 17:00	21	47	2.6	NNE	0
22/11/2015 17:30	21.3	48	2.6	NNE	0
22/11/2015 18:00	21.4	46	2.3	NE	0
22/11/2015 18:30	21.3	47	2.6	NNE	0
22/11/2015 19:00	21	49	1.9	NNE	0
22/11/2015 19:30	20.7	50	2.3	NE	0
22/11/2015 20:00	20.5	52	1.9	NNE	0
22/11/2015 20:30	20.1	53	2.3	NE	0
22/11/2015 21:00	19.6	54	2.3	NNE	0
22/11/2015 21:30	19.3	55	1.9	NNE	0
22/11/2015 22:00	19	58	1.6	NNE	0
22/11/2015 22:30	18.8	61	1.6	NNE	0
22/11/2015 23:00	18.1	64	1.1	N	0
22/11/2015 23:30	18.1	66	0.0	-	0
23/11/2015 0:00	17.7	68	0.0	-	0
23/11/2015 0:30	17.7	69	0.0	-	0
23/11/2015 1:00	17.4	71	0.0	-	0
23/11/2015 1:30	17.1	72	0.0	-	0
23/11/2015 2:00	16.9	75	0.0	-	0
23/11/2015 2:30	17	76	0.0	-	0
23/11/2015 3:00	16.9	74	0.0	-	0
23/11/2015 3:30	16.4	75	0.0	-	0
23/11/2015 4:00	16.6	76	0.0	-	0
23/11/2015 4:30	16	76	0.0	-	0
23/11/2015 5:00	15.6	79	0.0	-	0
23/11/2015 5:30	15.3	79	0.0	-	0
23/11/2015 6:00	15.2	82	1.1	N	0
23/11/2015 6:30	15.9	83	1.1	N	0
23/11/2015 6:40	16.4	82	1.2	NNW	-
23/11/2015 6:50	17.1	81	1.9	NNW	-
23/11/2015 7:00	17.3	77	1.6	NNW	0
23/11/2015 7:10	17.4	76	1.6	NNW	-
23/11/2015 7:20	17.7	74	1.6	N	-
23/11/2015 7:30	18.2	74	1.6	NNW	0
23/11/2015 7:40	18.5	71	1.9	NNW	-
23/11/2015 7:50	18.9	69	2.3	NW	-
23/11/2015 8:00	19.3	68	1.6	NW	0
23/11/2015 8:10	19.5	65	1.2	NNW	-
23/11/2015 8:20	20	64	1.1	NW	-
23/11/2015 8:30	20.6	62	0.4	NW	0
23/11/2015 9:00	20.9	58	0.7	SW	0
23/11/2015 9:30	22.2	54	1.1	SSW	0
23/11/2015 11:00	25.6	36	1.2	W	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
23/11/2015 11:30	25.4	47	3.3	ESE	0
23/11/2015 12:00	25.2	47	2.6	E	0
23/11/2015 12:30	25.1	47	4.2	E	0
23/11/2015 13:00	25.3	45	3.9	ESE	0
23/11/2015 13:30	26.2	46	4.6	SE	0
23/11/2015 14:00	25.5	48	4.9	ESE	0
23/11/2015 14:30	25.4	47	4.9	SE	0
23/11/2015 15:00	25.6	49	4.9	SE	0
23/11/2015 15:30	24.4	48	5.8	SE	0
23/11/2015 16:00	24	49	5.4	SE	0
23/11/2015 16:30	23.9	51	5.3	SSE	0
23/11/2015 17:00	23	53	5.3	SSE	0
23/11/2015 17:30	23	57	5.4	SSE	0
23/11/2015 18:00	22.5	56	5.4	SE	0
23/11/2015 18:30	21.9	57	4.6	SSE	0
23/11/2015 19:00	21.5	62	4.2	SSE	0
23/11/2015 19:30	21.2	65	3.9	SSE	0
23/11/2015 20:00	20.9	66	3.9	SE	0
23/11/2015 20:30	20.7	66	3.5	SE	0
24/11/2015 0:00	19.3	67	0.0	-	0
24/11/2015 0:30	17.8	73	0.0	-	0
24/11/2015 1:00	17.3	77	0.0	-	0
24/11/2015 1:30	17.2	79	0.0	-	0
24/11/2015 2:00	17.4	81	0.0	-	0
24/11/2015 2:30	16.4	81	0.0	-	0
24/11/2015 3:00	16.2	83	0.0	-	0
24/11/2015 3:30	15.6	83	0.0	-	0
24/11/2015 4:00	15.8	84	0.0	-	0
24/11/2015 4:30	15.6	84	0.0	-	0
24/11/2015 5:00	15.9	84	0.0	-	0
24/11/2015 5:30	14.6	83	0.4	NE	0
24/11/2015 6:00	15.4	86	0.0	-	0
24/11/2015 6:30	16	85	0.0	-	0
24/11/2015 7:00	17.3	83	0.0	-	0
24/11/2015 7:30	18.6	75	0.0	-	0
24/11/2015 8:00	20.2	68	1.2	W	0
24/11/2015 8:30	21.1	63	1.6	WNW	0
24/11/2015 9:00	22.7	58	1.6	W	0
24/11/2015 9:30	23.9	56	1.6	WNW	0
24/11/2015 10:00	25.7	49	1.9	NNW	0
24/11/2015 10:30	26.6	41	1.1	NNW	0
24/11/2015 11:00	28.2	31	1.2	NNW	0
24/11/2015 11:30	30.1	23	1.6	NW	0
24/11/2015 12:00	30.9	16	2.3	NW	0
24/11/2015 12:30	31.5	12	2.6	NNW	0
24/11/2015 13:00	31.8	10	3.0	NNE	0

