ERSKINE PARK LANDFILL - AIRSPACE INCREASE

Noise Impact Assessment

Prepared for:

Enviroguard Pty Limited
PO Box 1824
MILTON QLD 4064

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Enviroguard Pty Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30043-R01-v1.0	9 July 2020	Martin Davenport	Mark Russell	Mark Russell

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Enviroguard Pty Ltd to conduct a noise impact assessment (NIA) for the proposed modification to the final landform design of the Erskine Park Landfill site (the Site) involving the construction of a mechanical stabilised earthen (MSE) wall to the western, southern and eastern perimeter of the existing landfill site (the Project).

Broadly, the objective of this NIA is to identify the potential impacts of noise and vibration from the Project during construction and operation. Additionally, this NIA provides recommendations with regard to management strategies and mitigation measures, where necessary.

The NIA has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise Parts 1, 2 and 3* and in general accordance with the Environment Protection Authority's (EPA) NSW *Noise Policy for Industry*, *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) and the NSW *Road Noise Policy* (RNP) (DECCW, 2011).

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 Project Description

2.1 Existing Approval and Consent Conditions

The Site currently approved under development consent DA05/1740 issued by Penrith City Council.

The Site also operates under Environmental Protection License (EPL) No 4865, with the current version dated 20 March 2019.

An excerpt of EPL 4865 with regard to noise emissions is shown in **Figure 1**.

Figure 1 Excerpt of EPL 4865 - L5 Noise Limits

L5 Noise limits

L5.1

Location	Day
	LAeq (15 minutes)
Mamre Road Residence*	45
Erskine Park Road Residence*	54

Note: *As identified in section 7.8 of volume 1 of the document titles, *"Environmental Impact Statement - Enviroguard - Erskine Park Landfill - Revised Final Profile - National Environmental Consulting Services"* dated 17 October 2005.

Note: The noise limits represent the noise contribution from the landfill site for the modifications to the final profile.

L5.2 Noise from the premises is to be measured at the most affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the most-affected point within 30 metres of the residence to determine compliance with condition L5.1.

L5.3 The noise emission limits identified in condition L5.1 apply under meteorological conditions of:
a) Wind speed up to 3m/s at 10 metres above ground level; or
b) Temperature inversion conditions of up to 3oC/100m and wind speed up to 2m/s at 10 metres above the ground.

It is noted that the Erskine Park residence has been demolished as part of the construction of Lenore Drive and the remaining land is currently vacant.

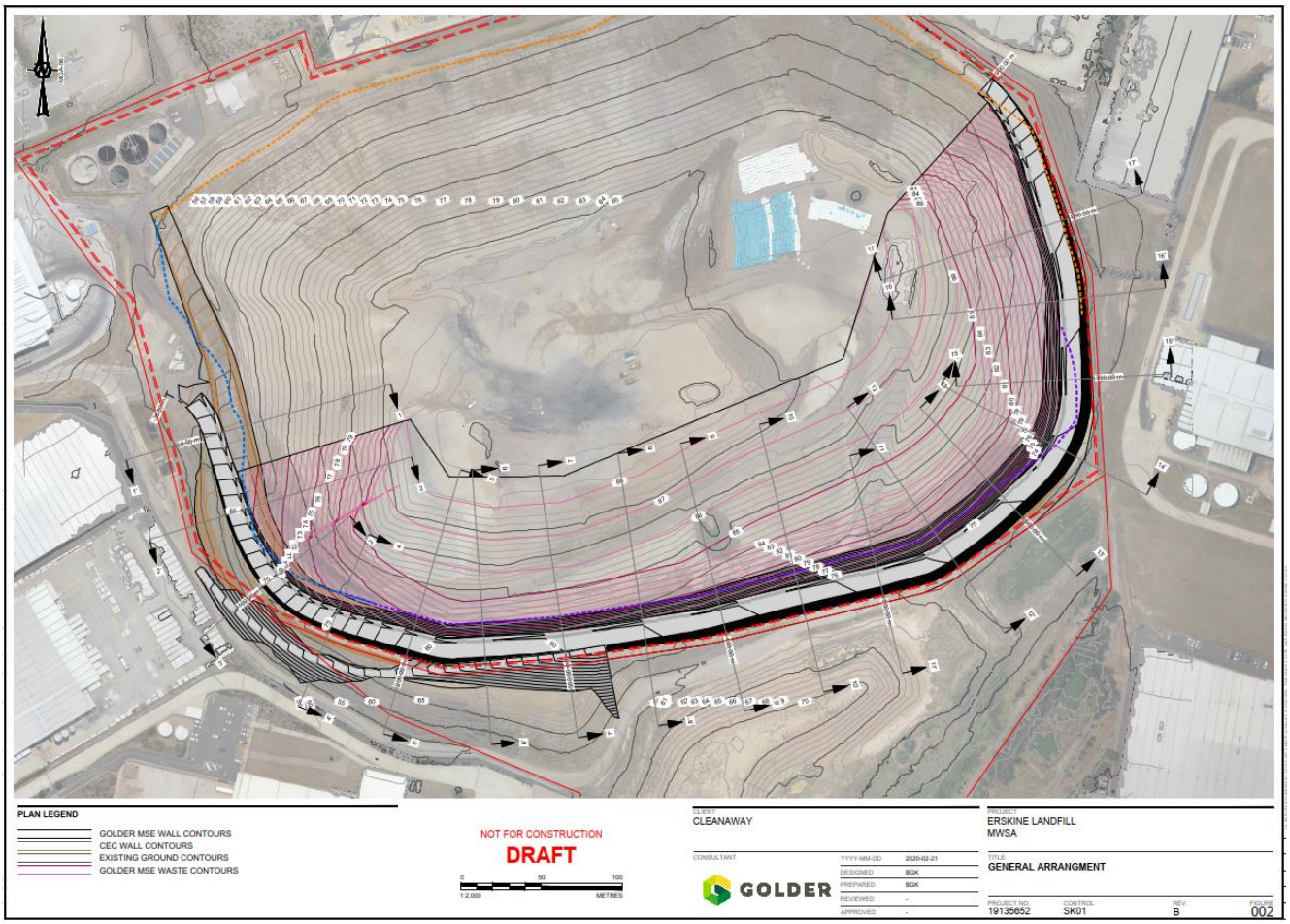
2.2 Proposal Overview

The Site is located at 4 Quarry Road, Erskine Park NSW. The Site is currently operating and is used as landfill for disposing dry waste.

The Project will allow for an increase in airspace available for landfilling, without altering the final height of the landform. It should be noted that the Proposal seeks to extend existing operations and will not intensify the use of the site once operational.

A general project arrangement is show in **Figure 2**.

Figure 2 General Project Arrangement



2.3 Hours of operation

The Site typically operates from 7:00 am to 5:00 pm Monday to Friday under peak operating periods. However the site is approved to operate from 6:00 am to 5:00 pm Monday to Friday, 6:00 am to 4:00 pm Saturdays and 7:00 am to 4:00 pm Sundays and public holidays.

