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GEELONG SALEYARDS PRECINCT PLAN

Acoustic Report

20 May 2022

City of Greater Geelong

MC944-01F02 Acoustic Report (r3)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

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Executive summary

Renzo Tonin & Associates has conducted an assessment of acoustic impacts that may affect the proposed residential redevelopment of Geelong Saleyards precinct.

EPA Victoria has issued a response letter (ref. REQ001805) dated 14 April 2021, in relation to the proposed Geelong Saleyards Precinct Plan. As part of the letter, the EPA has reviewed (the Acoustic Report) prepared by Renzo Tonin & Associates, entitled *"Geelong Saleyards Precinct Plan"* dated 19 July 2019 (ref: MC944-01F02 (r1)).

As set out in the EPA letter, the following recommendations from Council to consider in progressing the amendment, in relation to acoustics includes:

Noise

EPA has not undertaken a technical review of the Acoustic Report. Notwithstanding this, it is noted the Acoustic Report uses the assessment criteria from the State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No N-1 which has now been superseded by the:

- *Environment Protection Act 2017;*
- *Environment Protection Regulations 2021;*
- *Environment Reference Standards; and*
- *EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*

It is noted that that some of the above are policy documents under Clause 13.05-1S of the Victorian Planning Provisions. When considering potential noise impacts on the proposed use and development, Council should ensure the Acoustic Assessment:

- *identifies risk of harm to the human health of nearby sensitive uses; and,*
- *where potential harm is identified, demonstrates that risks can be reduced to an acceptable level.*

Where potential harm is identified and mitigation measures are proposed, the planning authority should make provisions in the planning controls for the mitigation measures to be implemented / complied with.

In undertaking the assessment, Renzo Tonin & Associates has:

(continued overleaf)

- Reviewed the Subject Land, surrounds, and possible development feasibility plans
- Inspected the Subject Land and placed noise monitors on site to record and benchmark existing noise impacts
- Set out relevant noise criteria:
  - *EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*
  - *Greater Geelong Planning Scheme Clause 53.06 - Live Music and Entertainment Noise*
  - *Greater Geelong Planning Scheme Clause 55.07-6 Standard B40 and 58.04-3 Standard D16*
  - *Australian Standard 2107: 2016 Acoustics – Recommended Design Sound Levels…*
- Proposed the following agent of change principle to guide the Subject Land development:
  - *Requirements to be met…*

    A noise sensitive residential use must be designed and constructed to include acoustic attenuation measures that will reduce noise levels from any:
    - *Live music entertainment venue to below the noise limits specified in EPA Publication 1826 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. For the purpose of assessing whether the above noise standards are met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors closed (Part II, B1 of EPA Pub. 1826 does not apply).*
    - *Commercial, industrial or trade premises to below the noise limits specified in EPA Publication 1826 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. For the purpose of assessing whether the above noise standard is met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors (Part I, B3 of EPA Pub. 1826 does not apply).*
- Assessed recorded existing noise impacts against the nominated criteria.
- Where existing noise impacts were predicted to exceed noise criteria, provided recommendations for noise barriers and dwelling construction requirements for criterion conformance.

Provided that the recommendations contained in this report are implemented it is predicted that the Subject Development can provide suitable residential amenity with respect to acoustics without unduly encroaching on the existing uses in the area.

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1 Introduction

1.1 Overview

Renzo Tonin & Associates was engaged by City of Greater Geelong (CoGG) to provide an assessment of potential acoustic impacts relevant to the proposed residential redevelopment of Geelong Saleyards precinct.

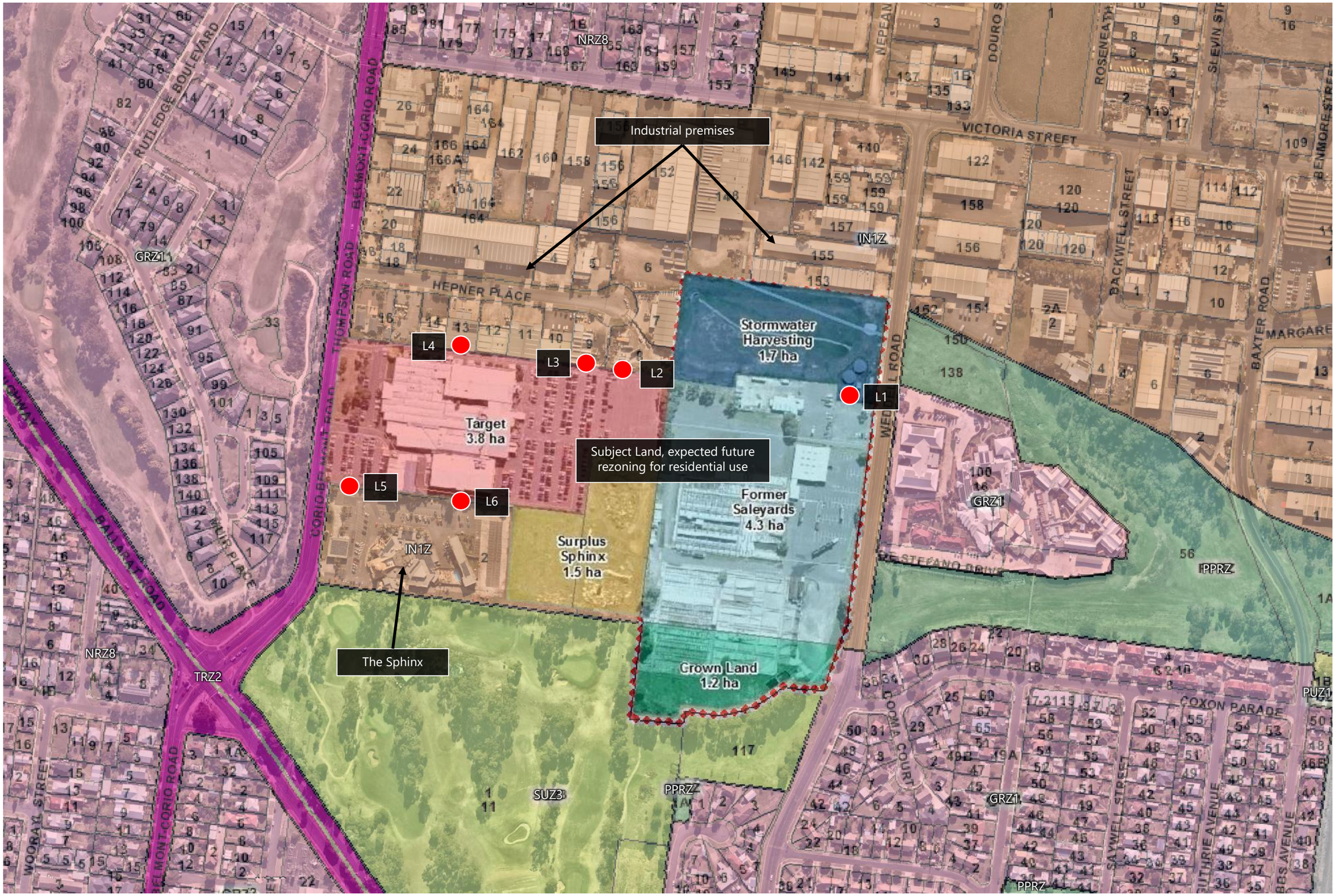
The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. APPENDIX A contains a glossary of acoustic terms used in this report.

1.2 Overview of proposed development

City of Greater Geelong has provided the following relevant land use and built form assumptions:

- Land use assumptions
  - Council supports a mixed-use development in the southern portion of the site with a focus on residential development (most likely medium to high density, including buildings up to five storeys)
  - Industries at the northern part of the study area will remain
  - The land likely to be redeveloped for housing includes the former Target site, the Saleyards, the Crown Land and the surplus Sphinx Site
  - Open space and potentially a small shopping strip may be included
- Built form assumptions
  - The existing business, Bellarine rural farm supplies and the building it occupies will not be retained
  - The existing office building on the former Target site will not be retained
  - All existing buildings on the Saleyards site will be demolished with the exception of a small tin shed on the western boundary and a small number of cattle pens
  - The Sphinx Hotel in the south-west of the study area will remain

Figure 1: Overview of Subject Land and surrounds



2 Existing noise environment

2.1 Noise sources

Based on a review of the existing site and surrounding uses, the following key noise sources have been identified:

- Industrial uses at the north-east of the site including high noise industry such as stonemasonry are expected to remain
- Industrial uses at the north and north-west of the site, including industrial buildings abutting the site with significant rooftop mechanical services plant and equipment are expected to remain
- Music noise, carpark noise and mechanical services plant and equipment associated with The Sphinx Hotel are expected to remain. Operational hours on its Licence (31916987) are 7:00am to 5:00am.

2.2 Site inspection and noise monitoring

Renzo Tonin & Associates made observations of the existing noise environment affecting the Subject Land during the following site visits:

- Thursday morning 20th June 2019 during monitor placement
- Wednesday afternoon 26th June 2019 during monitor retrieval

To quantify existing noise levels and noise emissions from the surrounding noise-emitting uses, Renzo Tonin & Associates conducted unattended noise monitoring from Thursday 20th June to Wednesday 26th June 2019. Noise monitors were placed at locations where they were expected to record highest noise impacts from surrounding existing uses. Noise monitor locations are presented in Figure 1 and described in Table 1. Noise monitor graphs are presented in APPENDIX D.

Table 1: Noise measurement locations

ID	Location	Description
•	Monitoring duration: Thursday 20th June to Wednesday 26th June 2019	
•	Monitors set to record broadband and spectral noise descriptors, and audio to assist in source recognition	
L1	Southeast extent of Stormwater Harvesting site	• Microphone approximately 4.5 metres from ground level atop inactive stormwater tank • Location selected to quantify noise impact from industrial activities concentrated towards the north-east of the proposal
L2	Northeast extent of former Target site	• Microphone approximately 3 metres above ground level at the boundary fence • Location selected to quantify noise impact from industrial activities to the north of the proposal
L3	North extent of former Target site, approximately 215m east of Thompson Road	• Microphone approximately 6.5 metres above ground level, 1m from boundary • Location selected to quantify noise impacts from rooftop mechanical services plant and equipment servicing the industrial premises directly to the north of the proposal

ID	Location	Description
L4	Northwest of former Target site, approximately 120m east of Thompson Road	• Microphone approximately 1.5 metres above ground level, at property boundary • Location selected to quantify noise impacts from partially screened industrial premises directly to the north of the proposal
L5	Southwest boundary of former Target site, approximately 30m east of Thompson Road	• Microphone approximately 1.5 metres above ground level, at property boundary • Location selected to quantify noise impacts from The Sphinx Hotel car park and entertainment activities
L6	South boundary of former Target site, approximately 130m east of Thompson Road	• Microphone approximately 1.5 metres above ground level, at property boundary • Location selected to quantify noise impacts from The Sphinx Hotel car park and mechanical services plant and equipment at the rear of The Sphinx Hotel

Notes: NTI XL2 Class 1 noise monitors were used for the campaign. Calibration of the devices was checked in the field immediately before and after the measurement using a Brüel & Kjær Type 4231 calibrator; no drift in calibration was observed.

The sound level meters conform with IEC 61672-1:2013 and IEC 61260-1:2014; the sound calibrator conforms with IEC 60942:2017, and; all carry manufacturers certification or NATA certification detailing Standard conformance testing within the last two years and one year respectively.

Table 2 and Table 3 below present the results of the noise monitor campaign.

Table 2: Minimum period average background noise levels

Monitoring location	Background noise level, L_{A90} dB(A)		
	Day	Evening	Night
L1 - Stormwater harvesting site	49	46	44
L2 - Former Target site, north east	48	46	43
L3 - Former Target site, north	48	47	43
L4 - Former Target site, north west	43	45	38
L5 - Thompson Road	54	52	44
L6 - Former Target site, South	46	48	44

Notes: Minimum period average background noise levels measured in absence of intrusive commercial noise sources.

Period Definitions:
Day: Monday to Saturday 7am - 6pm
Evening: Monday to Saturday 6pm - 10pm; Sundays 7am - 10pm
Night: All days 10pm - 7am

Table 3: Night time background noise level spectra

Monitoring location	Noise level L_{90} dB, at Frequency (Hz)						
	63	125	250	500	1k	2k	4k
L1 - Stormwater harvesting site	46	39	38	37	37	30	19
L2 - Former Target site, NE	44	42	39	36	35	27	15
L3 - Former Target site, N	44	42	40	37	38	30	17
L4 - Former Target site, NW	41	40	37	34	34	26	13
L5 - Thompson Road	48	46	39	38	36	27	15
L6 - Former Target site, S	46	43	41	37	36	27	19

Notes: Representative minimum 15 minute background noise level spectra observed to occur between midnight and 3am

3 Criteria

3.1 EPA Publication 1826

From 1 July 2021, EPA Publication 1826 *'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues'* (EPA Pub. 1826) superseded:

- *State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1), and
- *State Environment Protection Policy (Control of Music Noise from Public Premises) No. N-2* (SEPP N-2).
- EPA Publication 1411, *'Guidelines: Noise from Industry in Regional Victoria'* (NIRV)

For this assessment's application, EPA Publication 1826 uses materially the same methods to assess noise impacts as the superseded noise policies, but with slight amendments to the durations of day, evening and night.