Date & Time	Temp °C	Humidity %	Wind Speed m/s	Wind Direction	Rain 10 min mm
24/11/2015 13:30	32.5	12	3.5	NW	0
24/11/2015 14:00	32.5	14	3.0	N	0
24/11/2015 14:30	33.2	14	3.3	N	0
24/11/2015 15:00	33.3	9	3.3	N	0
24/11/2015 15:30	32.2	26	4.2	ENE	0
24/11/2015 16:00	31.4	32	4.6	NE	0
24/11/2015 16:30	30.6	33	4.6	NE	0
24/11/2015 17:00	30.3	33	4.6	NE	0
24/11/2015 17:30	30.3	32	4.6	NE	0
24/11/2015 18:00	29.8	35	4.9	NE	0
24/11/2015 18:30	29	38	3.9	NE	0
24/11/2015 19:00	28.7	40	3.5	NNE	0
24/11/2015 19:30	28.1	42	3.3	NNE	0
24/11/2015 20:00	27.1	46	3.3	NE	0
24/11/2015 20:30	26.5	48	3.3	NE	0
24/11/2015 21:00	26.1	50	3.3	NE	0
24/11/2015 21:30	25.6	51	3.0	NNE	0
24/11/2015 22:00	25.2	50	2.3	N	0
24/11/2015 22:30	25.3	50	1.6	N	0
24/11/2015 23:00	23.3	60	1.1	NNW	0
24/11/2015 23:30	20.7	68	0.0	-	0

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APPENDIX D
NOISE CONTOUR MAPS – PLANT NOISE IMPACT

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Figure 14: Scenario (1) - Predicted Noise Impact – Existing Operations Compared to INP Criteria – Daytime (LAeq)

