Lake Macquarie Fair shopping centre

Noise Impact Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy Pty Ltd has been engaged to conduct an acoustic assessment for the purpose of assessing the potential impacts on the acoustic amenity of the proposed Lake Macquarie Fair redevelopment, Lake Macquarie for both external noise impacts as part of the Planning Application submission. The noise sources investigated are as follows:

- Noise emissions associated with traffic generated from the site on surrounding receivers.
- Noise emissions from the site including mechanical plant and equipment noise to surrounding receivers.

Unattended and attended noise monitoring was conducted in order to determine the existing environmental noise levels around the perimeter of the site.

The report will address noise generated from the development to surrounding properties including building services and traffic movements. Detailed design of the mechanical plant will be provided as part of the CC submission for each stage of the project. This study will set the goal assessment criteria applicable to the project based on the Environmental Protection Authority (EPA) requirements, other council and relevant statutory/regulatory requirements.

2 SITE DESCRIPTION

Figure 1 below illustrates the location of the proposed Lake Macquarie Fair redevelopment site, and the location of noise monitoring and measurements.

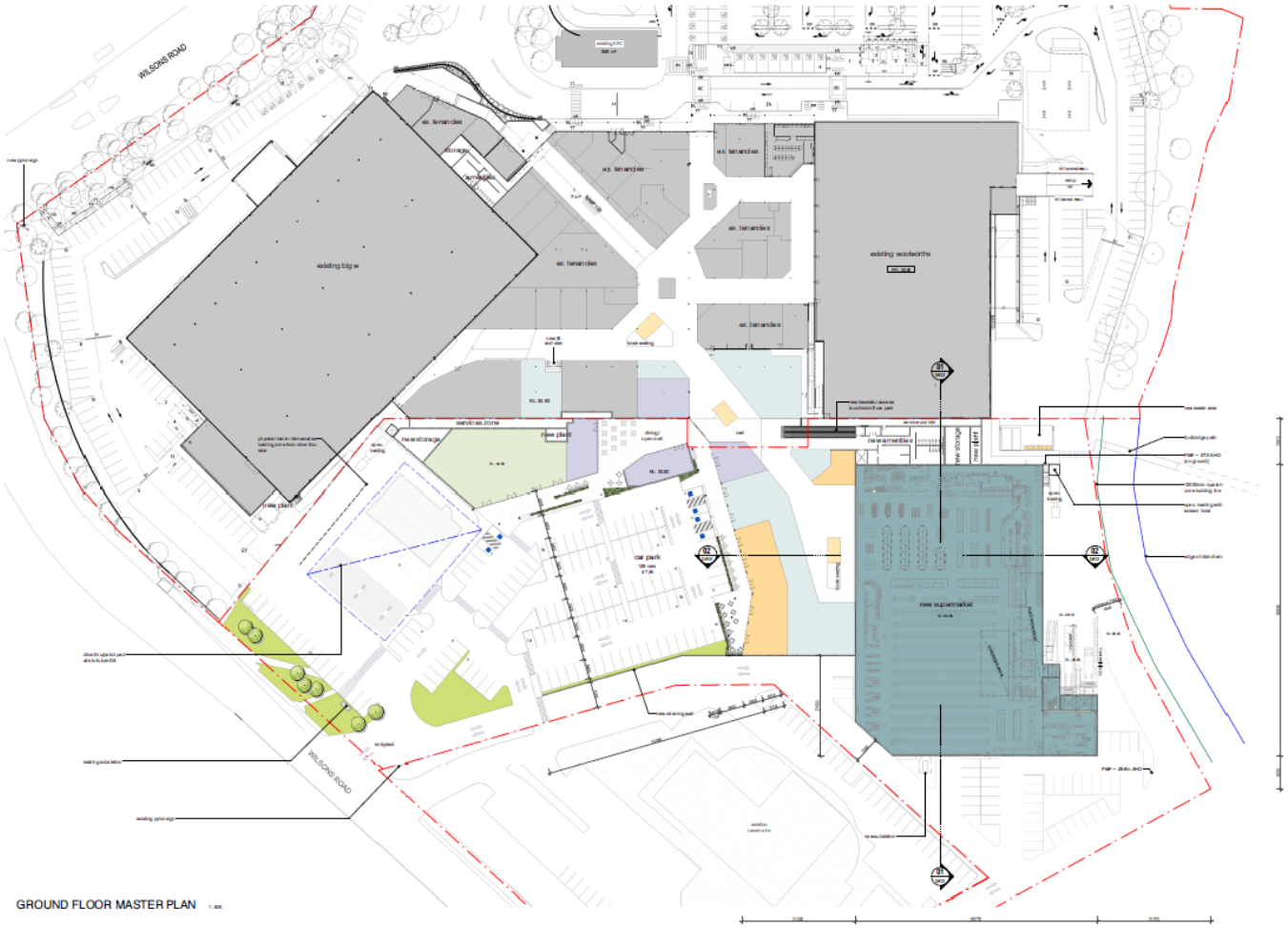


Figure 1 – Proposed development site

Figure 2 – Site Location and Measurement Positions

The existing environmental noise sources affecting the site are as follows:

- The development is affected by environmental noise predominantly from traffic noise from Wilson Road to the south of the site which carries medium to high volumes of traffic.
- Other surrounding boundaries are neighboured by existing retail commercial including a number of existing plant and equipment items which are generating noise.

The environmental noise source outlined above has varying degrees of impact upon the proposed development which will be outlined in this report.

3 EXISTING ACOUSTIC ENVIRONMENT

Environmental noise impacting the site is a result of traffic noise from the surrounding perimeter roadways and other surrounding land existing land uses.

3.1 TOPOGRAPHY

The topography of the site and surrounding land of the proposed development is generally flat, the acoustic assessment has taken this topography into account.

4 ACOUSTIC SURVEY

As part of this assessment an acoustic survey of the proposed Lake Macquarie Fair redevelopment site has been conducted.