3.1.1 Commercial noise limits - EPA Publication 1826-P1

Since the Subject Site is located within the Greater Geelong Major Urban Area, applicable noise limits for commercial activity are set out in Part 1 of EPA Publication 1826 '*Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*' (1826-P1). Table 4 presents the applicable EPA 1826-P1 noise limits, which are applicable for mechanical services and on-site commercial activities.

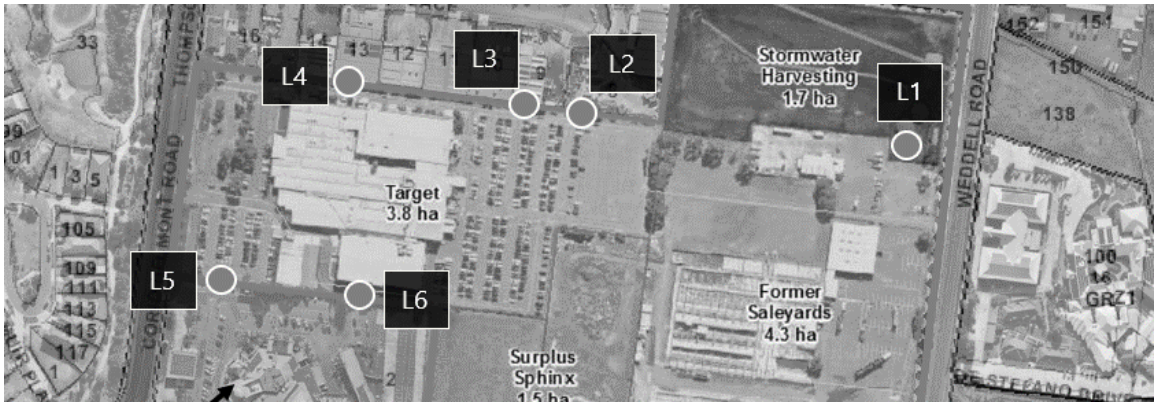
Note that although the Subject Land is currently zoned Industrial 1, the EPA Pub. 1826-P1 noise limits presented in Table 4 have been calculated on the basis that the area will be rezoned for residential use in the future. A zoning map is presented in Figure 1.

Table 4: EPA Pub. 1826-P1 noise limit

Period	Zoning level, L_{Aeq} dB(A)	Background L_{90} dB(A)	Background classification	EPA 1826-P1 limit L_{Aeq} dB(A)
L1 - stormwater harvesting site				
Day	52	49	High	**55**
Evening	46	46	High	**49**
Night	41	44	High	**47**
L2 - northeast (near industry)				
Day	57	48	Neutral	**57**
Evening	51	46	Neutral	**51**
Night	46	43	Neutral	**46**
L3 - north (near HVAC)				
Day	58	48	Neutral	**58**
Evening	52	47	Neutral	**52**
Night	47	43	Neutral	**47**
L4 - northwest				
Day	59	43	Low	**55**
Evening	52	45	Neutral	**52**
Night	47	38	Neutral	**47**
L5 - Thompson Road (front carpark, The Sphinx)				
Day	53	54	High	**60**
Evening	47	52	High	**55**
Night	42	44	High	**47**
L6 - Southeast (rear carpark, the Sphinx)				
Day	56	46	Neutral	**56**
Evening	50	48	Neutral	**50**
Night	45	44	High	**47**

EPA 1826 Period Definitions:
Day: Monday-to-Saturday 7am-to-6pm; Sundays NA
Evening: Monday-to-Saturday 6pm-to-10pm; Sundays 7am-to-10pm
Night: All days 10pm-to-7am

Notes: Background noise levels per Table 2



EPA 1826-P1 night-time noise limits are more stringent than that of the day or evening periods. As such, compliance during the night-time period implies compliance during the day and evening periods, provided that emitted noise levels do not vary. For this assessment the applicable location of assessment is outside surrounding dwellings, assessed over a 30-minute period.

EPA Pub. 1826-P1 sets out the following adjustments for assessment of noise sources:

Indoors	+ 20 dB if assessment is undertaken indoors within a sensitive premises meeting BCA 2006 energy efficiency requirements. *"The indoor adjustment is not meant to be used to determine the effectiveness of the design response and construction of buildings affected by noise from commercial, industry and trade premises."*

3.1.2 Music noise limits – EPA Publication 1826-P2

Music noise emissions from public premises are controlled and assessed in accordance with Part 2 of EPA Publication 1826 '*Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*' (EPA 1826-P2), which applies the following music noise limits:

- For the day/evening period: Music noise L_{eq} dB(A) shall not exceed the background noise L_{90} + 5 dB(A)
- For the night period: Music noise L_{OCT10} dB shall not exceed the background noise L_{OCT90} + 8 dB

EPA 1826-P2 period definitions:	Monday-to-Saturday:	7am-11pm;
	Sunday or a public holiday (other than if either is preceding a public holiday):	9am-10pm
	Sunday or a public holiday (if either is preceding a public holiday):	9am-11pm

The night-time noise criteria are more stringent than those applied during the day/evening periods, in particular at bass frequencies. Therefore, compliance with night period criteria generally implies compliance with day and evening period criteria. For this assessment, the applicable location of assessment is outside surrounding dwellings, assessed over a 15-minute period. Compliance with EPA 1826-P2 does not correspond to inaudibility. The applicable location of assessment is summarised below:

	External assessment location	**Internal assessment location**
Day /evening	Outside, near a habitable room	Inside a habitable room
Night	Outside a room used for the purposes of sleep	Inside a room used for the purposes of sleep
Reason for measuring at this location	All instances except…	…. where an outdoor measurement does not represent the noise impact within the habitable room

Noise limits derived from the measured background noise levels are presented below.

Table 5: EPA Pub. 1826-P2 external music noise limits

EPA 1826-P2 noise limits	**dB(A)**	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**
L1 - stormwater harvesting site								
Day, L_{Aeq}	54	-	-	-	-	-	-	-
Evening, L_{Aeq}	51	-	-	-	-	-	-	-
Night, L_{OCT10}	-	54	47	46	45	45	38	27

EPA 1826-P2 noise limits	dB(A)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
L2 - northeast (near industry)								
Day, L_{Aeq}	53	-	-	-	-	-	-	-
Evening, L_{Aeq}	51	-	-	-	-	-	-	-
Night, L_{OCT10}	-	52	50	47	44	43	35	23
L3 - north (near HVAC)								
Day, L_{Aeq}	53	-	-	-	-	-	-	-
Evening, L_{Aeq}	52	-	-	-	-	-	-	-
Night, L_{OCT10}	-	52	50	48	45	46	38	25
L4 – northwest								
Day, L_{Aeq}	48	-	-	-	-	-	-	-
Evening, L_{Aeq}	50	-	-	-	-	-	-	-
Night, L_{OCT10}	-	49	48	45	42	42	34	21
L5 – Thompson Road (front carpark, The Sphinx)								
Day, L_{eq}	59	-	-	-	-	-	-	-
Evening, L_{eq}	57	-	-	-	-	-	-	-
Night, L_{OCT10}	-	56	54	47	46	44	35	23
L6 – Southeast (rear carpark, the Sphinx)								
Day, L_{Aeq}	51	-	-	-	-	-	-	-
Evening, L_{Aeq}	53	-	-	-	-	-	-	-
Night, L_{OCT10}	-	54	51	49	45	44	35	27

EPA Pub. 1826-P2 night period definition: All times outside EPA Pub. 1826-P2 day-and-evening-period

Notes: Noise limits derived from background noise levels presented in Table 2 and Table 3

EPA Pub. 1826-P2 base noise limits are presented below. These are often applied within proposed dwellings in instances of residential encroachment (see Section 3.2.1).

Table 6: EPA Pub. 1826-P2 base music noise limits (often applied within proposed dwellings)

EPA 1826-P2 noise limits	dB(A)	EPA 1826-P2 night limits						
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Day, L_{Aeq}	32	-	-	-	-	-	-	-
Evening, L_{Aeq}	32	-	-	-	-	-	-	-
Night, L_{OCT10}	-	40	30	20	20	15	10	10

EPA Pub. 1826-P2 night period definition: All times outside EPA Pub. 1826-P2 day-and-evening-period

Note
1. Base noise limits applied for night period. Noise limits based on internal background noise levels may be higher once Subject Development has been constructed.
2. Internal noise limits may be applied due to encroachment of residential development on existing uses.

3.2 Greater Geelong Planning Scheme

3.2.1 Clause 53.06 - Live Music and Entertainment Noise

Greater Geelong Planning Scheme Clause 53.06 states the following with regard to the construction of any new noise sensitive residential use within 50m of a live music entertainment venue:

Application

This clause applies to an application required under any zone of this scheme to use land for, or to construct a building or construct or carry out works associated with:

- *a noise sensitive residential use that is within 50 metres of a live music entertainment venue.*

This clause does not apply to:

- *the extension of an existing dwelling.*

Requirements to be met…

A noise sensitive residential use must be designed and constructed to include acoustic attenuation measures that will reduce noise levels from any:

- *indoor live music entertainment venue to below the noise limits specified in State Environment Protection Policy (Control of Music Noise from Public Premises) No. N-2 (SEPP N2).*
- *outdoor live music entertainment venue to below 45dB(A), assessed as an L_{eq} over 15 minutes.*

For the purpose of assessing whether the above noise standards are met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors closed (Schedule B1 of SEPP N2 does not apply).

Department of Environment, Land, Water and Planning (DELWP) *Planning Practice Notice 81 - Live Music & Entertainment Noise, April 2022* (PNN 81) provides guidance in application of the Clause for residential uses:

*"**The Agent of Change Principle…***

In planning, the agent of change principle assigns responsibility for noise attenuation measures to the 'agent of change' – a new use or development that is introduced into an existing environment.

… a new residential development close to an existing live music venue will be responsible for noise attenuation of its building to protect future residents from the live music venue…..

Attenuating a Noise Sensitive Residential Use

Measures that may help meet the requirements of Clause 53.06 include:

- *locating noise-sensitive rooms (particularly bedrooms) away from significant noise exposure by using spaces like walkways, laundries and storage as a buffer*
- *using acoustic glazing, wall, ceiling and roof construction*
- *sealing gaps, joints and service penetrations and using acoustic insulation*
- *using setbacks and acoustic fencing*
- *using a noise masking system (for example by relying on heating, ventilation or air-conditioning noise)."*

3.2.2 Clause 55.07-6 Standard B40 and 58.04-3 Standard D16

Greater Geelong Planning Scheme Clause 55.07-6 (Standard B40) and 58.04-3 (Standard D16) provide target criteria for environmental noise impacts on new apartment developments in Victoria. These criteria cover continuous or semi-continuous noise sources including traffic and railway, and noise from industrial zones.

Apartment developments within a "noise influence area" must be designed and constructed to achieve applicable internal noise level targets. Table 7 below is adapted from Clause 58.04 and 55.07; and outlines any noise influence areas within which the Subject Development resides.

Table 7: Noise influence area assessment

Noise source	Noise influence area	Development within noise influence area?
Zone interface		
Industrial zone 1, 2 & 3	300m to the zone boundary	✓
Road		
Freeways and tollways	300m	×
Other roads carrying 40,000 Annual Average Daily Traffic Volume	300m	×
Railway		
Railway servicing passengers in Victoria	80m	×
Railway servicing freight in non-Metropolitan Melbourne	80m	×
Railway servicing freight in Metropolitan Melbourne	135m	×
Development within noise influence area/s and therefore subject to Clause 58.04/55.07 internal noise level criteria?		✓

Note:
- The noise influence area is measured from the closest part of the development building to the noise source.
- Traffic volumes reviewed per VicRoads Traffic Profile Viewer

As indicated in Table 7, the Subject Development is within 300m of an Industrial zone 1 and therefore Clause 55.07-6 Standard B40 and 58.04-3 Standard D16 noise criteria have been applied for the Subject Land. Table 8 presents the applicable internal noise level criteria.

Table 8: Clause 55.07 and 58.04 – internal noise level criteria

Type of occupancy / activity	Internal noise level criterion, dB(A)
Sleeping areas, $L_{Aeq,\ 8h}$ (from 10pm to 6am)	≤ 35
Living areas, $L_{Aeq,\ 16h}$ (from 6am to 10pm)	≤ 40

3.3 Australian Standard 2107:2016

Australian/New Zealand Standard AS/NZS 2107: 2016 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors (AS2107) provides target criteria for environmental noise impacts on apartments, as presented in Table 9. These criteria are typically applied for continuous or semi-continuous noise sources (mechanical plant, traffic etc.).

Table 9: AS2107 internal noise level criteria

Type of occupancies within apartments near entertainment districts or near major roads	Recommended design sound level range, L_{Aeq} dB(A)
Living areas	35 to 45
Sleeping areas[1]	35 to 40

Notes: 1. Criteria in sleeping areas has been applied during the night time period, 10pm to 6am

The criteria are presented in terms of satisfactory and maximum equivalent continuous (L_{eq}) noise levels over a *… sufficiently long period to characterise the sound source*. Design to Greater Geelong Planning Scheme Clause 55.07-6 Standard B40 and 58.04-3 Standard D16 is expected to result in internal noise levels consistent with AS2107.