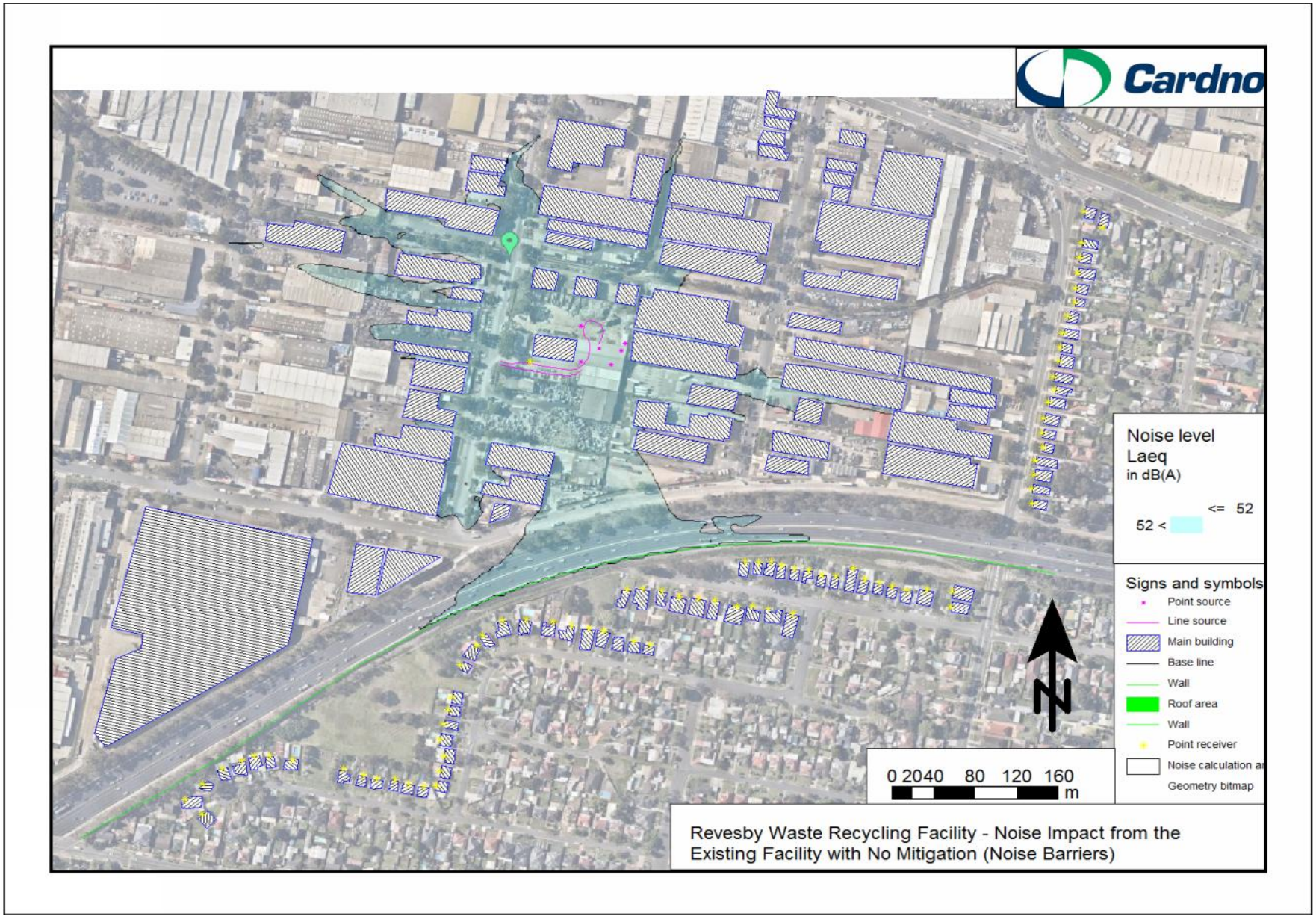


Figure 15: Scenario (2) - Predicted Noise Impact – Proposed Operations with No Mitigation Compared to INP Criteria – Daytime (LAeq)

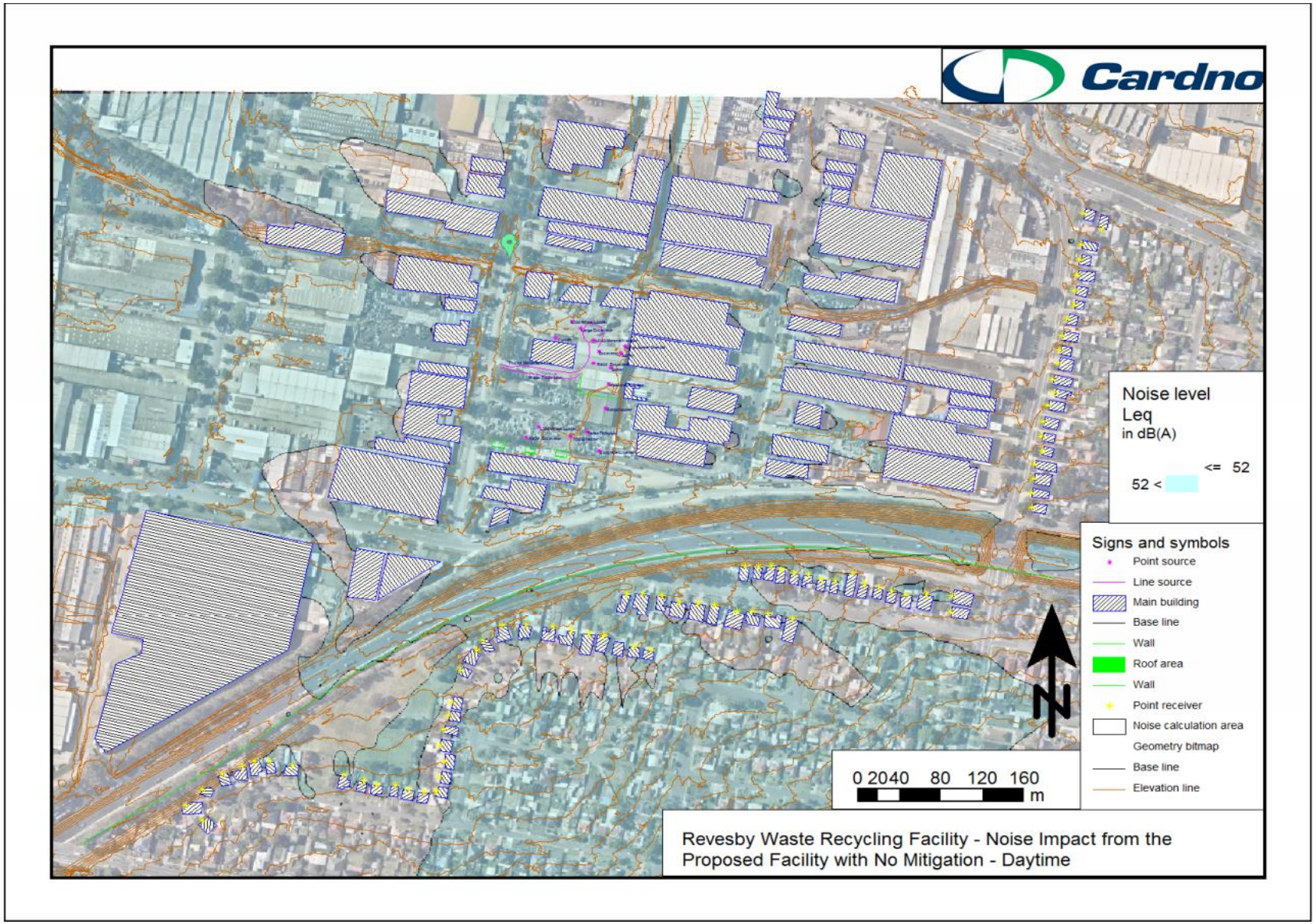


Figure 16: Scenario (3a) - Predicted Noise Impact – Proposed Operations with Recommended 3m Barrier Only Compared to INP Criteria – Daytime (LAeq)