Construction would only occur during standard construction hours being

- Monday to Friday7:00 am to 6:00 pm
- Saturday 8:00 am to 1:00 pm
- No work on Sundays or public holidays

2.4 Vehicular Access and Traffic Generation

Access to the Site will continue to be via Mamre Road into James Erskine Drive and Quarry Road.

The total Project construction period is expected to occur for approximately 12 months. During construction an additional 100 truck arrivals per day is expected in addition to the existing (site generated) 122 truck arrivals per day. It should be noted that the original EIS for the Site assumed a trip generation of up to 288 truck arrivals per day.

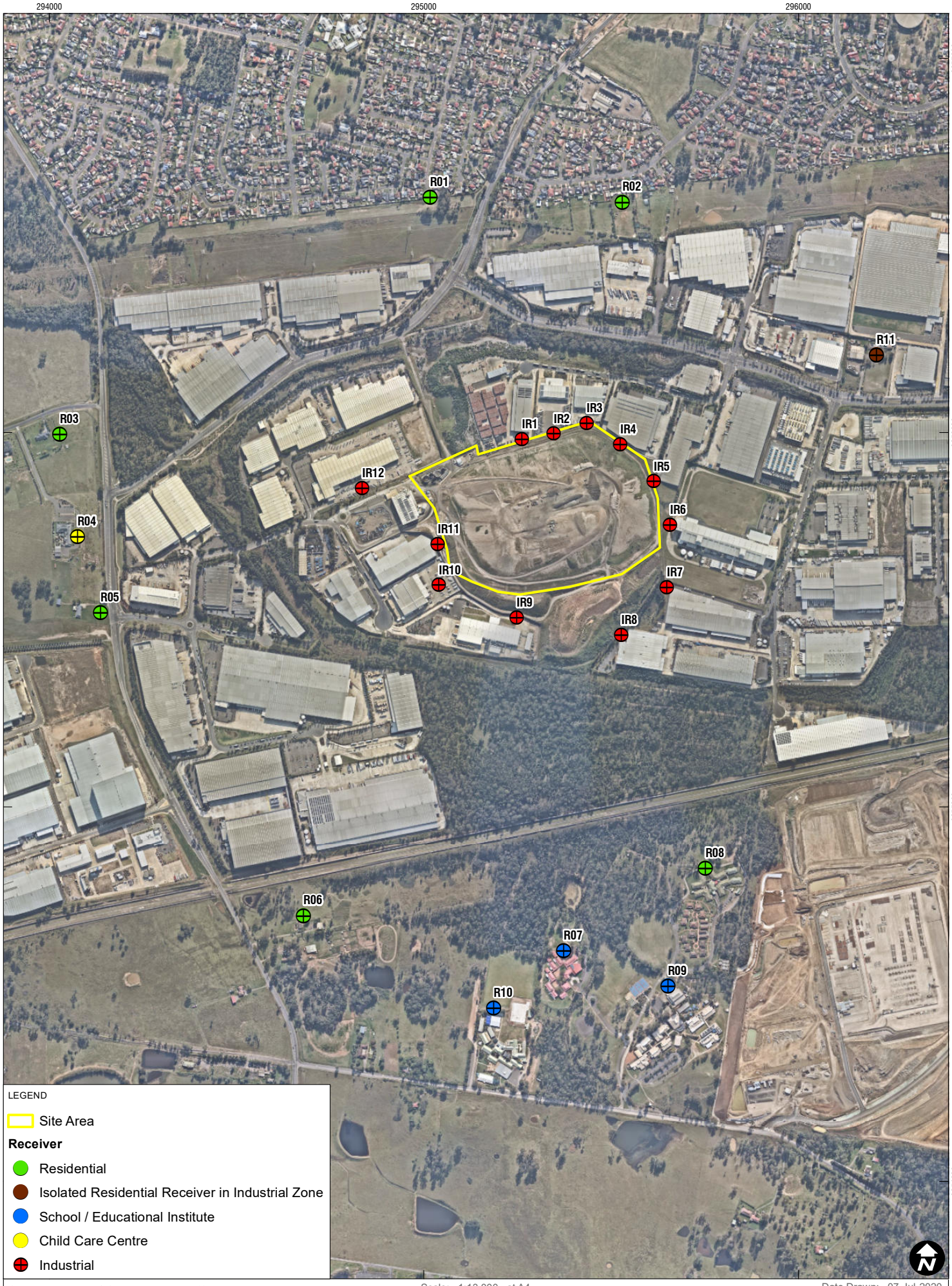
2.5 Sensitive Receivers

The Site is in an industrial business park and is bordered by established industrial receivers.

Table 1 and **Figure 3** show the location of the project site and the nearest noise sensitive receivers.

Table 1 Nearest Noise Sensitive Receivers

Receptor ID	Description and Address	Receiver Type
R01	55 Coowarra Drive Erskine Park	Residential
R02	66 Chameleon Drive Erskine Park	Residential
R03	19 Mandalong Close Orchard Hills	Residential
R04	21A Mandalong Road Orchard Hills	Child Care Centre
R05	573 Mamre Road Orchard Hills	Residential
R06	674 Mamre Road Kemps Creek	Residential
R07	61-109 Bakers Lane Kemps Creek	School/Educational Institute
R08	61-109 Bakers Lane Kemps Creek	Residential
R09	61-109 Bakers Lane Kemps Creek	School/Educational Institute
R10	59 Bakers Lane Kemps Creek	School/Educational Institute
R11	119 Lenore Drive Erskine Park	Isolated Residential Receiver in Industrial Zone
IR1 – IR12	Industrial Receivers immediately surrounding the Project boundary.	Industrial Receiver