3.4 Design targets for other noise sources

For noise sources which are not addressed by the above criteria, it is typical practice for Victorian acoustic consultants to apply design targets based on the following:

- A benchmark for continuous noise impacts measurable outside, generally consistent with EPA Pub. 1826-P1 (see Section 3.1)
- A design target for continuous noise impacts inside habitable rooms consistent with AS2107 (see Section 3.3) or EPA Pub. 1826-P1 (see Section 3.1) as appropriate.
- A sleep disturbance design target for noise peaks (L_{max}) received within bedrooms during the night

With respect to sleep disturbance, drawing on the results from an extensive survey of studies conducted world-wide on the impact of noise on domestic amenity, NSW EPA document '*Environmental Criteria for Road Traffic Noise, 1999*' (ECRTN) and the subsequent New South Wales Office of Environment and Heritage '*Road Noise Policy, March 2011'* (RNP), concluded that:

From the research on sleep disturbance to date it can be concluded that:

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

When a window to a room is open (such as might be required for natural ventilation during the night), it is commonly accepted that the noise level inside the room due to external sources would be 10dB(A) lower than the noise level outside the room. To summarise, the applicable criteria are presented in Table 10 below.

Table 10: Targets for other noise sources

Noise type	Benchmark outside dwellings (trigger for design to indoor targets)	Design target inside dwellings
Continuous noise (L_{Aeq})	EPA Pub. 1826-P1 outside habitable rooms	See Table 11
Noise peaks (L_{Amax})	L_{Amax} 60-65 dB(A) at night outside bedroom	L_{Amax} 50-55 dB(A) at night in bedrooms

4 Agent of change principle

Victorian Planning Provision / Greater Geelong Planning Scheme Clause 53.06 *'Live Music and Entertainment Noise'* introduces the agent of change principle to manage the relationship between live music venues and residential uses. For encroachment of new residential developments on existing venues, this is done by modifying EPA Pub. 1826-P2 to permit indoor assessment.

Victorian Planning Provision / Greater Geelong Planning Scheme Clause 55.07-6 and 58.04-3 set requirements for the average day and night noise levels not to exceed $L_{Aeq,16hour}$ 40 and $L_{Aeq,8hour}$ 35 respectively, when within 300 metres of industrial zones. However, a new residential development designed for conformance with Clause 55.07-6 and 58.04-3, would not prevent existing industry from exceeding EPA Pub. 1826-P1 $L_{Aeq,30min}$ criteria, outside and inside the new dwellings, even if operating at the benchmarked residential development design noise levels.

With the documented measured noise levels in this report as a noise level benchmark, we propose the following agent of change principle be applied to the proposed residential development; and if possible included in its planning design overlay:

Requirements to be met…

A noise sensitive residential use must be designed and constructed to include acoustic attenuation measures that will reduce noise levels from any:

- *Live music entertainment venue to below the noise limits specified in EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. For the purpose of assessing whether the above noise standards are met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors closed (Part II, B1 of EPA Pub. 1826 does not apply).*
- *Commercial, industrial or trade premises to below the noise limits specified in EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. For the purpose of assessing whether the above noise standard is met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors (Part I, B3 of EPA Pub. 1826 does not apply).*

Benchmark noise level impacts to be addressed by a noise sensitive residential use shall be as per Renzo Tonin & Associates Report MC944-01F02, dated 20 May 2022, entitled 'Geelong Saleyards Precinct Plan'.

Renzo Tonin & Associates has assessed existing noise impacts on the Subject Land, on the basis of the above agent of change principle.

5 External noise level assessment

As described in Section 2.2, noise monitors were placed at locations where they were expected to record highest noise impacts from surrounding existing uses.

As such, where criterion conformance is achieved at these locations, it is also expected to conform at other locations on the Subject Land.

Recorded audio, noise levels, and relevant facility operating times were reviewed to identify noise emissions from the relevant sources and exclude extraneous noise sources, as applicable.

Noise levels from the car park serving The Sphinx was observed to be negligible during the assessed period, and as such noise impacts from this noise source were modelled using a Cadna-A three-dimensional noise model, implementing ISO 9613 noise propagation algorithms; and car park noise levels from Renzo Tonin & Associates database.

Table 11presents the noise assessment.

Table 11: Existing external noise level assessment

Monitor location	Noise source	Observed operational hours	Measured outdoor noise level	Outdoor noise criterion	Observed outdoor noise levels conform?	Expected indoor noise level with typical construction[1]	Indoor target noise level	Indoor levels with typical construction expected to conform?	Comment
L1 - Stormwater harvesting site	**Industrial noise, north of site**	7:30am to 5:00pm, Monday to Friday	$L_{Aeq,30min}$ 49	EPA 1826-P1 day limit $L_{Aeq,30min}$ 55	**Yes**	$L_{Aeq,30min}$ 29	EPA 1826-P1 day indoor[2] $L_{Aeq,30min}$ 35	**Yes**	Rarely detectible, weekdays only.
	Daytime environmental noise level	6:00am to 10:00pm	$L_{Aeq,16hour}$ 57	-	-	$L_{Aeq,16hour}$ 37	Clause 55.07 $L_{Aeq,16hour}$ 40	**Yes**	
	Night time environmental noise level	10:00pm to 6:00am	$L_{Aeq,8hour}$ 51	-	-	$L_{Aeq,8hour}$ 31	Clause 55.07 $L_{Aeq,8hour}$ 35	**Yes**	
L2 – Former Target site, NE	**Industrial noise, north of site**	7:30am-5:00pm, Monday to Friday	$L_{Aeq,30min}$ 67	EPA 1826-P1 day limit $L_{Aeq,30min}$ 57	**No, 10dB excess**	$L_{Aeq,30min}$ 47	EPA 1826-P1 day indoor[2] $L_{Aeq,30min}$ 37	**No, 10dB excess**	11 events detected throughout monitor period, weekdays only. Internal assessment and acoustic treatments required for dwelling.
	Daytime environmental noise level	6:00am to 10:00pm	$L_{Aeq,16hour}$ 54	-	-	$L_{Aeq,16hour}$ 34	Clause 55.07 $L_{Aeq,16hour}$ 40	**Yes**	
	Night time environmental noise level	10:00pm to 6:00am	$L_{Aeq,8hour}$ 49	-	-	$L_{Aeq,8hour}$ 29	Clause 55.07 $L_{Aeq,8hour}$ 35	**Yes**	
L3 - Former Target site, N	**Mechanical services plant and equipment servicing industrial premises north of site**	7:30am-5:00pm, Monday to Friday	$L_{Aeq,30min}$ 66	EPA 1826-P1 day limit $L_{Aeq,30min}$ 58	**No, 8dB excess**	$L_{Aeq,30min}$ 46	EPA 1826-P1 day indoor[2] $L_{Aeq,30min}$ 38	**No, 8dB excess**	Internal assessment and acoustic treatments required for dwelling.
		4:00pm-9:00am Tuesday to Wednesday	$L_{Aeq,30min}$ 50	EPA 1826-P1 night limit $L_{Aeq,30min}$ 47	**No, 3dB excess**	$L_{Aeq,30min}$ 30	EPA 1826-P1 night indoor[2] $L_{Aeq,30min}$ 27	**No, 3 dB excess**	
	Daytime environmental noise level	6:00am to 10:00pm	$L_{Aeq,16hour}$ 56	-	-	$L_{Aeq,16hour}$ 36	Clause 55.07 $L_{Aeq,16hour}$ 40	**Yes**	
	Night time environmental noise level	10:00pm to 6:00am	$L_{Aeq,8hour}$ 50	-	-	$L_{Aeq,8hour}$ 30	Clause 55.07 $L_{Aeq,8hour}$ 35	**Yes**	
L4 - Former Target site, NW	**Mechanical services plant and equipment servicing industrial premises north of site**	Single event during daytime	$L_{Aeq,30min}$ 63	EPA 1826-P1 day limit $L_{Aeq,30min}$ 55	**No, 8dB excess**	$L_{Aeq,30min}$ 43	EPA 1826-P1 day indoor[2] $L_{Aeq,30min}$ 35	**No, 8dB excess**	Internal assessment and acoustic treatments required for dwelling.
	Daytime environmental noise level	6:00am to 10:00pm	$L_{Aeq,16hour}$ 53	-	-	$L_{Aeq,16hour}$ 33	Clause 55.07 $L_{Aeq,16hour}$ 40	**Yes**	
	Night time environmental noise level	10:00pm to 6:00am	$L_{Aeq,8hour}$ 44	-	-	$L_{Aeq,8hour}$ 24	Clause 55.07 $L_{Aeq,8hour}$ 35	**Yes**	
L5 - Thompson Road (front carpark, The Sphinx)	**Car park serving The Sphinx** nb. actual measured car park noise levels were negligible, so Renzo Tonin & Associates modelled noise impacts based on a vehicle moving in a car park continuously (L_{Aeq}), and slamming its boot at the boundary (L_{Amax}), [3].	7:00am-5:00am, 7 days	$L_{Aeq,30min}$ 55	EPA 1826-P1 benchmark Day: $L_{Aeq,30min}$ 60 Evening: $L_{Aeq,30min}$ 55 Night: $L_{Aeq,30min}$ 47	**No, 8 dB excess**	$L_{eq,30min}$ 35	EPA 1826-P1 benchmark indoors[2] Day: $L_{Aeq,30min}$ 40 Evening: $L_{Aeq,30min}$ 35 Night: $L_{Aeq,30min}$ 27	**No, 8 dB excess**	If single storey dwellings – Can conform with 2 metre noise barrier as discussed in Section 6. If two or more storey dwellings – Internal assessment and acoustic treatments required for dwelling.
			L_{AMax} 72	L_{AMax} 65	**No, 7 dB excess**	L_{AMax} 52	Sleep disturbance L_{Amax} 50-to-55	**Yes, provided windows are closed**	

Monitor location	Noise source	Observed operational hours	Measured outdoor noise level	Outdoor noise criterion	Observed outdoor noise levels conform?	Expected indoor noise level with typical construction[1]	Indoor target noise level	Indoor levels with typical construction expected to conform?	Comment
	Mechanical services serving the sphinx	7:00am-5:00am, 7 days	Not audible	EPA 1826-P1	**Yes**	-	-		
	Music noise (including understood live performance 22/06/2019)	7:00am-5:00am, 7 days	Not audible	EPA 1826-P2	**Yes**	-	-		
	Daytime environmental noise level - Traffic on Thompson Road	6:00am to 10:00pm	$L_{Aeq,16hour}$ 61	-	-	$L_{Aeq,16hour}$ 41	Clause 55.07 $L_{Aeq,16hour}$ 40	**Marginal excess**	
	Night time environmental noise level - Traffic on Thompson Road	10:00pm to 6:00am	$L_{Aeq,8hour}$ 54	-	-	$L_{Aeq,8hour}$ 34	Clause 55.07 $L_{Aeq,8hour}$ 35	**Marginal conformance**	
L6 - Southeast (rear carpark, The Sphinx)	**Car park (The Sphinx)** nb. actual measured car park noise levels were negligible, so Renzo Tonin & Associates modelled noise impacts based on a vehicle moving in a car park continuously (L_{Aeq}) , and slamming its boot at the boundary (L_{Amax}), [3].	7:00am-5:00am, 7 days	$L_{Aeq,30min}$ 55	EPA 1826-P1 benchmark Day: $L_{Aeq,30min}$ 56 Evening: $L_{Aeq,30min}$50 Night: $L_{Aeq,30min}$ 47	**No, 5 to 8 dB excess**	$L_{eq,30min}$ 35	EPA 1826-P1 benchmark indoors[2] Day: $L_{Aeq,30min}$ 36 Evening: $L_{Aeq,30min}$ 30 Night: $L_{Aeq,30min}$ 27	**No, 5 to 8 dB excess**	If single storey dwellings – Can conform with 2 metre noise barrier as discussed in Section 6. If two or more storey dwellings – Internal assessment and acoustic treatments required for dwelling.
			L_{AMax} 73	L_{AMax} 65	**No, 8 dB excess**	L_{AMax} 53	Sleep disturbance L_{Amax} 50-to-55	**Yes, provided windows are closed**	
	Mechanical services serving the sphinx	7:00am-5:00am, 7 days	Not audible	EPA 1826-P1	**Yes**	-	-	**Yes**	
	Music noise (including understood live performance 22/06/2019)	7:00am-5:00am, 7 days	Not audible	EPA 1826-P2	**Yes**	-	-	**Yes**	
	Daytime environmental noise level - Traffic on Thompson Road	6:00am to 10:00pm	$L_{Aeq,16hour}$ 51	-	-	$L_{Aeq,16hour}$ 31	Clause 55.07 $L_{Aeq,16hour}$ 40	**Yes**	
	Night time environmental noise level - Traffic on Thompson Road	10:00pm to 6:00am	$L_{Aeq,8hour}$ 48	-	-	$L_{Aeq,8hour}$ 28	Clause 55.07 $L_{Aeq,8hour}$ 35	**Yes**	

Notes:

(1) Predicted indoor noise levels, assuming 20dB noise reduction from outdoors to indoors, as observed for typical dwelling constructions, incorporating typical Rw27 6mm single glazing, with closed windows and doors

(2) EPA 1826-P1 applies a 20dB adjustment for indoor assessment. This adjustment has been applied directly to the noise limit (rather than plant noise level), to simplify comparison with other internal noise level criteria.