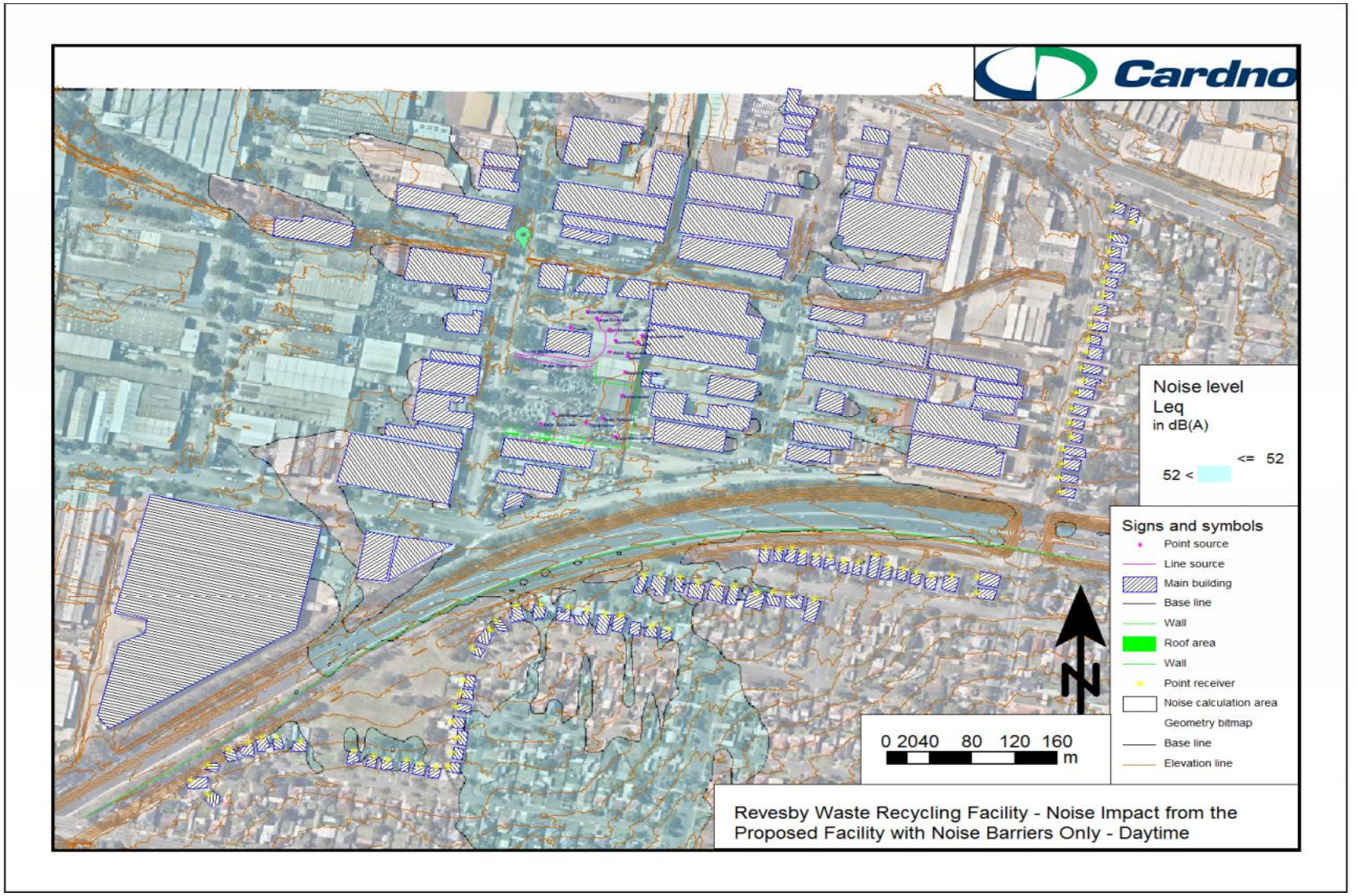


Figure 17: Scenario (3b) - Predicted Noise Impact – Proposed Operations with Barrier & Reduce Plant Source Noise Levels Compared to INP Criteria – Daytime (LAeq)