SLR

Site Location and Nearest Sensitive Receptors

FIGURE 3

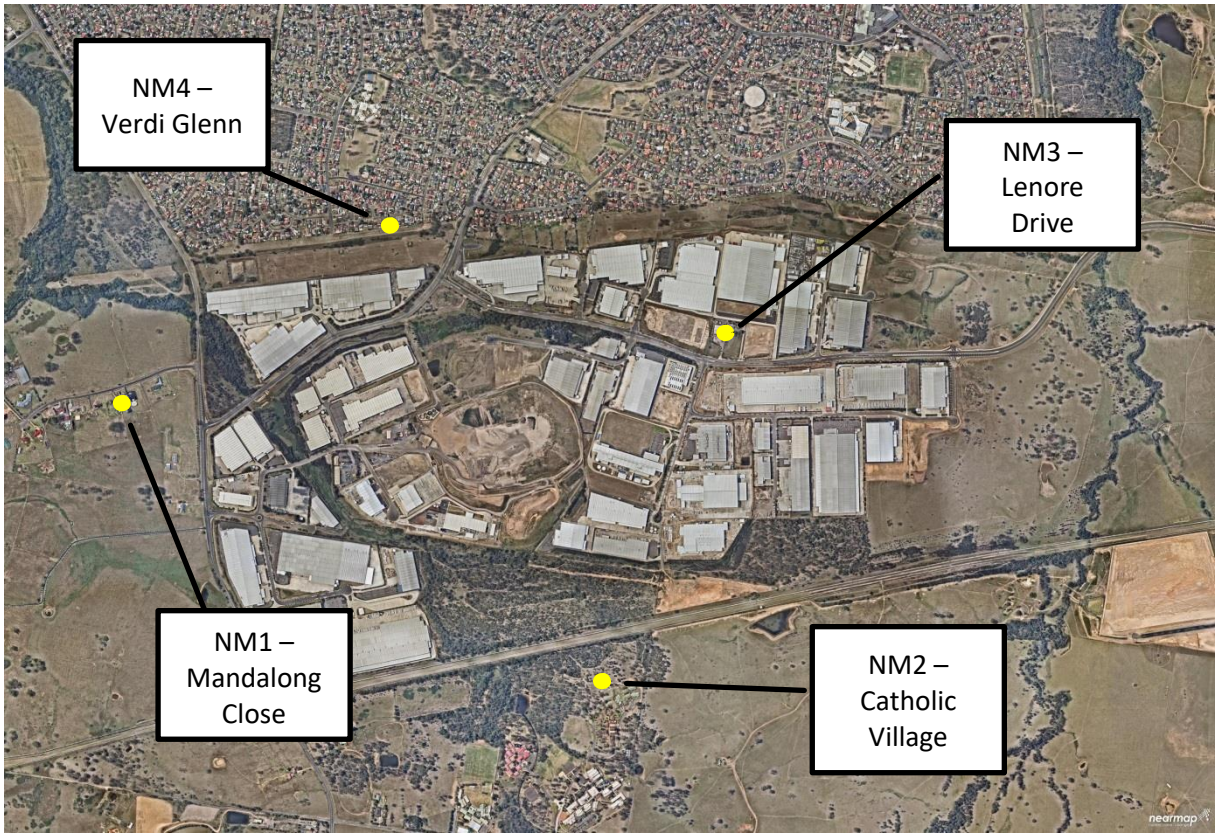
3 Existing Acoustical Environment

3.1 Ambient Background Noise Levels

Environmental noise monitoring was conducted in 2015 at four locations representing the potentially most affected noise sensitive receivers surrounding the site as part of the noise impact assessment for the Erskine Park Resource Management Facility Waste Transfer Station (refer SLR report 610.14324 *Erskine Park Resource Management Facility Staged SSD – Stage 1 Waste Transfer Station – Construction and Operation Noise Assessment* dated 19 October 2015).

Noise monitoring was conducted at the locations show in **Figure 4.**

Figure 4 Ambient Noise Monitoring Locations



Source - SLR 2015

Results from the unattended noise monitoring is shown in **Table 2**.

Table 2 Summary of Existing Ambient Noise Levels - dBA

Noise Monitoring Location	Rating Background Noise Level			Measured $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
NM1 – Mandalong Close	44	45	39	54	54	53
NM2 – Catholic Village	35	38	36	49	43	44
NM3 – Lenore Drive	46	38	44	57	54	53

Noise Monitoring Location	Rating Background Noise Level			Measured $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
NM4 – Verdi Glenn	43	41	39	51	53	48

The 2015 noise monitoring data was re-analysed to obtain the 10th percentile $L_{A90(15minute)}$ over the shoulder period. Results are provided in **Table 3**.

Table 3 Shoulder Period (6:00 am to 7:00 am) Background Noise Levels

Noise Monitoring Location	6:00 am to 7:00 am 10th percentile $L_{A90(15minute)}$
NM1 – Mandalong Close	41
NM2 – Catholic Village	38
NM3 – Lenore Drive	45
NM4 – Verdi Glenn	44

Given the increase in industrial premises in the area since the monitoring was conducted in 2015, the adoption of the background noise levels presented in **Table 2** and **Table 3** is considered to be conservative, as it is likely that background noise levels have increased in the area over time. This is particularly likely for residential receiver R08 which immediately adjoins the approved Oakdale West Stage 2 development approved on 9 April 2020.

3.2 Annual Compliance Noise Monitoring

Operator attended noise monitoring is conducted on an annual basis at two locations. The locations are representative of receivers to the west of the Site, off Mamre Road and to the north of the Site off Lenore Drive.. A summary of the findings from the annual daytime attended noise surveys is provided in **Table 4**.

Table 4 Annual Daytime Operator Attended Noise Monitoring Results - 2018-2020

Year	Results Summary
2018	No audible or measurable noise from the Site at both monitoring locations. Measured noise levels dominated by road traffic.
2019	No audible or measurable noise from the Site at both monitoring locations. Measured noise levels dominated by road traffic.
2020	No audible or measurable noise from the Site at both monitoring locations. Measured noise levels dominated by road traffic.

Furthermore, it is noted that there was no evidence of Site noise emissions that would trigger any modifying factors as described by the NSW *Industrial Noise Policy* and NPfI.

4 Impact Assessment Procedures

4.1 NSW Noise Policy for Industry

The EPA has regulatory responsibility for the control of noise from 'scheduled premises' under the *Protection of the Environment Operations Act 1997* (POEO Act 1997). In implementing the NPfI, the EPA has two broad objectives:

- Controlling intrusive noise levels in the short term.
- Maintaining noise amenity levels for particular land uses over the medium to long-term.

In general terms, the NPfI sets out procedures for establishing the project intrusiveness $L_{Aeq(15minute)}$ and project amenity $L_{Aeq(period)}$ noise levels, with a view of determining the lower (that is, the more stringent) being the Project Noise Trigger Level (PNTL), NPfI Section 2.1 states:

> *The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.*

For assessing intrusiveness, the existing background noise generally needs to be measured. The intrusiveness trigger level essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured (or default) Rating Background Level (RBL).

The amenity assessment is based on amenity noise levels specific to the land use and associated activities. The NPfI Recommended and Project Amenity Noise Levels are shown in **Table 5** and relate only to industrial/commercial-type noise and do not include road, rail or community noise. The residential receivers have been categorised as 'Urban' for this assessment, due to their proximity to major roadways and the Erskine Business Park.

Table 5 Amenity Criteria – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended Amenity $L_{Aeq(Period)}$ Noise Level (dBA)	Project Amenity $L_{Aeq(Period)}$ Noise Level (dBA)
Residential	Urban	Day	60	55
		Evening	50	45
		Night	45	40
School Classroom – internal	All	When in use	35	30
Active recreation area (school playground)	All	When in use	55	50
Industrial premises	All	When in use	70	65

Note: Daytime 7:00 am - 6:00 pm; Evening 6:00 pm - 10:00 pm; Night-time 10:00 pm - 7:00 am
On Sundays and Public Holidays, Daytime 8:00 am - 6:00 pm; Evening 6:00 pm - 10:00 pm; Night-time 10:00 pm - 8:00 am.
The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

The PNTLs are then determined in accordance with NPfI Section 2.1 *Project Noise Trigger Level* by identifying the lower of the project amenity or project intrusive noise levels (following conversion of the $L_{Aeq(period)}$ project amenity noise level to an equivalent $L_{Aeq(15minute)}$ value for comparison with the $L_{Aeq(15minute)}$ project intrusive noise level). NPfI Section 2.2 *Noise Descriptors* assumes a default conversion factor of plus 3 dB for the conversion of $L_{Aeq(period)}$ noise levels to $L_{Aeq(15minute)}$ noise levels.