(3) Previously measured simulated worst-case car park activity noise levels, corresponding to L_{Aeq} 54 dB(A) at 5-10 metres from tested vehicle movement, and L_{Amax} 69 dB(A) at 5 metres from a car boot slam.

1826-P1 *EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises* (1826-P1) criteria for the Subject Land, as set out Section 3.1.

Clause 55 *Greater Geelong Planning Scheme Clause 55.07-6 Standard B40 and 58.04-3 Standard D16* criteria, as set out in Section 3.2.

1826-P2 *EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from entertainment venues* (1826-P2) criteria for the Subject Land, as set out Section 3.1

6 Residential design measures for acoustic amenity

Section 5 documents noise level at locations expected to receive the highest noise impacts from surrounding existing uses. To predict noise levels at other locations, a Cadna-A three-dimensional noise model implementing ISO 9613 noise propagation algorithms was developed. The following propagation effects were included in the predictive model:

- Local topography
- Mitigation of noise with distance, including geometrical spreading and air absorption
- Reflections from buildings and environment
- Barrier effects due to obstructions between noise sources and residential receivers
- Ground absorption effects

Results from the noise model were used to establish the extent of acoustic treatment requirements documented in the following subsections, and within APPENDIX B. APPENDIX C presents predicted noise level contours.

6.1 Noise barriers

For security and visual privacy, it is expected that fences will require to be installed at key locations separating the development from the surrounding existing operations. It is recommended that these barriers extend to a minimum height of 2 metres at the locations indicated in Figure 2 below and observe the following construction recommendations.

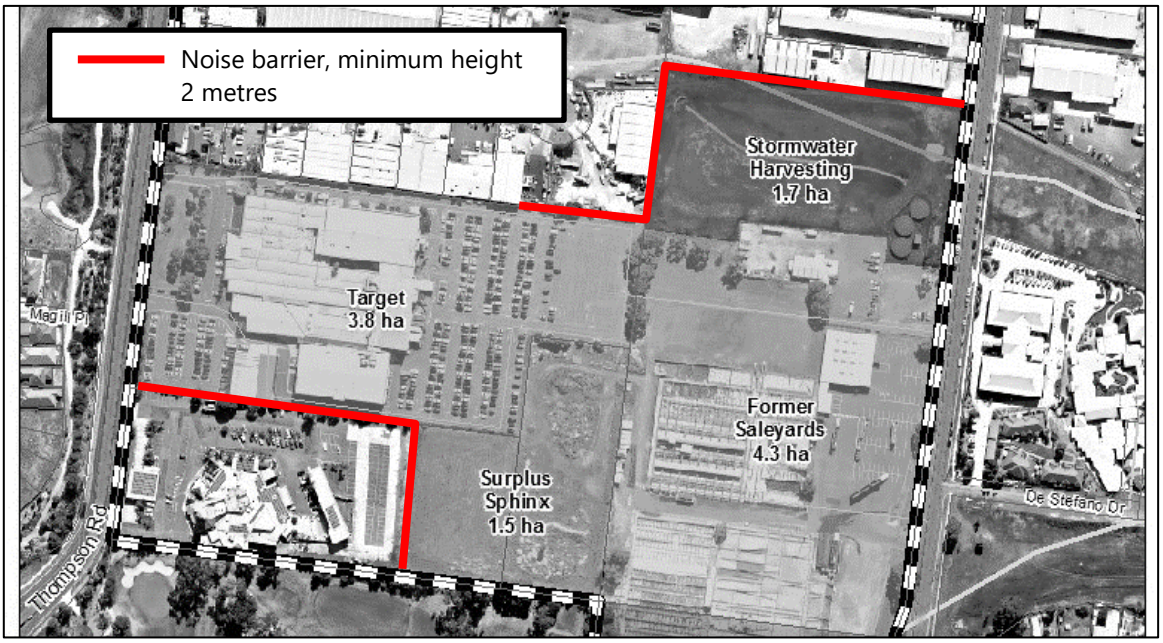
With incorporation of the barrier, car park noise levels (per Table 11), may be addressed with typical dwelling construction, and with minor upgrades at higher storeys.

Renzo Tonin & Associates recommends a noise barrier be constructed from any durable material with sufficient mass to prevent direct noise transmission, e.g., masonry, steel, fibrous-cement, timber, acrylic or polycarbonate, selected to withstand weather elements. A treated timber lapped-and-capped fence cold be used, provided it has no gaps so that it can perform as an effective noise screen. a Colorbond barrier is also acceptable.

Any noise barrier should give regard to the following to maintain acoustic integrity:

- Any penetrations through the fabric of the barrier should be sealed airtight.
- All joints and gaps between barrier panels/planks should be sealed airtight.
- Any gaps between the barrier and ground should be filled.
- Any gaps between the barrier and abutting building façades should be sealed airtight (if applicable)

Figure 2: Noise barrier locations



6.2 Dwelling acoustic treatment requirements

In addition to the barriers presented in Figure 2, the following additional design measures shall be required for residential internal criterion conformance, based on the measured existing benchmark noise levels. These recommendations are based on construction details for typical dwelling and apartment configurations, and may require review for atypical configurations.

APPENDIX B presents mark-ups showing the extent of the acoustic treatment requirements.

Table 12: Existing external noise level assessment

Noise contour category affecting facade (refer Appendix B)	Minimum acoustic rating (R_W) & description of typical construction of habitable rooms		
	Window & door assemblies	**Façade**	**Roof/ceiling**
Category A (black): ≥29dB(A) overall noise reduction to dwelling interior required (black)	R_W≥37 Requires acoustic consultant advice. Typically achieved with double glazing assembly consisting of one pane of 10.38mm thick laminated glass separated by an air cavity of 12mm from a secondary pane of 6mm float glass.	R_W ≥50 Light weight façade: not recommended, requires acoustic consultant advice. Masonry façade: Typical brick, blockwork or concrete with suitable studwork sitting 20mm clear of masonry, with thermal insulation and internal plasterboard for domestic amenity.	R_W ≥50 Light weight roof: not recommended, requires acoustic consultant advice. Concrete decking with suspended plasterboard ceiling and typical thermal bulk insulation suitable.
Category B (cyan): Approximately 25dB(A) overall noise reduction to dwelling interior required	R_W≥33 Typically achieved with: double glazing assembly consisting of two panes of 6mm thick float glass separated by an air cavity of 12mm; or 6.38mm thick single laminated glazing assembly.	Rw≥43 Light weight façade: Any external cladding over ≥9mm fibre cement sheet, on ≥90mm timber or steel studs with 90mm bulk insulation (ie. fibreglass, polyester) in stud cavities and ≥13mm plasterboard fixed to the interior. Masonry façade: Typical brick, blockwork or concrete with suitable studwork, thermal insulation and internal plasterboard for domestic amenity.	R_W ≥43 Typically achieved by a pitched roof clad with tiles & sarking or 0.6mm thick metal deck over a ceiling consisting of a layer of 13mm thick standard plasterboard with 200mm bulk insulation (ie. fibreglass, polyester). Eaves shall be boxed in using 6mm FC sheet or otherwise treated to prevent noise break-in to the roof cavity.
No Category: ≤20dB(A) overall noise reduction to dwelling interior required	No additional requirements beyond typical construction practice	No additional requirements beyond typical construction practice	No additional requirements beyond typical construction practice

Notes:

R_W 'Weighted sound reduction index' which relates to the desired noise reduction level.

Sarking A reflective foil laminate membrane product which is laid under roof tiles to act as a protective skin from moisture / weather.

- The commentary provided is in respect of acoustics only. Professional advice is required for fire ratings, structural design, buildability, wind loading, waterproofing, fitness for purpose and the like.
- The commentary is based on construction details for typical dwelling and apartment configurations, and requires review for atypical configurations. It is assumed that the total glazed area does not exceed 80% of one side of a typically configured habitable room. For 'No Category' predictions assume 20dB noise reduction from outdoors to indoors, as observed for typical dwelling constructions, incorporating typical Rw27 6mm single glazing, with closed windows and doors.
- "Overall noise reduction to dwelling interior", refers to the noise reduction from outside the dwelling façade, to within a habitable room of a dwelling.
- Any ventilation requirements shall be provided in a manner that does not diminish the sound insulation performance of habitable room constructions.
- The term "glazing assembly" means the glass, frame and seals including the perimeter seal at the wall junction. The specified R_w rating must be achieved by the glazing product specified or selected.
- The information in this table is provided for the purpose of Council feasibility study, and as such shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
- The builder shall ensure that installation techniques will not diminish the R_w performance of the partitions when installed on site.

7 Conclusion

Renzo Tonin & Associates has conducted an assessment of acoustic impacts that may affect the proposed residential redevelopment of Geelong Saleyards precinct.

EPA Victoria has issued a response letter (ref. REQ001805) dated 14 April 2021, in relation to the proposed Geelong Saleyards Precinct Plan. As part of the letter, the EPA has reviewed (the Acoustic Report) prepared by Renzo Tonin & Associates, entitled *"Geelong Saleyards Precinct Plan"* dated 19 July 2019 (ref: MC944-01F02 (r1)).

As set out in the EPA letter, the following recommendations from Council to consider in progressing the amendment, in relation to acoustics includes:

Noise

EPA has not undertaken a technical review of the Acoustic Report. Notwithstanding this, it is noted the Acoustic Report uses the assessment criteria from the State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No N-1 which has now been superseded by the:

- *Environment Protection Act 2017;*
- *Environment Protection Regulations 2021;*
- *Environment Reference Standards; and,*
- *EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*

It is noted that that some of the above are policy documents under Clause 13.05-1S of the Victorian Planning Provisions. When considering potential noise impacts on the proposed use and development, Council should ensure the Acoustic Assessment:

- *identifies risk of harm to the human health of nearby sensitive uses; and,*
- *where potential harm is identified, demonstrates that risks can be reduced to an acceptable level.*

Where potential harm is identified and mitigation measures are proposed, the planning authority should make provisions in the planning controls for the mitigation measures to be implemented / complied with.

In undertaking the assessment, Renzo Tonin & Associates has:

- Reviewed the Subject Land, surrounds, and possible development feasibility plans
- Inspected the Subject Land and placed noise monitors on site to record and benchmark existing noise impacts
- Set out relevant noise criteria:
  - *EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.*
  - *Greater Geelong Planning Scheme Clause 53.06 - Live Music and Entertainment Noise*
  - *Greater Geelong Planning Scheme Clause 55.07-6 Standard B40 and 58.04-3 Standard D16*
  - *Australian Standard 2107: 2016 Acoustics – Recommended Design Sound Levels…*
- Proposed the following agent of change principle to guide the Subject Land development:

- *Requirements to be met…*

  A noise sensitive residential use must be designed and constructed to include acoustic attenuation measures that will reduce noise levels from any:

  - *Live music entertainment venue to below the noise limits specified in EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. For the purpose of assessing whether the above noise standards are met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors closed (Part II, B1 of EPA Pub. 1826 does not apply).*
  - *Commercial, industrial or trade premises to below the noise limits specified in EPA Publication 1826.4 – Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. For the purpose of assessing whether the above noise standard is met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors (Part I, B3 of EPA Pub. 1826 does not apply).*

- Assessed recorded existing noise impacts against the nominated criteria.
- Where existing noise impacts were predicted to exceed noise criteria, provided recommendations for noise barriers and dwelling construction requirements for criterion conformance.

Provided that the recommendations contained in this report are implemented it is predicted that the Subject Development can provide suitable residential amenity with respect to acoustics without unduly encroaching on the existing uses in the area.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.		
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.		
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{A90} noise level if measured as an overall level or an L_{90} noise level when measured in octave or third-octave bands.		
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:		
	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro-Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.		
Free-field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.		
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.		

Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{Aeq} or L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the L_{Aeq}.
L_{max}	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the L_{Amax}.
Reflection	Sound wave reflected from a solid object obscuring its path.
R_w	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australa. R_w is measured and calculated using the procedure in ISO 717-1. The related field measurement is the $D_{nT,w}$. The higher the value the better the acoustic performance of the building element.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the R_w and the sound insulation between two rooms can be described by the $D_{nT,w}$.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 mico Pascal.