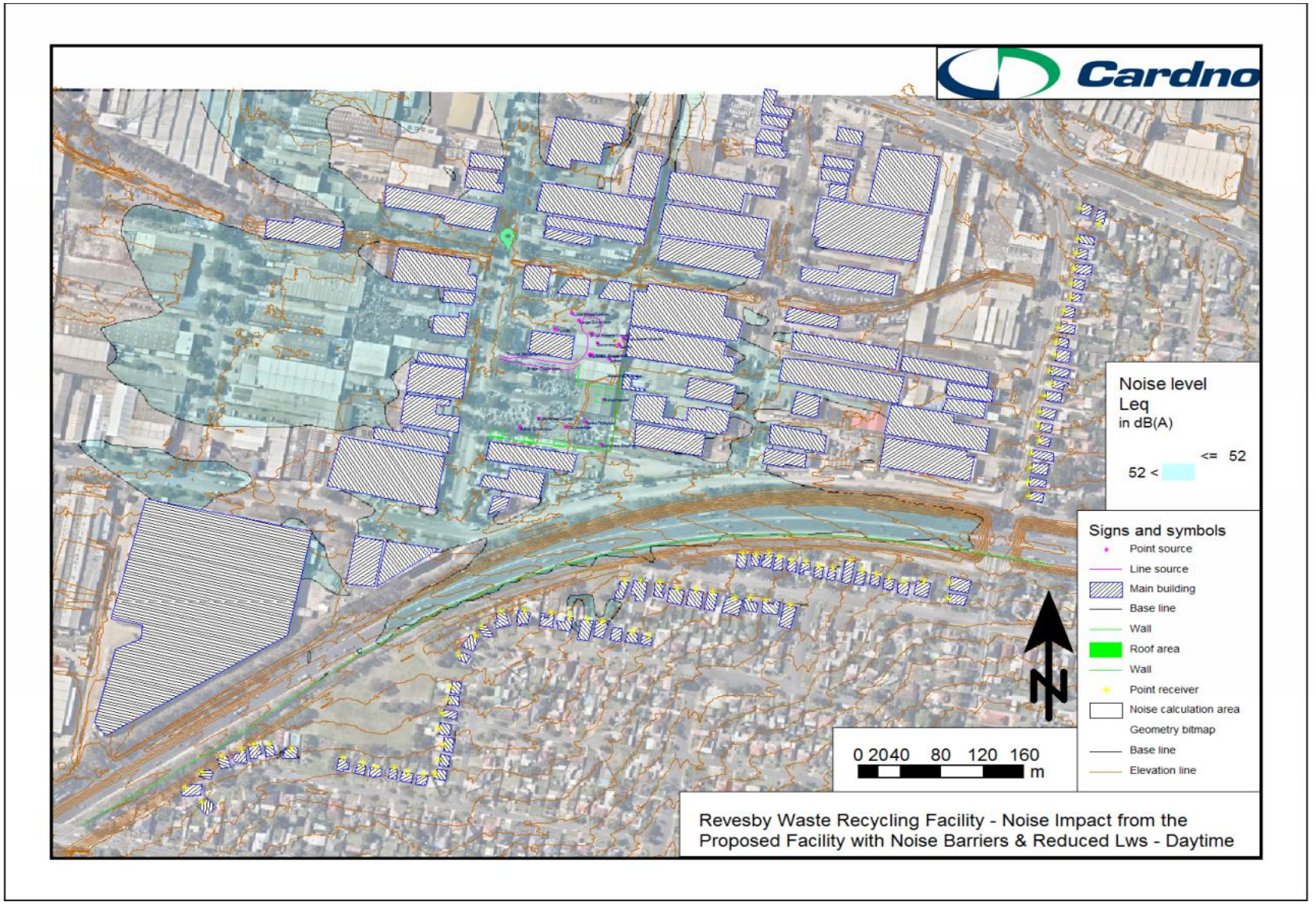


Figure 18: Scenario (4) - Predicted Noise Impact – Proposed Operations with No Mitigation Compared to INP Criteria – Evening & Night-time (LAeq)