It should be noted that for an existing industrial premise the NPfI also states the following:

- *The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.*

4.2 Assessing Sleep Disturbance

NPfI provides criteria for when a sleep disturbance assessment should be conducted. **Section 2.5** of the NPfI states:

Where the subject development/premise night-time noise levels at a residential location exceed:

- $L_{Aeq(15minute)}$ *40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
- L_{AFmax} *52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater,*

A detailed maximum noise level event assessment should be undertaken.

Guidance regarding potential for sleep disturbance is provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

- Maximum internal noise levels below 50 to 55 dBA are unlikely to awaken people from sleep.
- One or two noise events per night, with maximum internal noise levels of 65 to 70 dBA, are not likely to affect health and wellbeing significantly.

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dB lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dB, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

4.3 Road Traffic Noise

The RNP sets out noise criteria applicable to particular types of projects, road categories and land uses for the purpose of defining traffic noise impacts. **Table 6** presents the most relevant RNP criteria for residential land uses affected by noise from additional traffic on a freeway, arterial, sub-arterial, or local road. Noise levels provided in **Table 6** are external noise levels and refer only to road traffic noise; they do not include ambient noise from other sources.

Table 6 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of project/land use	Assessment criteria – dBA	
		Day (7 am–10 pm)	Night (10 pm–7 am)
Freeway / arterial / sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, (15 hour) 60 (external)	LAeq, (9 hour) 55 (external)

Note: 1. Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see Appendix C10 of the RNP for details).

Note: 2. Sub-arterial roads previously designated as 'collector roads' in the Environmental criteria for road traffic noise.

Section 3.4 of the RNP also states:

> *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.*
>
> *For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*

4.4 Construction Noise

The NSW EPA's ICNG sets out noise management levels for residential and other noise-sensitive receivers and outlines how they are to be applied. The policy suggests restricting the hours of construction for activities that generate noise at residences above the 'highly affected' noise management level. A summary of the noise management levels from the ICNG is contained in **Table 7** and **Table 8.**

Table 7 Construction Noise Management at Residential Receivers

Time of Day	Noise Management Level LAeq(15minute)*	How to Apply
Recommended standard hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work 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 $L_{Aeq(15minute)}$ 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 dBA	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. • 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 dBA above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Note: *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise-affected residence.
**RBL: Rating Background Level, as defined in the NSW Industrial Noise Policy (EPA, 2000).

Table 8 Noise at Sensitive Land Uses (Other than Residences)

Land use	Management level, LAeq(15minute) (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterized by sporting activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterized by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

4.4.1 Industrial Receivers

The ICNG explains that due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into two categories:

- Industrial premises: external $L_{Aeq(15minute)}$ 75 dBA; and
- Offices and retail outlets: external $L_{Aeq(15minute)}$ 70 dBA.

The external noise levels should be assessed at the most-affected occupied point of the premises.

5 Effects of Meteorology on Noise Levels

The Project Site meteorological environment has been assessed in accordance with the requirements of the NPfI Fact Sheet D, which sets out procedures for establishing noise enhancing weather conditions. There are two options available to consider meteorological effects, as follows.

1. *Adopt the **noise-enhancing meteorological conditions** for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur - a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night.*

Or

2. *Determine the **significance** of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.*

NPfI Fact Sheet D also contains several important notes, and in particular states:

> *Noise limits derived for consents and licences will apply under the meteorological conditions used in the environmental assessment process, that is, standard or noise-enhancing meteorological conditions. For 'very noise-enhancing meteorological conditions' (see glossary) a limit is set based on the limit derived under standard or noise-enhancing conditions (whichever is adopted in the assessment) plus 5 dB. In this way a development is subject to noise limits under all meteorological conditions.*
>
> *It should be noted that noise limit conditions will include the wind speed (scalar quantity without direction) under which noise limits will apply.*

To provide a conservative approach and based on guidance presented in the NPfI Table D1, both standard and noise enhancing meteorological conditions have been considered in the assessment. **Table 9** summarises the meteorological conditions as presented in the NPfI.

Table 9 NPfI Table D1 Standard and Noise Enhancing Meteorological Conditions

Meteorological Conditions	Meteorological Parameters
Standard	Day/evening/night: stability categories A-D with wind speed up to 0.5m/s at 10m AGL
Noise-enhancing	Day/evening: stability categories A-D with light winds (up to 3m/s at 10m AGL) Night-time: stability categories A-D with light winds (up to 3m/s at 10m AGL) and/or stability category F with winds up to 2m/s at 10m AGL

Notes: m/s = metres per second, m = metres, AGL = above ground level

where a range of conditions is nominated, the meteorological condition delivering the highest predicted noise level should be adopted for assessment purposes. However, feasible and reasonable noise limits in consents and licences derived from this process would apply under the full range of meteorological conditions nominated under standard or noise-enhancing conditions as relevant. All wind speeds are referenced to 10m AGL. Stability categories are based on the Pasquill-Gifford stability classification scheme.

The NPfI standard and noise enhancing meteorological conditions can be further defined for noise modelling purposes as presented in **Table 10**.

Table 10 Meteorological Parameters Considered for Noise Predictions

Period	Meteorological Conditions	Wind Speed (m/s) (Source to receiver)	Stability Category
Day	Standard	0.5	D Class
	Noise enhancing	3	
Morning Shoulder	Standard	0.5	D Class
	Noise enhancing	3	
		2	F Class

6 Project Specific Noise Criteria

6.1 Operational Noise Criteria

The project specific noise criteria has been established with reference to the NPfI and ambient noise monitoring conducted in 2015.

The resulting operational project specific noise criteria to the nearest noise sensitive receivers from the Project are contained within **Table 11**.

Table 11 Operational Project Trigger Noise Levels - dBA

Location	Period	Project Intrusiveness[1] $L_{Aeq(15minute)}$	Project Amenity[2] $L_{Aeq(period)}$	Project Amenity[3] $L_{Aeq(15minute)}$	Resulting PTNL[4] $L_{Aeq(15minute)}$
R01, R02	Morning Shoulder	48	40	43	**43**
	Day	48	55	58	**48**
R03, R05, R06	Morning Shoulder	46	40	43	**43**
	Day	49	55	58	**49**
R08	Morning Shoulder	40	40	43	**40**
	Day	40	55	58	**40**
R04	When in use	-	50	53	**53**
R07, R09, R10	When in use	-	40[5]	43[5]	**43[5]**
R11	When in use	-	65	68	**68**
IR1-IR12	When in use	-	65	68	**68**

Note 1: Project Intrusiveness is the RBL plus 5 dBA.