APPENDIX B Acoustic treatment requirements

Legend:

- Category A
- Category B

City of Greater Geelong

Consultant:

RENZO TONIN & ASSOCIATES
inspired to achieve
Acoustics, Vibration & Structural Dynamics
Sydney Melbourne Brisbane Gold Coast Kuwait

Project:
GEELONG SALEYARDS
PRECINCT MASTERPLAN

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Description:
MARKUP OF ACOUSTIC TREATMENT CATEGORIES, 4.5 height and above

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F15 (r0)	Grid:	MU_02
Date:	17/07/2019	Scale:	1: 1857 A3

Legend:

- Category A
- Category B

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Sydney Melbourne Brisbane Gold Coast Kuwait

Project:
GEELONG SALEYARDS
PRECINCT MASTERPLAN

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Description:
MARKUP OF ACOUSTIC TREATMENT CATEGORIES, 1.5 height

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F16 (r0)	Grid:	MU_01
Date:	17/07/2019	Scale:	1: 1857 A3

APPENDIX C Noise level contours

Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

City of Greater Geelong

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Sydney Melbourne Brisbane Gold Coast Kuwait

Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

Description:

NORTHEASTERN INDUSTRY, 1.5m height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F01 (r0)	Grid:	NE_01
Date:	16/07/2019	Scale:	1: 1857 A3

Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

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Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

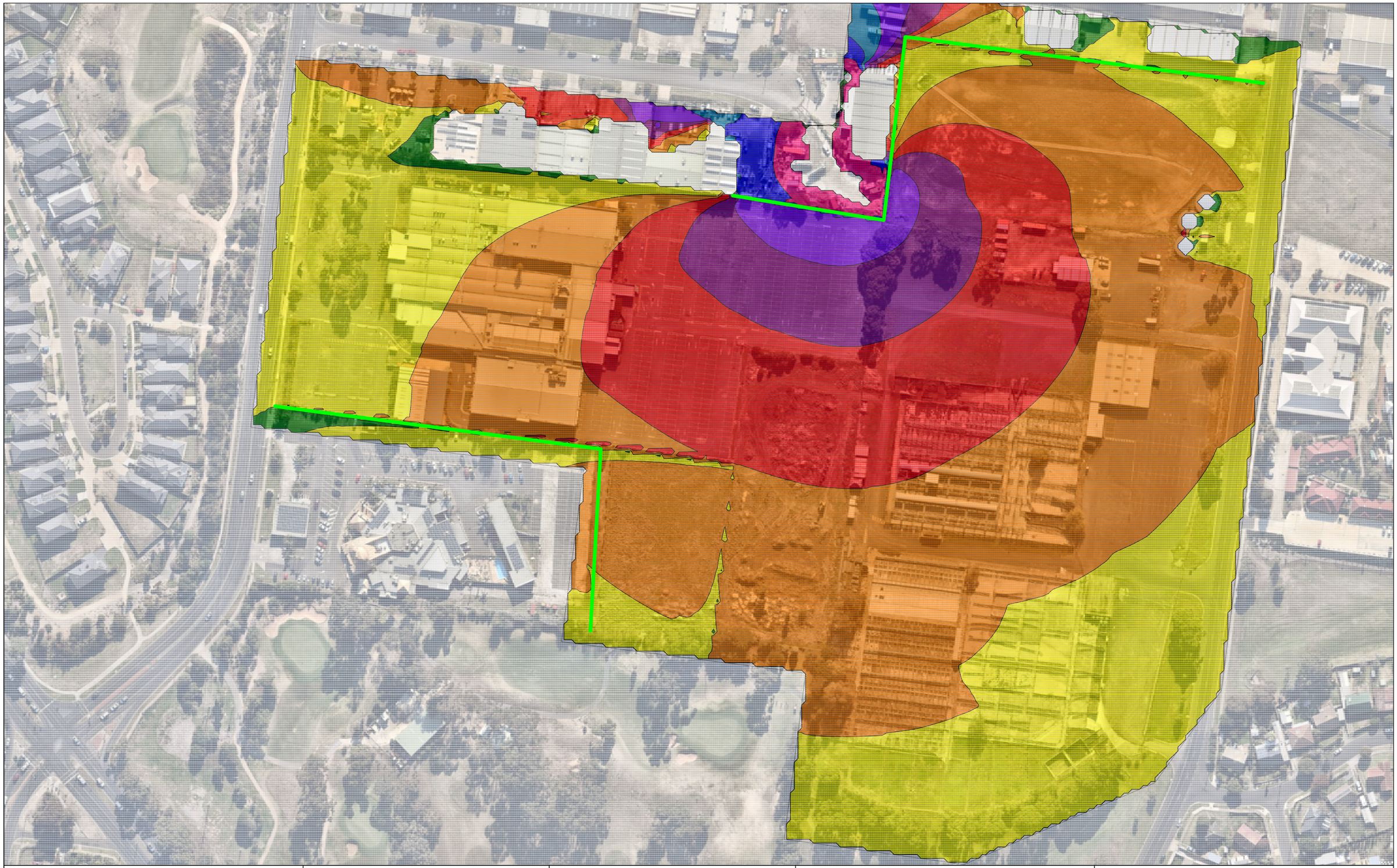
Description:

NORTHEASTERN INDUSTRY, 4.5m height

Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F02 (r0)	Grid:	NE_02
Date:	16/07/2019	Scale:	1: 1857 A3



Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

City of Greater Geelong

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Project:

GEELONG SALEYARDS

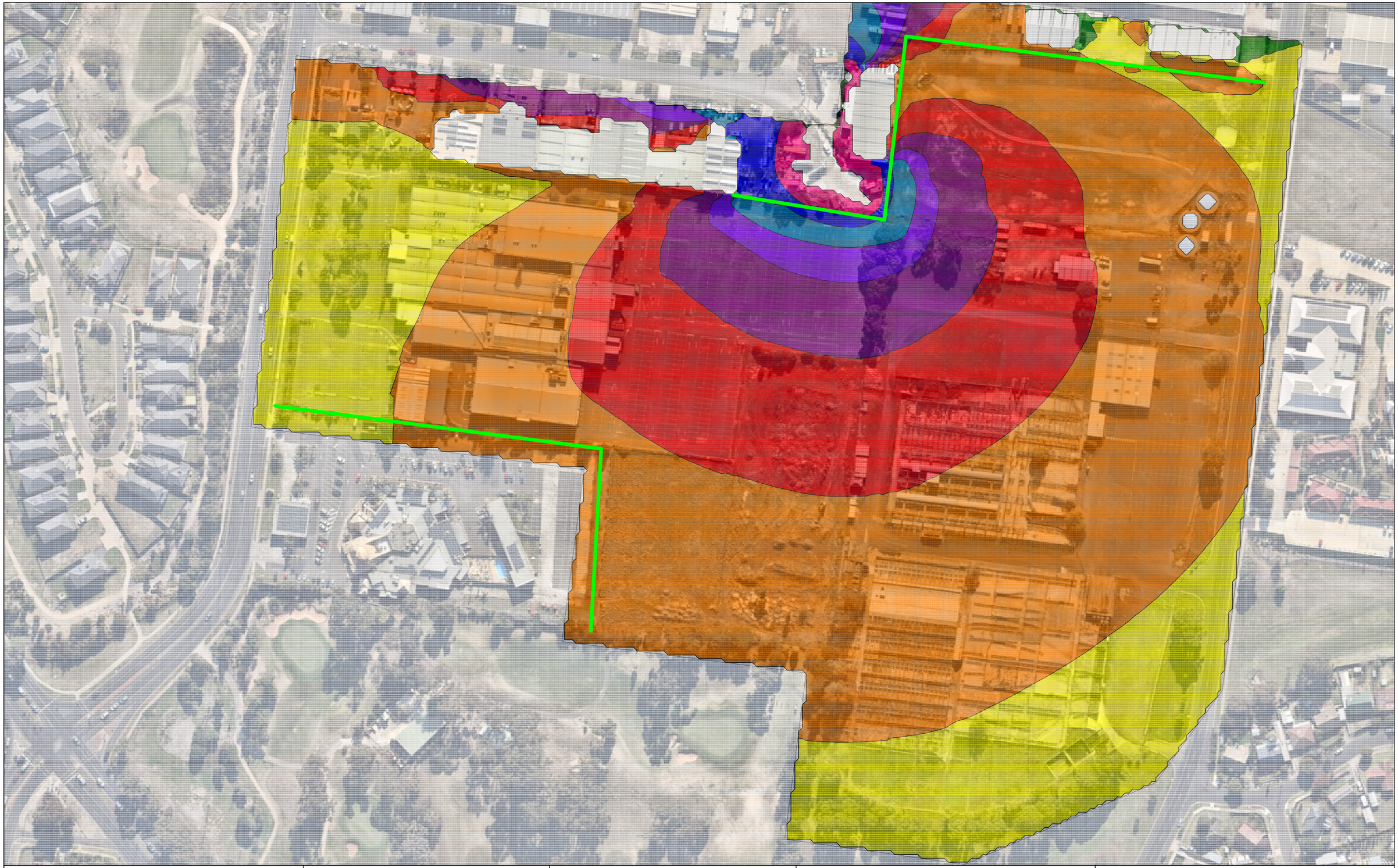
PRECINCT MASTERPLAN

Description:

NORTHERN INDUSTRY, 1.5m height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F03 (r0)	Grid:	N_01
Date:	16/07/2019	Scale:	1: 1857 A3



Legend:
Barrier

Noise Level - dB(A)
<35
35<= <40
40<= <45
45<= <50
50<= <55
55<= <60
60<= <65
65<= <70
70<=

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Project:
GEELONG SALEYARDS
PRECINCT MASTERPLAN

Description:
NORTHERN INDUSTRY, 4.5m height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F04 (r0)	Grid:	N_02
Date:	16/07/2019	Scale:	1: 1857 A3

Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

City of Greater Geelong

Consultant:

RENZO TONIN & ASSOCIATES

inspired to achieve

Acoustics, Vibration & Structural Dynamics

Sydney Melbourne Brisbane Gold Coast Kuwait

Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

Description:

NORTHERN HVAC, 1.5m height

Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F05 (r0)	Grid:	N2_01
Date:	16/07/2019	Scale:	1: 1857 A3

Legend:
Barrier

Noise Level - dB(A)
<35
35<= <40
40<= <45
45<= <50
50<= <55
55<= <60
60<= <65
65<= <70
70<=

City of Greater Geelong

Consultant:
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Project:
GEELONG SALEYARDS
PRECINCT MASTERPLAN

Description:
NORTHERN HVAC, 4.5m height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F06 (r0)	Grid:	N2_02
Date:	16/07/2019	Scale:	1: 1857 A3

Legend:

Barrier

Noise Level - dB(A)

- <35
- 35<= <40
- 40<= <45
- 45<= <50
- 50<= <55
- 55<= <60
- 60<= <65
- 65<= <70
- 70<=

City of Greater Geelong

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Project:

GEELONG SALEYARDS

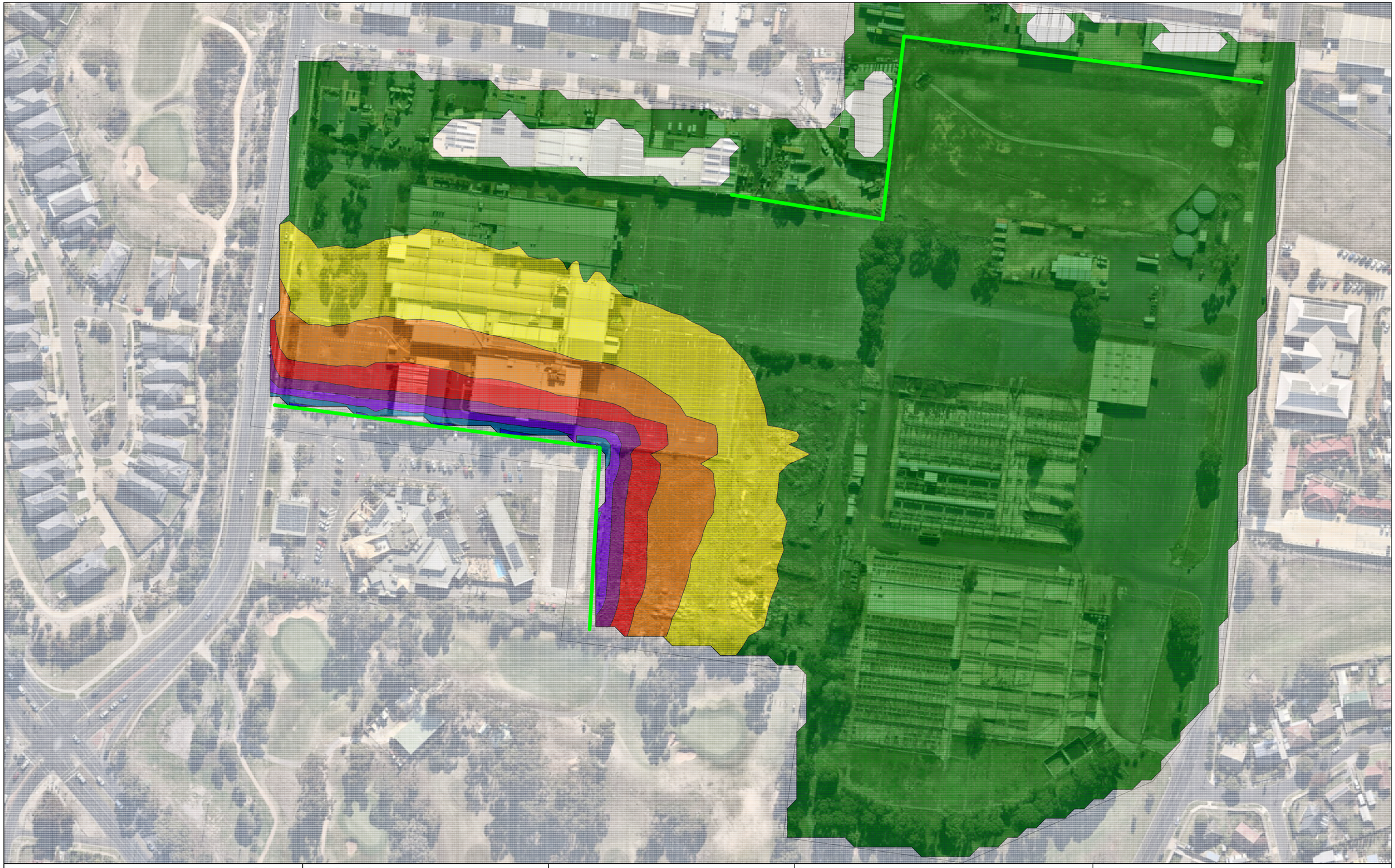
PRECINCT MASTERPLAN

Description:

CARPARK LMAX, 1.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F07 (r0)	Grid:	LM_01
Date:	16/07/2019	Scale:	1: 1857 A3



Legend:
- Barrier

Noise Level - dB(A)
- <35
- 35<= <40
- 40<= <45
- 45<= <50
- 50<= <55
- 55<= <60
- 60<= <65
- 65<= <70
- 70<=

City of Greater Geelong

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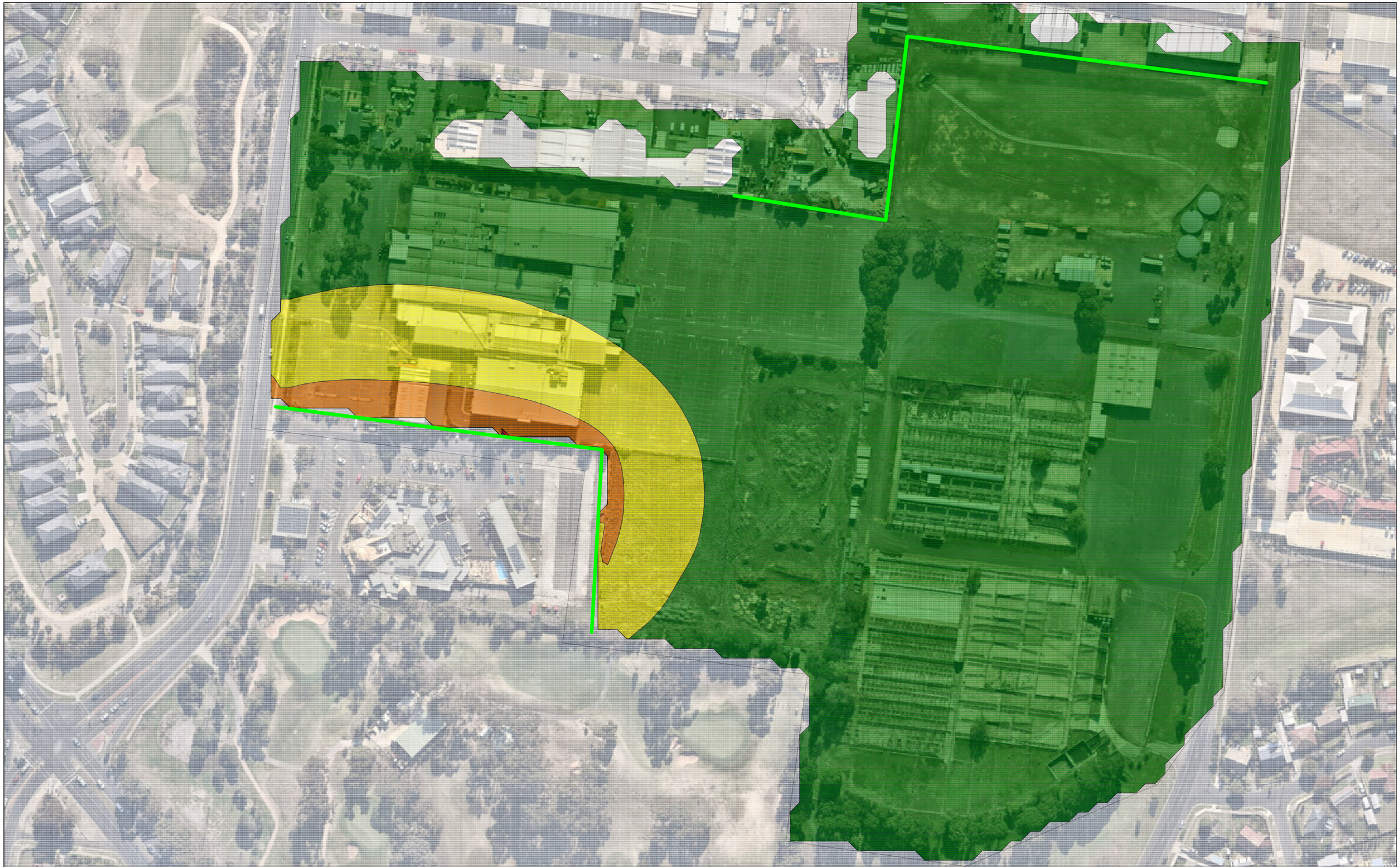
Project:
GEELONG SALEYARDS
PRECINCT MASTERPLAN

Description:
CARPARK LMAX, 4.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F08 (r0)	Grid:	LM_02
Date:	16/07/2019	Scale:	1: 1857 A3



Legend:

Barrier

Noise Level - dB(A)

- <35
- 35<= <40
- 40<= <45
- 45<= <50
- 50<= <55
- 55<= <60
- 60<= <65
- 65<= <70
- 70<=

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Sydney Melbourne Brisbane Gold Coast Kuwait

Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

Description:

CARPARK LEQ, 1.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F09 (r0)	Grid:	LE_01
Date:	16/07/2019	Scale:	1: 1857 A3

Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

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Sydney Melbourne Brisbane Gold Coast Kuwait

Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

Description:

CARPARK LEQ, 4.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F10 (r0)	Grid:	LE_02
Date:	16/07/2019	Scale:	1: 1857 A3

Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

City of Greater Geelong

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Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

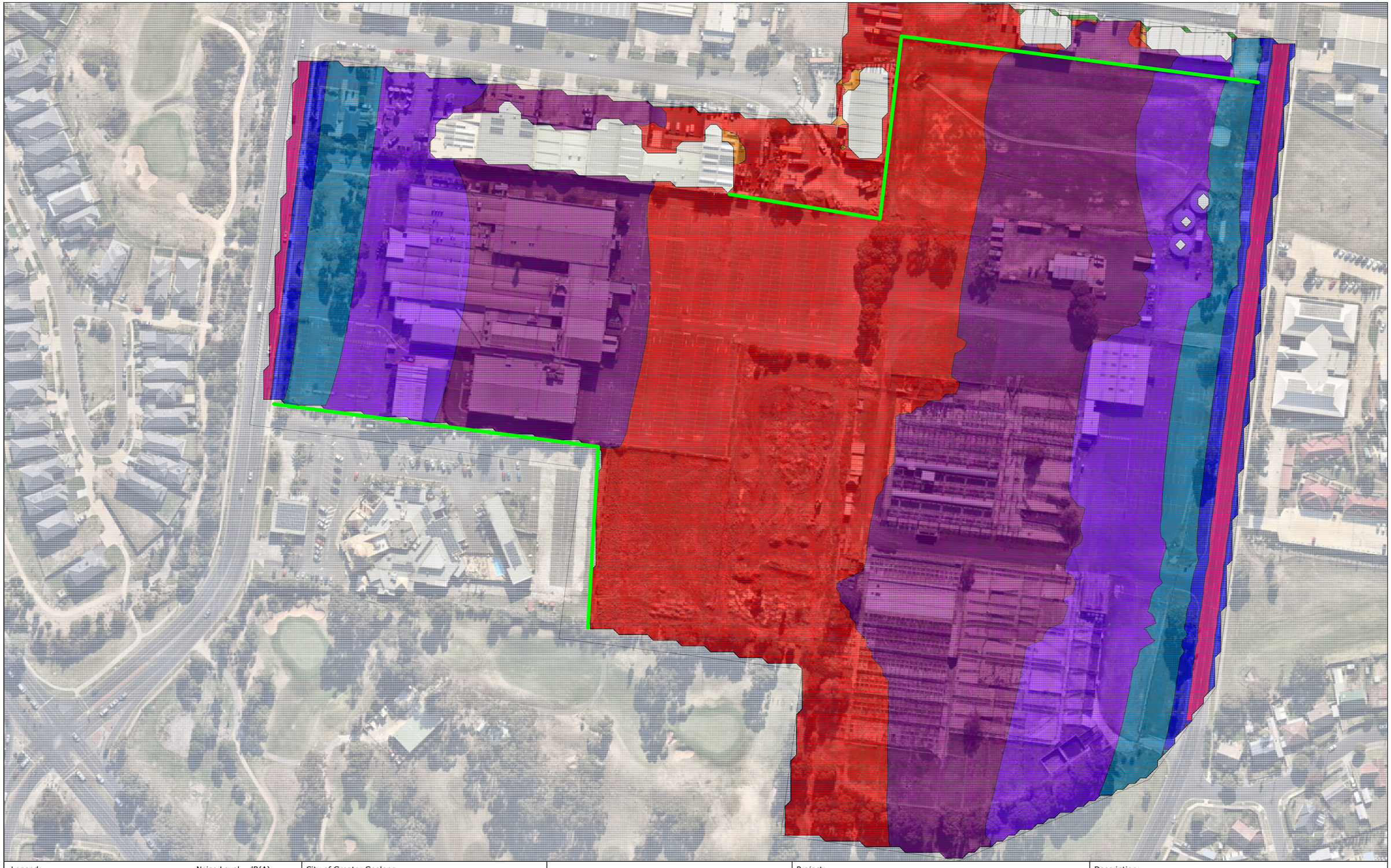
Description:

TRAFFIC DAY, 1.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F11 (r0)	Grid:	TD_01
Date:	17/07/2019	Scale:	1: 1857 A3



Legend:

Barrier

Noise Level - dB(A)

	<35
35<=	<40
40<=	<45
45<=	<50
50<=	<55
55<=	<60
60<=	<65
65<=	<70
70<=	

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Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

Description:

TRAFFIC DAY, 4.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F12 (r0)	Grid:	TD_02
Date:	17/07/2019	Scale:	1: 1857 A3

Legend:

Barrier

Noise Level - dB(A)

- <35
- 35<= <40
- 40<= <45
- 45<= <50
- 50<= <55
- 55<= <60
- 60<= <65
- 65<= <70
- 70<=

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Sydney Melbourne Brisbane Gold Coast Kuwait

Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

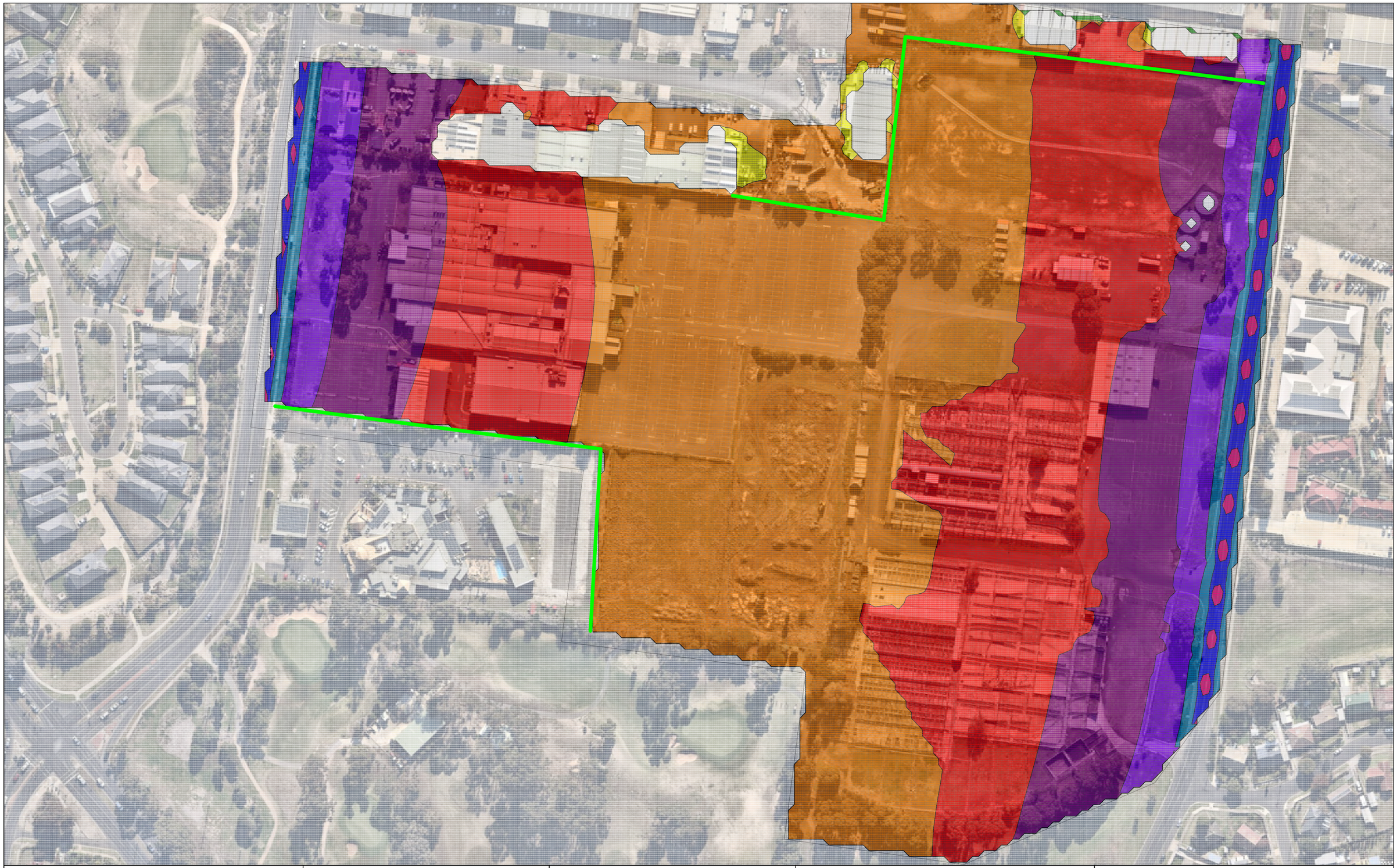
Description:

TRAFFIC NIGHT, 1.5 height

Noise levels are approximate due to interpolation of contours and should be used for reference only.