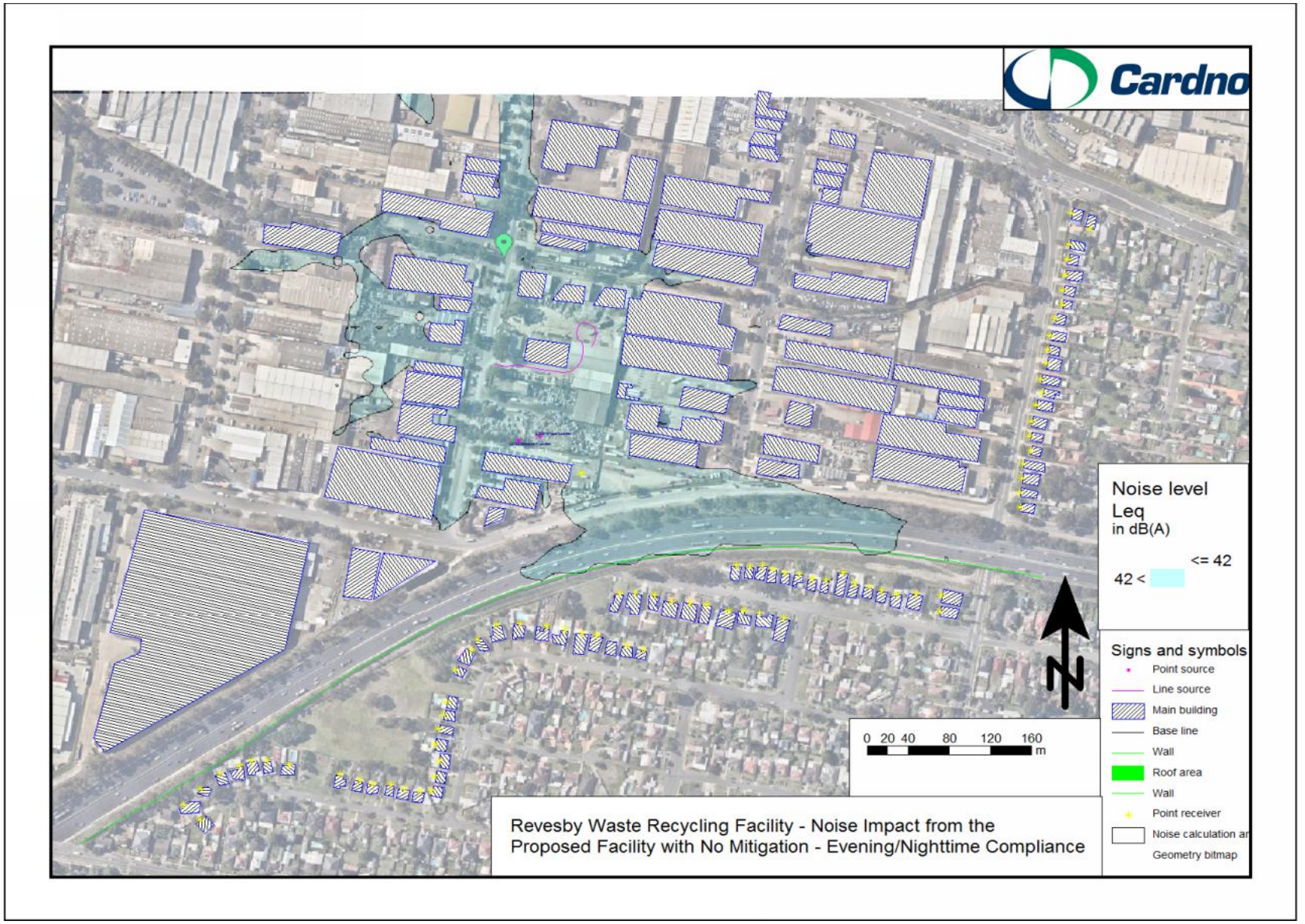


Figure 19: Scenario (5) - Predicted Noise Impact – Proposed Operations with Mitigation Compared to INP Criteria – Evening & Night-time (LAeq)

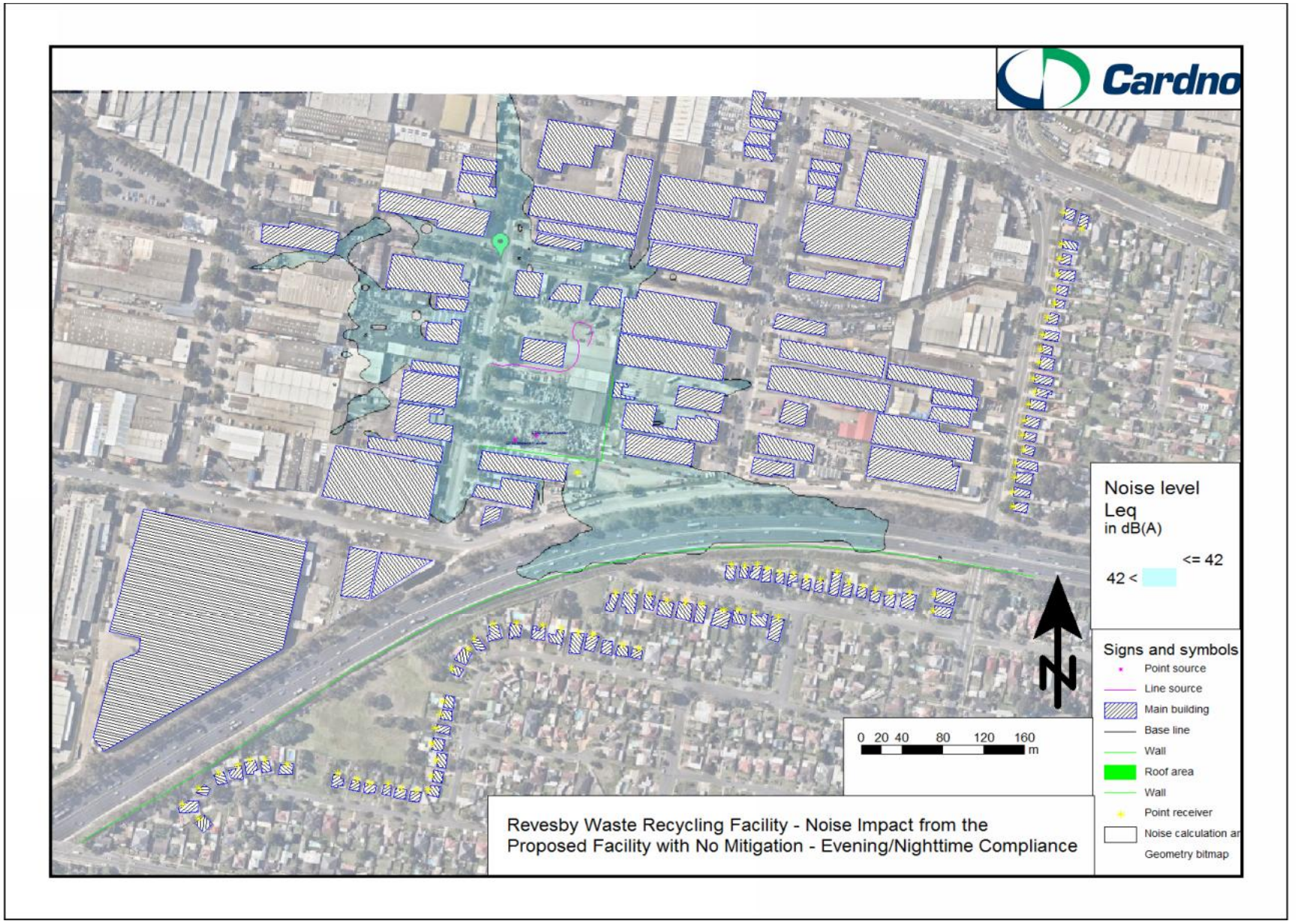


Figure 20: Scenario (5) - Predicted Noise Impact – Proposed Operations with No Mitigation Compared to Industrial Criteria – (70 dB(A) (LAeq))