Note 2: Project Amenity (period) noise level is the Amenity Criteria minus 5 dBA.

Note 3: Project Amenity (15 minute) is the Project Amenity (period) noise level plus 3 dBA.

Note 4: Resulting PTNL is the lower of the Project Intrusiveness and the Project Amenity (15 minute) noise levels.

Note 5. 10 dB added to internal criteria to account for external noise prediction

Sleep disturbance screening noise levels are provided in **Table 12**

Table 12 Sleep Disturbance Screening Criteria - dBA

Location	Period	$L_{Aeq(15minute)}$	L_{Amax}
R01, R02	Morning Shoulder	48	58
R03, R05, R06	Morning Shoulder	46	56
R08	Morning Shoulder	40	52

6.2 Construction Noise

The NMLs for standard construction hours at the nearest receivers is provided in **Table 13**.

Table 13 Construction Noise Management Levels – dBA

Location	Time of Day	Standard Hours NML	Highly Affected NML
R01, R02	Recommended standard hours	53	75
R03, R05, R06	Recommended standard hours	54	75
R08	Recommended standard hours	45	75
R04	Recommended standard hours	65	-
R07, R09, R10	Recommended standard hours	45	-
R11	Recommended standard hours	56	75
IR1 – IR12	Recommended standard hours	75	-

7 Noise Impact Assessment

7.1 Noise Modelling Methodology and Assumptions

Computer noise modelling was used to predict operational noise emissions from the Project. The noise modelling was undertaken using SoundPLAN v8.1 software. A three-dimensional digital terrain map including topographic information was used in the modelling process, together with noise source data and shielding by barriers and/or adjacent buildings to predict noise levels at the nearest potentially affected receivers.

Atmospheric parameters under which noise predictions were made are given in **Table 14**.

Table 14 Meteorological Parameters Considered for Noise Predictions

Meteorological Scenario	Temperature	Humidity	Wind Speed (m/s)	Wind Direction	Stability Category
Standard (Morning Shoulder, Day)	10°C	70%	0.5	Source to receiver	D
Noise Enhancing Day	10°C	70%	3	Source to receiver	D
Noise Enhancing Morning Shoulder)	10°C	70%	3	Source to receiver	D
Noise Enhancing Morning Shoulder)	10°C	70%	2	Source to receiver	F

Sound power levels of acoustically significant plant and equipment proposed for use on the subject site have been obtained from a SLR database of similar equipment. It is assumed that all plant and equipment operate simultaneously and in repetitive cycles over a 15 minute period.

The scenarios modelled during each period together with assumed sound power level information is summarised in **Table 15**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of items of the equipment that has been considered in the noise model during the relevant period.

Table 15 Construction and Operational Scenarios

Plant and Equipment	Sound Power Level	Morning Shoulder Normal	Daytime Normal Tonnage	Daytime Peak Tonnage	Construction
Landfill Compactor (Cat 826H)	109 dBA	✓	✓	✓	
Liebherr 756 Dozer	106 dBA	✓	✓	✓	
Cat D6R Dozer	106 dBA	×	×	✓	
Articulated Dump Truck	110 dBA	✓	✓	✓	✓ (2)
Cat 336B Excavator	105 dBA	✓	✓	✓	✓ (2)
Customer Waster Delivery Trucks / Material Delivery Truck	108 dBA	✓ (6)	✓ (6)	✓ (9)	✓ (4)
Sheep Foot Roller	109 dBA	×	×	×	✓ (2)
Telehandler	108 dBA	×	×	×	✓

Under normal tonnage operations the landfill has four operators and six customer trucks onsite in any 15 minute period. The modelling assumed that customer trucks would access the site and drive up the northern batter to reach the landfill crown (RL 92), where they would dump their load and exit along the southern batter from RL 82, being the peak height of the MSE wall. The landfill operators would then spread and redistribute materials around the crown area.

Under peak tonnage operations the landfill would remain similar to normal tonnage operations with the exception of an additional landfill operator and up to nine customer trucks onsite in any 15 minute period.

The Construction plant and equipment fleet has been modelled operating at RL82 on top of the MSE wall and RL 65 on the southern property boundary with articulated dump trucks moving between the locations and four material delivery trucks onsite in any 15 minute period.

7.2 Predicted Operational Noise Levels and Assessment

Results of the operational noise modelling is presented in **Table 16**. Predicted noise contours for each operational scenario are also provided in **Appendix B**.

Table 16 Predicted Operational Noise Levels – dBA

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$		PTNL $L_{Aeq(15minute)}$	EPL $L_{Aeq(15minute)}$
		Standard Weather Condition	Noise Enhancing Weather Condition		
R01	Morning Shoulder – Normal Tonnage	37	40	44	-
	Day Normal Tonnage	37	40	44	45
	Day Peak Tonnage	38	41	44	45
R02	Morning Shoulder – Normal Tonnage	39	42	44	-
	Day Normal Tonnage	39	42	44	45
	Day Peak Tonnage	40	43	44	45
R03	Morning Shoulder – Normal Tonnage	33	37	43	-
	Day Normal Tonnage	33	37	49	45
	Day Peak Tonnage	35	38	49	45

Location	Period	Predicted Noise Level LAeq(15minute)		PTNL LAeq(15minute)	EPL LAeq(15minute)
		Standard Weather Condition	Noise Enhancing Weather Condition		
R04	Morning Shoulder – Normal Tonnage	36	40	53	-
	Day Normal Tonnage	36	40	53	-
	Day Peak Tonnage	38	41	53	-
R05	Morning Shoulder – Normal Tonnage	35	38	43	-
	Day Normal Tonnage	35	38	49	45
	Day Peak Tonnage	36	39	49	45
R06	Morning Shoulder – Normal Tonnage	33	37	43	-
	Day Normal Tonnage	33	37	49	45
	Day Peak Tonnage	35	38	49	45
R07	Morning Shoulder – Normal Tonnage	35	38	43	-
	Day Normal Tonnage	35	38	43	-
	Day Peak Tonnage	36	39	43	-
R08	Morning Shoulder – Normal Tonnage	37	41	40	-
	Day Normal Tonnage	37	41	40	45
	Day Peak Tonnage	38	42	40	45
R09	Morning Shoulder – Normal Tonnage	35	38	43	-
	Day Normal Tonnage	35	38	43	-

Location	Period	Predicted Noise Level LAeq(15minute)		PTNL LAeq(15minute)	EPL LAeq(15minute)
		Standard Weather Condition	Noise Enhancing Weather Condition		
	Day Peak Tonnage	36	39	43	-
R10	Morning Shoulder – Normal Tonnage	33	36	43	-
	Day Normal Tonnage	33	36	43	-
	Day Peak Tonnage	34	37	43	-
R11	Morning Shoulder – Normal Tonnage	38	41	68	54
	Day Normal Tonnage	38	41	68	54
	Day Peak Tonnage	39	42	68	54
IR1-IR123	Morning Shoulder – Normal Tonnage	57	58	68	-
	Day Normal Tonnage	57	58	68	-
	Day Peak Tonnage	59	60	68	-

Note 1: Predicted noise level complies with the PTNL

Note 2: Negligible residual noise exceedance 1 to 2 dBA above PTNL

Note 3: Noise level presented is the highest predicted noise level from IR1-IR12

Table 16 indicates that compliance with EPL consent conditions is predicted at all receiver locations. Additionally, predicted noise levels are predicted to meet the relevant PTNLs at all receiver locations, with the exception of R08.