For information only and not for construction.

Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F13 (r0)	Grid:	TN_01
Date:	17/07/2019	Scale:	1: 1857 A3



Legend:

Barrier

Noise Level - dB(A)

	<35
	35<= <40
	40<= <45
	45<= <50
	50<= <55
	55<= <60
	60<= <65
	65<= <70
	70<=

City of Greater Geelong

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Acoustics, Vibration & Structural Dynamics

Sydney Melbourne Brisbane Gold Coast Kuwait

Project:

GEELONG SALEYARDS

PRECINCT MASTERPLAN

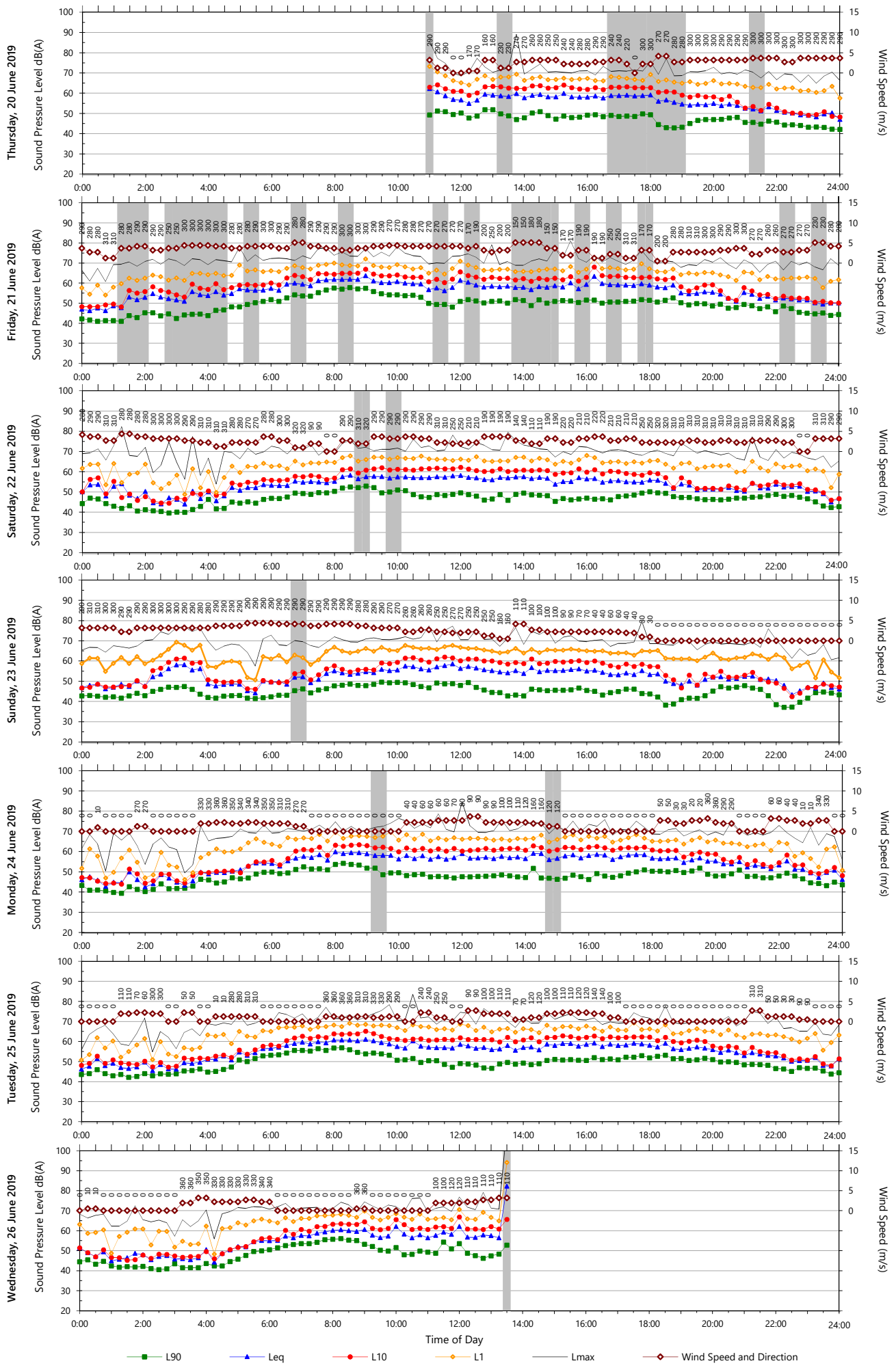
Description:

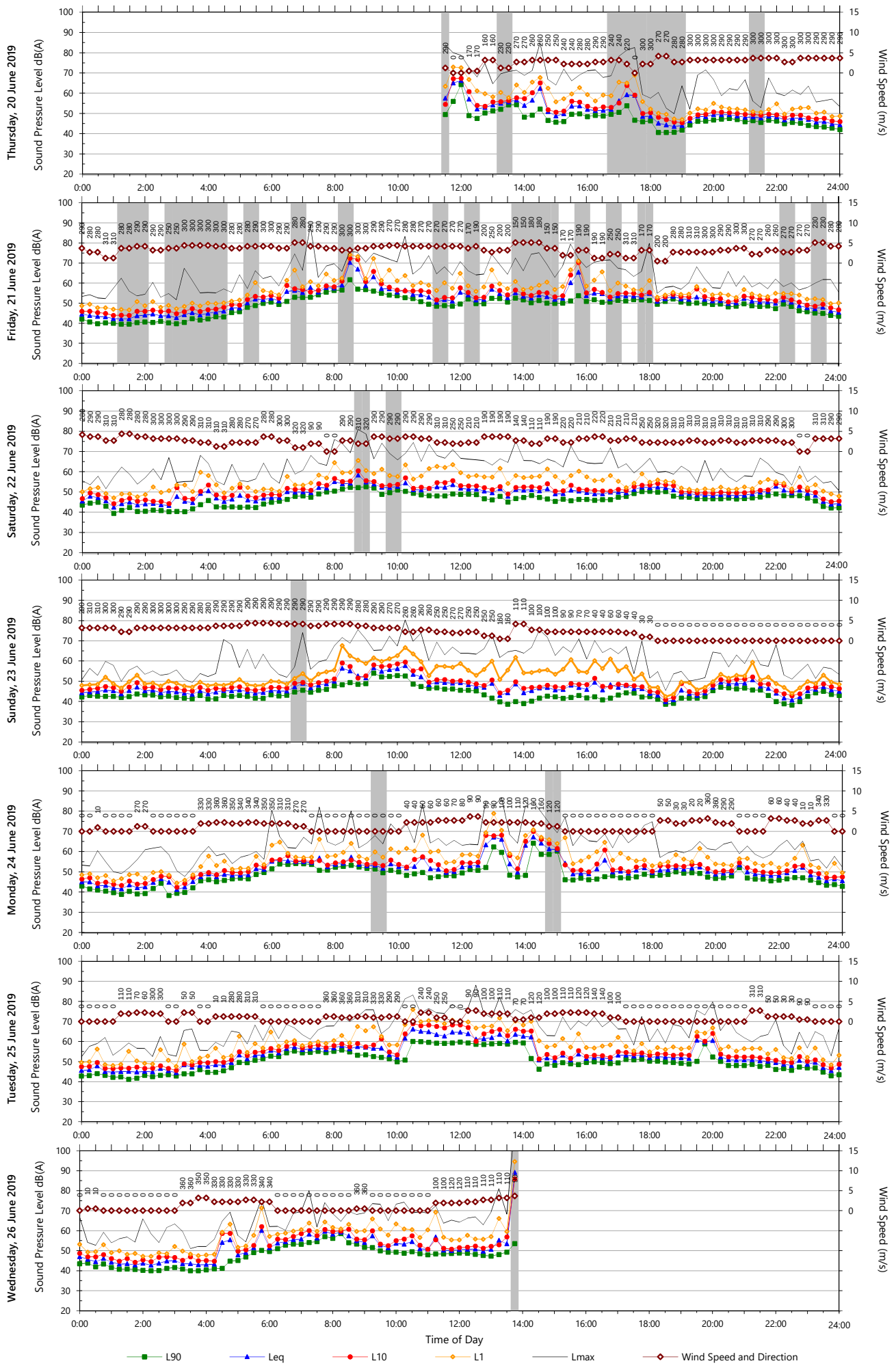
TRAFFIC NIGHT, 4.5 height

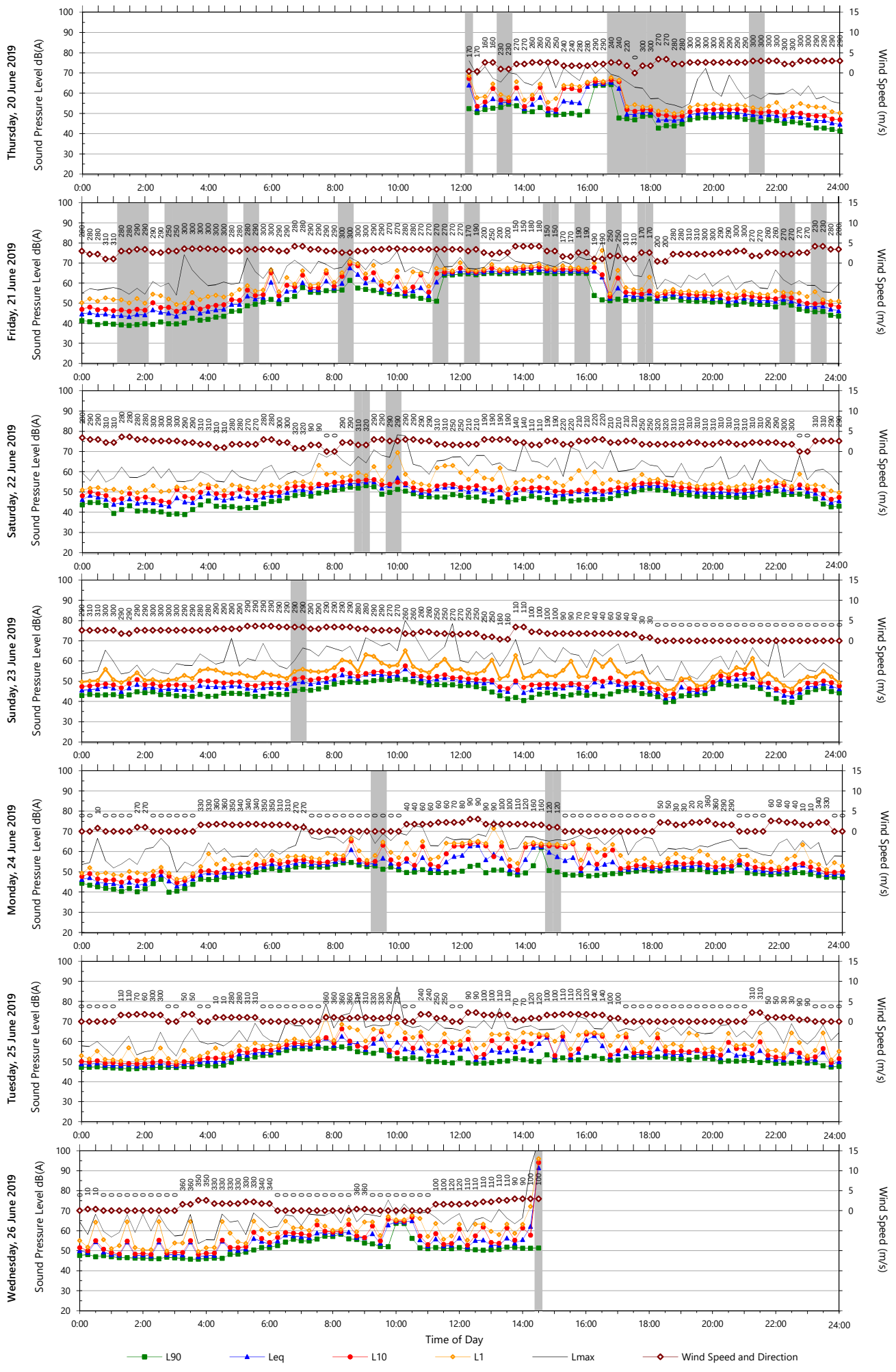
Noise levels are approximate due to interpolation of contours and should be used for reference only.
For information only and not for construction.