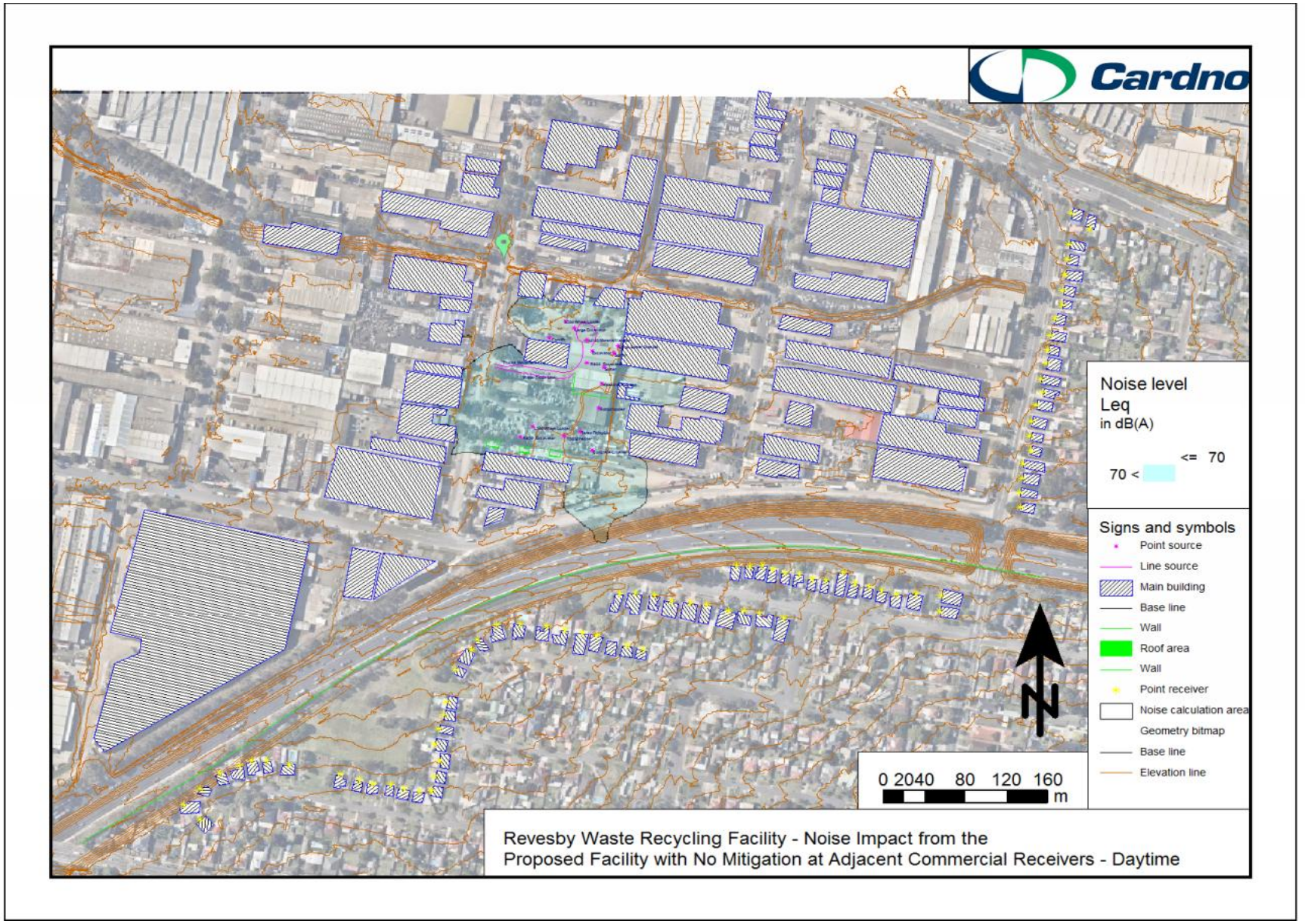
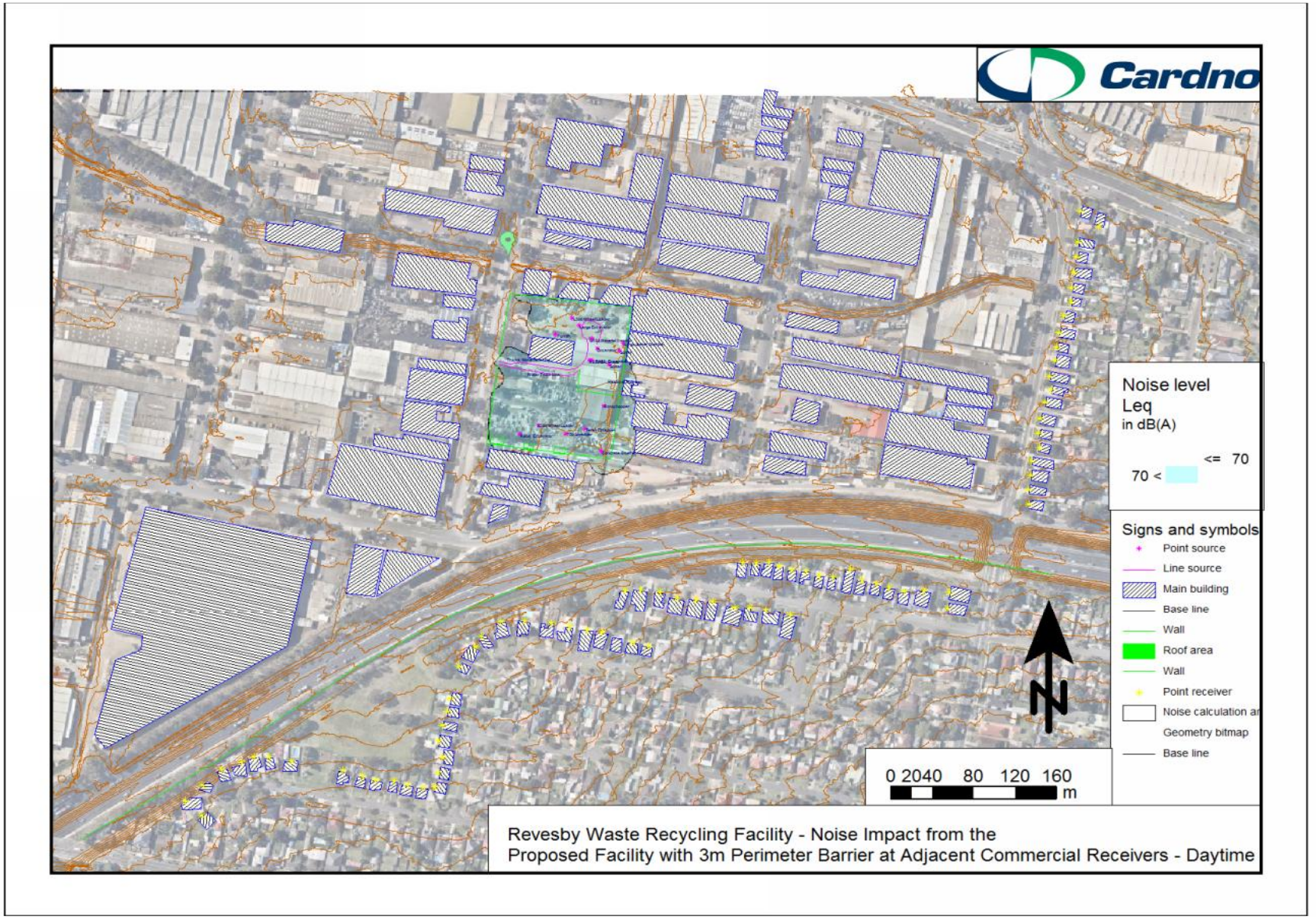