For R08 noise levels under standard weather conditions are predicted to meet the PTNLs under standard weather conditions. Under noise enhancing weather conditions an exceedance of 1 dB is predicted under normal tonnage conditions and 2 dB under peak tonnage conditions. The significance of the residual 1 dB to 2 dB exceedance at this receiver is considered negligible and no further treatment or controls are warranted. It should also be noted that PTNLs at R08 are likely to be conservative given the increase in industrial premises in the area.

Notwithstanding the above it is recommended that management procedures be implemented including:

- Prompt response to any community issues of concern.
- Noise monitoring on site and within the community in the event of complaints if genuine and source of origin is identified as from the Project Site.

- Refinement of on-site noise mitigation measures and best practice plant operating procedures where practical.
- Ensuring spoil/product is placed and not dropped into awaiting trucks.
- Use of less noise-intensive equipment, where reasonable and feasible particularly during the morning shoulder period.
- Briefing of the work team and plant operators (i.e. tool box talks) in order to create awareness of the locality of sensitive receivers and the importance of minimising noise emissions.

With these measured in place operational noise impacts from the Project are predicted to be negligible.

7.3 Sleep Disturbance Noise Assessment

In assessing sleep disturbance, typical L_{amax} noise levels of acoustically significantly plant and equipment to be used during the morning shoulder period were used as input to the computer model and are presented in **Table 17.**

Table 17 Maximum Noise Event

Source	L_{Amax}
Excavator bucket impact/scrape and or Truck impact body rumble/air brake release.	120 dBA

Predicted maximum noise levels during the morning shoulder at the residential receivers are provided in **Table 18**

Table 18 Maximum Noise Level Predictions – dBA

Location	Period	Predicted Noise Level – Noise Enhancing Weather Conditions		$L_{aeq(15minute)}$	L_{amax}
		$L_{Aeq(15minute)}$	L_{Amax}		
R01	Morning Shoulder	40	51	48	58
R22	Morning Shoulder	42	51	48	58
R03	Morning Shoulder	37	49	46	56
R05	Morning Shoulder	38	47	46	56
R06	Morning Shoulder	37	45	46	56
R08	Morning Shoulder	41	48	40	52

Note 1: Predicted noise level complies with the Sleep disturbance screening criteira

Note 2: Exceedance 1 dB above sleep disturbance criteria

Results of maximum noise predictions indicate that the sleep disturbance screening noise goal will be achieved at all locations with the exception of R08. It should be noted that the external maximum noise levels at all receptors are below 60 dBA. This infers that internal levels (assuming a 10 dB reduction outside to inside with windows normally open) will be well below 50 dBA and are therefore unlikely to cause awakening reactions.

7.4 Construction Noise Assessment

Noise levels from construction activities associated with the MSE at the nearest noise sensitive receivers is provided in **Table 19**.

Table 19 Predicted Construction Noise Levels

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$		Standard Hours NML	Highly Affected NML
		Standard Weather Condition	Noise Enhancing Weather Condition		
R01	Standard Construction Hours	31	34	53	75
R02		<30	32	53	75
R03		<30	33	54	75
R04		32	35	65	-
R05		33	36	54	75
R06		36	40	54	75
R07		37	40	45	-
R08		40	43	45	75
R09		37	40	45	-
R10		35	38	45	-
R11		33	36	56	75
IR1-IR12[1]		58	60	75	-

Note 1: Noise level presented is the highest predicted noise level from IR1-IR12

Results of construction noise modelling indicates that the noise affected management level is predicted to be achieved at all noise sensitive locations.

Notwithstanding the above, the following recommendations are made with the aim of minimising construction noise impacts at nearby noise sensitive receivers:

- An important aspect of the mitigation of noise impacts during all construction phases will be adherence to the standard daytime construction hours.
- Noisy plant operating simultaneously to be avoided wherever possible.
- Maintenance work on all construction plant will be carried out away from noise sensitive areas and confined to standard daytime construction hours, where practicable.
- Keep equipment well maintained.
- Employ “quiet” practices when operating equipment (eg positioning and unloading of trucks in appropriate areas).

With regard to potentially offensive noise events associated with construction activities AS 2436-1981 "*Guide to noise control on construction, maintenance and demolition sites"* provides the following:

> *If noisy operations must be carried out, then a responsible person should maintain liaison between the neighbouring community and the contractor. This person should inform the public at what time to expect noisy operations and also inform the contractor of any special needs of the public.*
>
> *Consultation and co-operation between the contractor and his neighbours and the removal of uncertainty and rumour can help to reduce the adverse reaction to noise.*

8 Road Traffic Noise

Given the Project does not seek to intensify tuck movements to the site following construction of the MSE no increase in road traffic noise levels is predicted.

During construction however, an additional 100 truck arrivals per day is expected in addition to the existing Site generation of 122 truck arrivals.

Given the existing traffic volumes on Mamre Road, traffic noise levels are not predicted to increase by more than 2 dB due. As such any increase in road traffic noise would be minor and barely perceptible to the average person. Impacts from additional road traffic during construction is predicted to be negligible.

9 Conclusion

SLR has undertaken a NIA relating to the modification to the final landform design of the Erskine Park Landfill site (the Site) involving the construction of a mechanical stabilised earthen (MSE).

The aim of this assessment was to assess the potential noise impacts associated with the proposed development on surrounding sensitive receptors.

Predicted noise levels indicate that compliance with the EPL consent conditions is predicted at all receiver locations.

Predicted noise levels are predicted to meet the relevant PTNLs at all receiver locations, with the exception of R08 where an exceedance of up to 2 dB is predicted. The up to 2 dB exceedance is considered negligible and no further treatment or controls are warranted.

Results of maximum noise predictions indicate that the Project is unlikely to cause awakening reactions.

Construction noise impacts are predicted to be below the relevant noise goals.