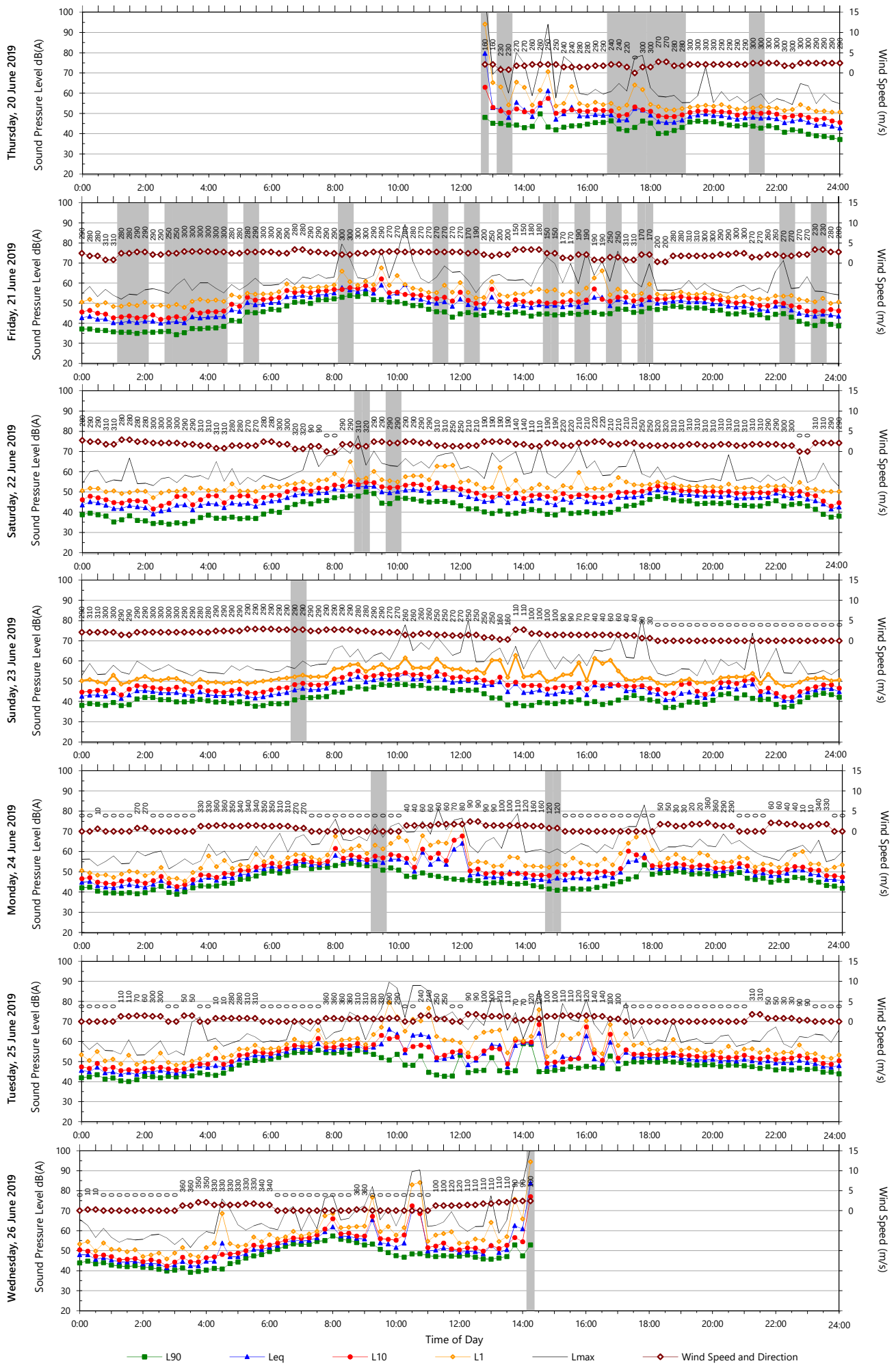
Project No.:	MC944-01	Created by:	MW
Fig Ref:	MC944-01F14 (r0)	Grid:	TN_02
Date:	17/07/2019	Scale:	1: 1857 A3

APPENDIX D Noise monitor graphs


Thursday, 20 June 2019
Friday, 21 June 2019
Saturday, 22 June 2019
Sunday, 23 June 2019
Monday, 24 June 2019
Tuesday, 25 June 2019
Wednesday, 26 June 2019
Sound Pressure Level dB(A)
Wind Speed (m/s)
Time of Day
L90
Leq
L10
L1
Lmax
Wind Speed and Direction

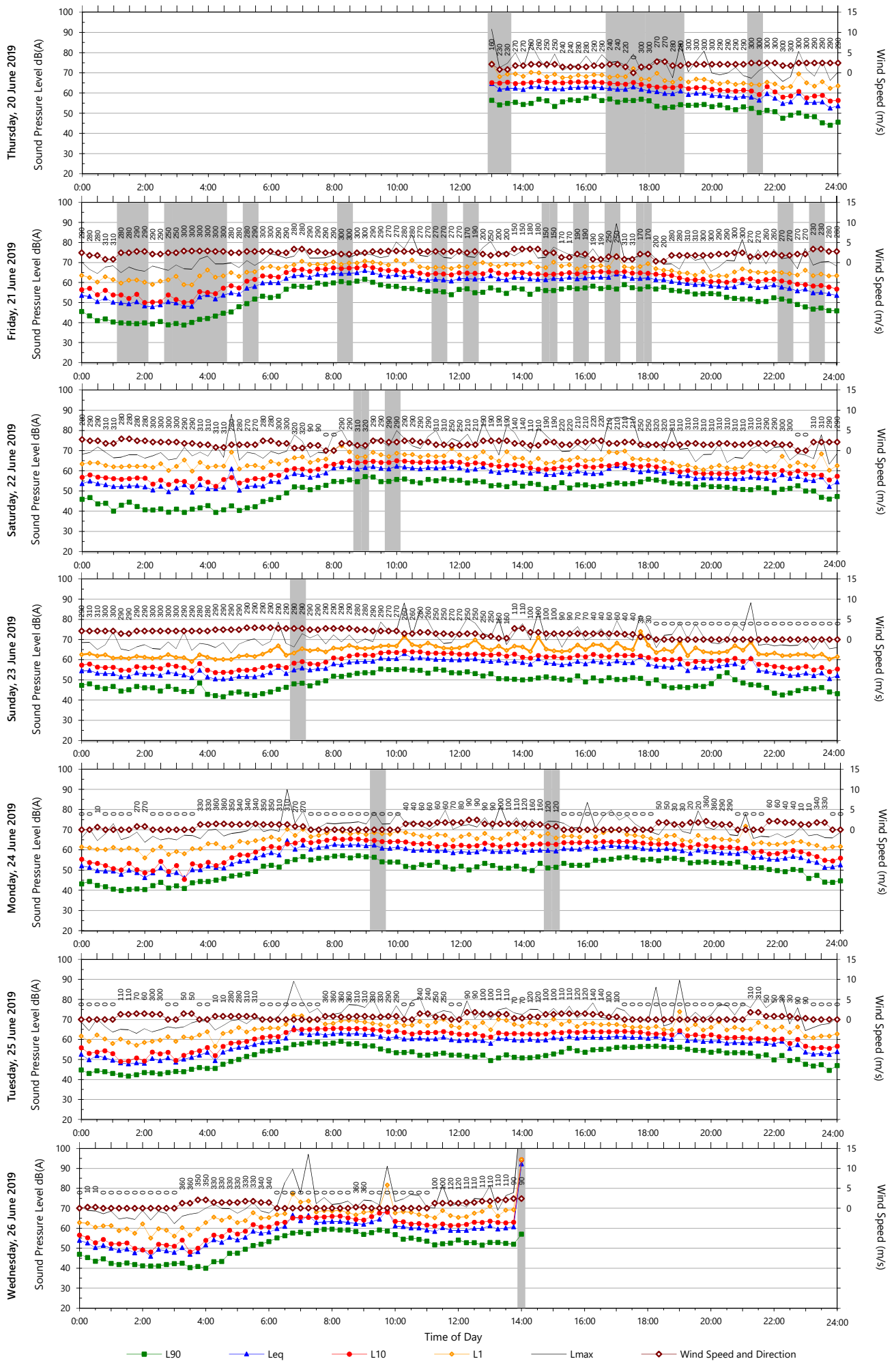

Thursday, 20 June 2019
Friday, 21 June 2019
Saturday, 22 June 2019
Sunday, 23 June 2019
Monday, 24 June 2019
Tuesday, 25 June 2019
Wednesday, 26 June 2019
Sound Pressure Level dB(A)
Wind Speed (m/s)
Time of Day
L90
Leq
L10
L1
Lmax
Wind Speed and Direction

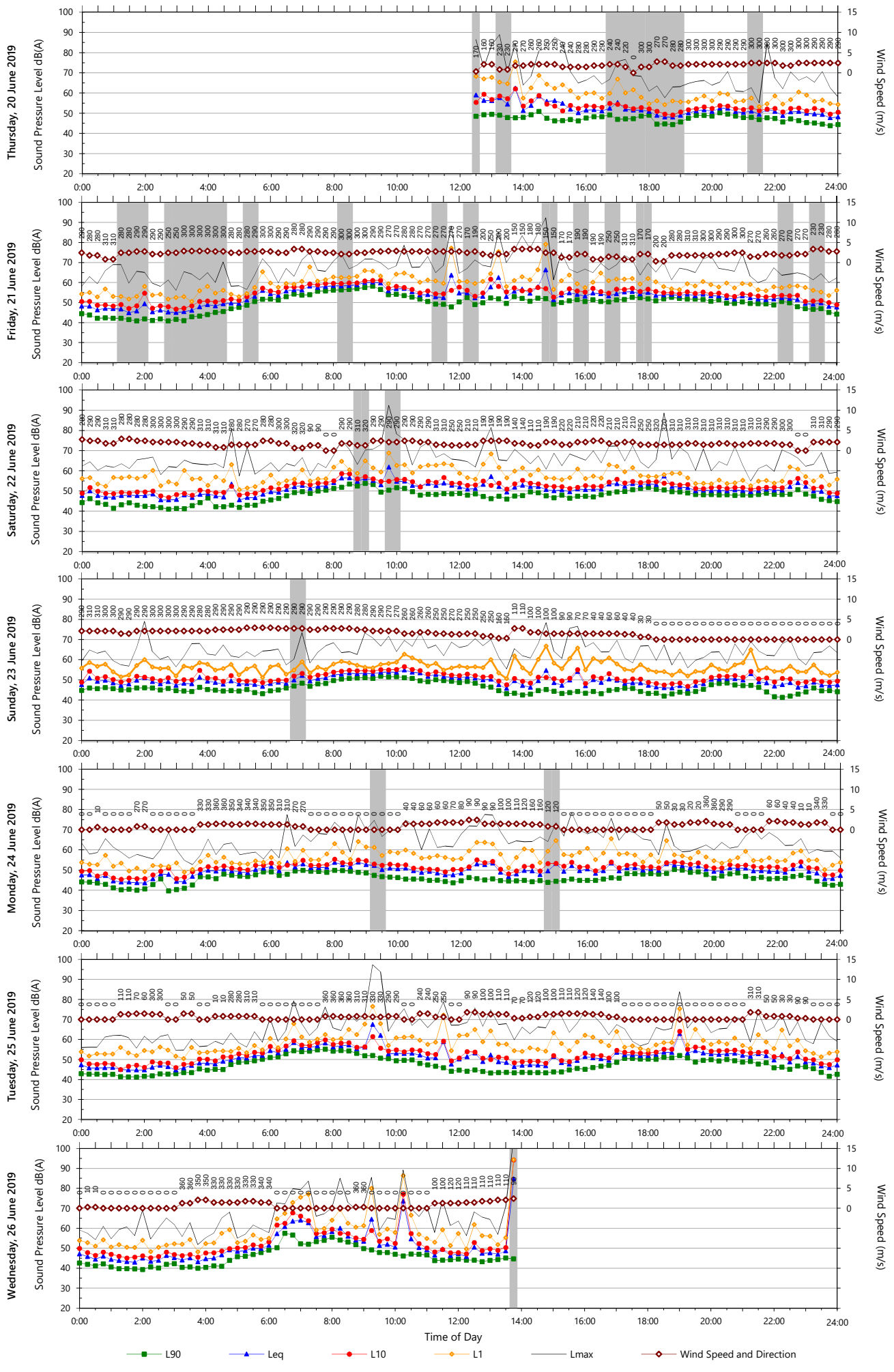

Thursday, 20 June 2019
Friday, 21 June 2019
Saturday, 22 June 2019
Sunday, 23 June 2019
Monday, 24 June 2019
Tuesday, 25 June 2019
Wednesday, 26 June 2019
Sound Pressure Level dB(A)
Wind Speed (m/s)
Time of Day
L90
Leq
L10
L1
Lmax
Wind Speed and Direction


Thursday, 20 June 2019
Friday, 21 June 2019
Saturday, 22 June 2019
Sunday, 23 June 2019
Monday, 24 June 2019
Tuesday, 25 June 2019
Wednesday, 26 June 2019
Sound Pressure Level dB(A)
Wind Speed (m/s)
Time of Day
L90
Leq
L10
L1
Lmax
Wind Speed and Direction

Unattended Monitoring Results

Location: L05 Thompson Road




Thursday, 20 June 2019
Friday, 21 June 2019
Saturday, 22 June 2019
Sunday, 23 June 2019
Monday, 24 June 2019
Tuesday, 25 June 2019
Wednesday, 26 June 2019
Sound Pressure Level dB(A)
Wind Speed (m/s)
Time of Day
L90
Leq
L10
L1
Lmax
Wind Speed and Direction