Figure 21: Scenario (5) - Predicted Noise Impact – Proposed Operations with a Full Perimeter Noise Barrier Compared to Industrial Criteria – (70 dB(A) (LAeq))



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APPENDIX E
PROPOSED TEMPORARY NOISE BARRIER INFORMATION

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Figure 22: Example of Proposed Temporary Noise Barriers (1)

flex SHIELD

On-site noise reduction: *fast, easy and safe.*

Our acoustic curtains are specially designed for maximum noise reduction.

Flexshield sonic curtains combine a sound barrier and noise absorption product in one, for highly effective noise control.

Our portable noise control barriers reduce noise by the required number of decibels – so you can comply with government legislation and provide safe and enjoyable working conditions for employees and not disturb the environment.

Having a soundproofed site enables you to work extended hours to get the job done quickly, which in turn increases efficiency and profits.

These noise control barriers can be quickly, easily and safely hung from temporary site fencing or hoarding.

They are suitable for a range of applications, including:

- Earth and road works,
- Construction sites,
- Night works,
- Civil engineering sites,
- Drilling sites,
- Building refurbishments,
- Tunnel and rail projects,
- And more.

Available to BUY or HIRE! Talk to us today.

Sonic curtains used to control mobile plant noise.

flexshield.com.au | flexshield.co.nz

Curtains used to meet EPA requirements for directional drilling.

Flexshield — the trusted name in noise attenuation solutions.

Our acoustic curtains are made in Australia and have been specially developed to provide a number of benefits, including:

1. 26dB reduction at 1000Hz lab test – for effective sound attenuation
2. Fully transportable – move them with you to each construction site
3. Quick and easy to erect – to get the job done faster
4. Weather, fire and UV resistant
5. Robust and durable – to provide excellent ROI
6. Versatile – can be installed indoors and outdoors
7. Can also control the spread of dust & fumes
8. Available to suit a full range of noise frequencies
9. Can easily incorporate vision panels, access doors and other penetrations
10. NATA Tested AS ISO 354 – 2006

All our sonic curtains are custom-made to suit your exact requirements, so you can comply with government requirements and keep on working. They can be printed with your logo, as an easy and cost-effective way to advertise your company while working on-site. Call 1300 799 969 to ask us how.

Figure 23: Example of Proposed Temporary Noise Barriers (2)