Road traffic noise impacts associated with the Project are expected to be minimal and only during the construction period given the relatively small increase in proposed traffic volumes compared to existing volumes on the road network.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

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

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

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

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

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

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

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

3. Sound Power Level

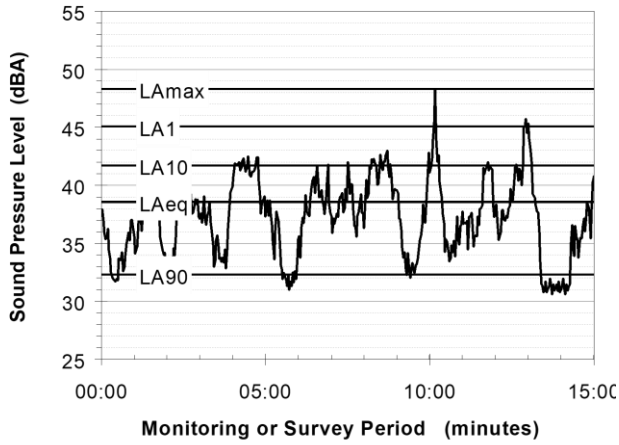
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

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



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

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

5. Frequency Analysis

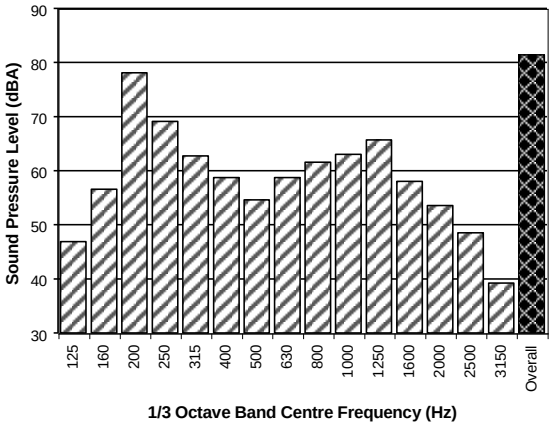
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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

Frequency analysis can be in:

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

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



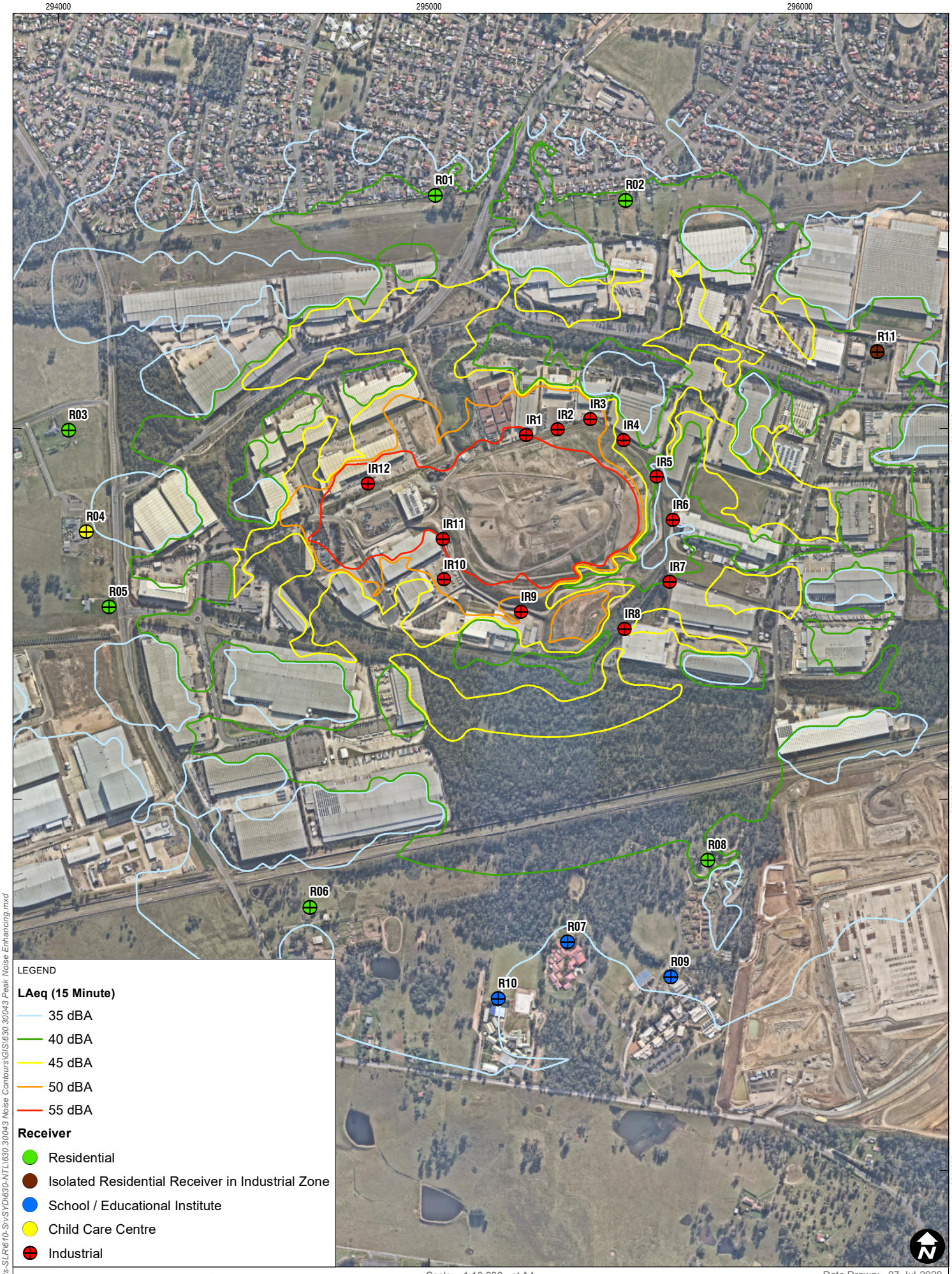
6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

APPENDIX B

Noise Contour Plots



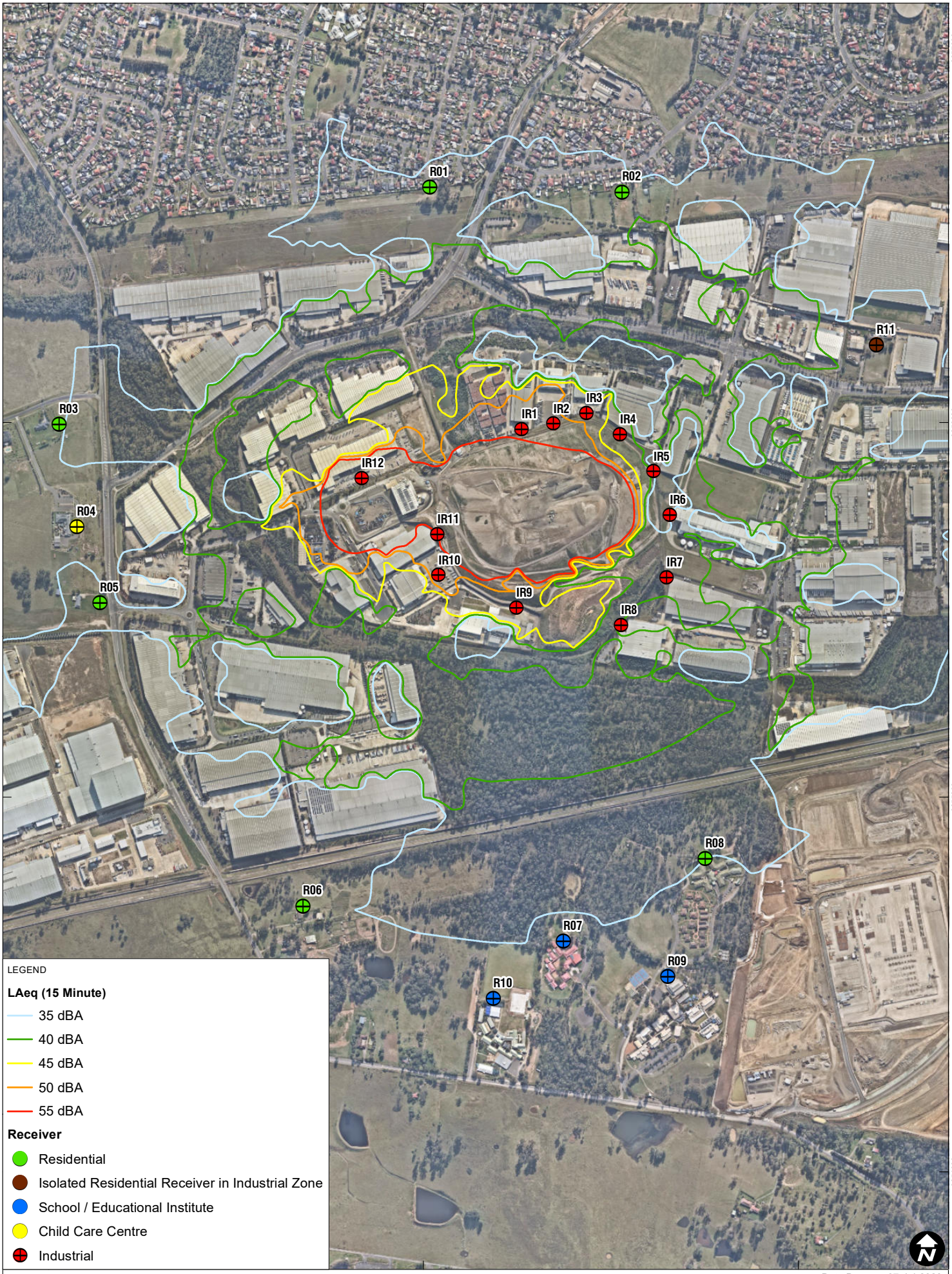
Scale: 1:13,000 at A4
Coordinate System: GDA 1994 MGA Zone 56

Date Drawn: 07-Jul-2020
Project Number: 630.30043

Peak Tonnage
Daytime Noise-enhanching
Meteorological Conditions

APPENDIX B1

\\au.slr\local\Corporate\Projects-SLR\610-SrvSYD\630-NTL\630.30043 Noise Contours\GIS\630.30043 Peak Noise Enhancing.mxd



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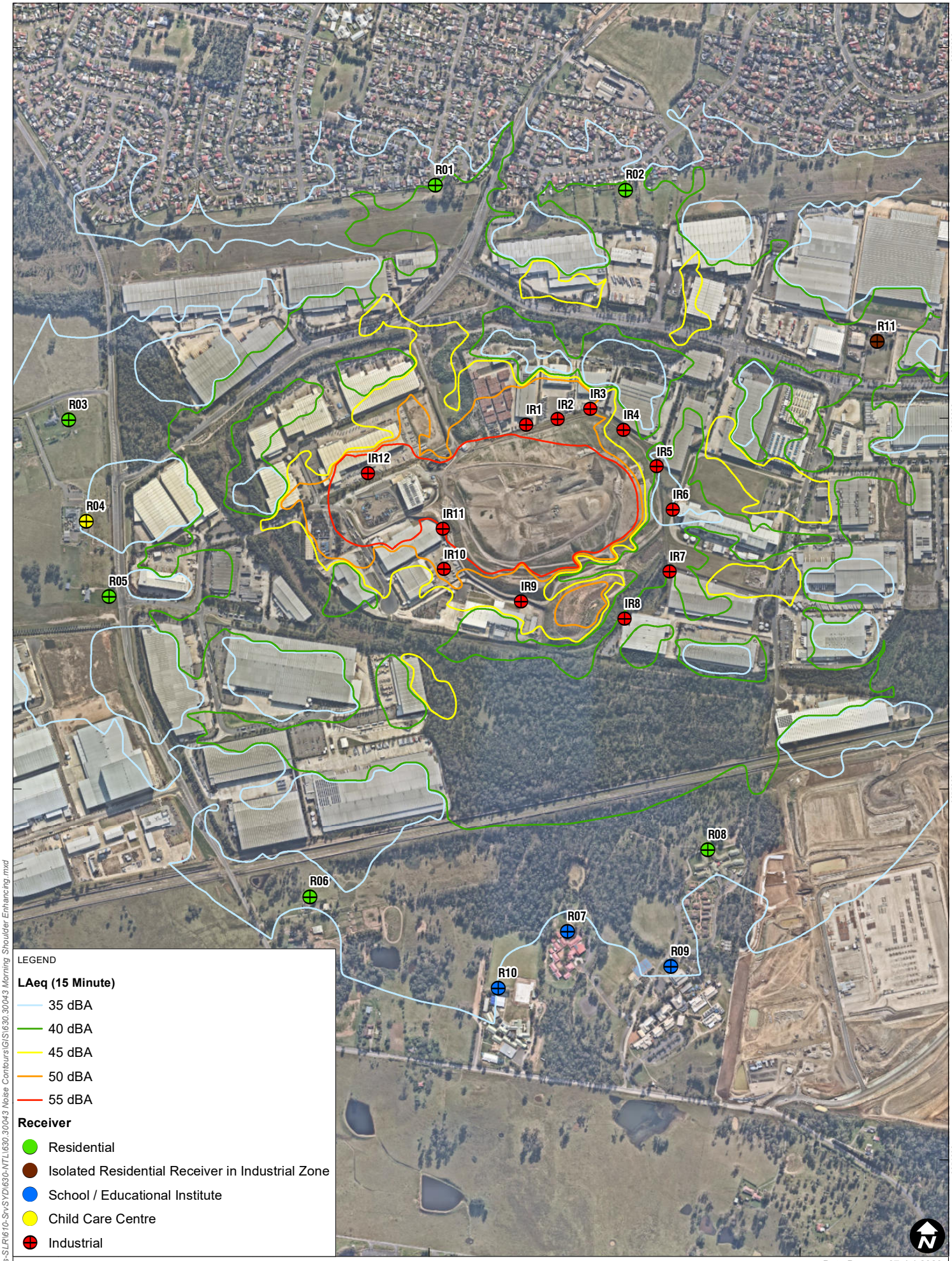
SLR

Peak Tonnage
Daytime Standard
Meteorological Conditions

APPENDIX B2



\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\630-NTL\630.30043 Noise Contours\GIS\630.30043 Morning Shoulder Enhancing.mxd

SLR

Normal Tonnage
Morning Shoulder Noise-enhancing
Meteorological Conditions

APPENDIX B3

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