The acoustic survey included attended and unattended noise logging which is detailed in this section of the report.

4.1 ENVIRONMENTAL NOISE LEVELS

Environmental noise constantly varies in level, due to fluctuations in local noise sources including road traffic. Accordingly, a 15 minute measurement interval is normally utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In the case of environmental noise three principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source depends on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of industrial noise.

4.2 ATTENDED NOISE MEASUREMENTS

Attended noise level measurements conducted as part of this assessment are detailed in this section of the report. All noise levels undertaken as part of this assessment were conducted in conjunction with the requirements of AS1055.

4.2.1 Measurement Equipment

Attended measurements were undertaken using a Norsonic 140 sound level analyser, set to A-weighted fast response. The sound level analyser was calibrated before and after the measurements, no significant drift was noted.

4.2.2 Measurement Period

Noise measurements was conducted at the locations detailed in Figure 2 in Section 2 above during the following period:

1. Peak afternoon conditions between 4.30pm and 6pm on the 19th of January, 2016.

2. Attended measurements were conducted on the evening of the 19th of January, 2016during a period when the existing centre was not impacting on noise levels surrounding site between the hours of 11pm and midnight.

4.3 UNATTENDED NOISE MONITORING

Unattended noise monitoring conducted as part of this assessment is detailed in this section of the report. The results of unattended noise logging are included in Appendix A.

4.3.1 Unattended Monitoring Period

Unattended noise monitoring was conducted at the site during the period of 19th to 26th January 2016 in order to measure the existing background and environmental noise levels at the site.

The noise level monitors were located at the following locations:

1. Location 1 – Within the existing land directly to the east of the site within a vegetated area as detailed in Figure 2 of this report. The location was selected as it was not impacted from direct road noise and is a representative location for the exiting background noise levels are the surrounding reciviers.

4.3.2 Monitoring Equipment

Unattended noise measurements were obtained using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noise monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator. No significant drift was detected. All measurements were taken on A-weighted fast response mode. Periods of adverse weather conditions during the during the measurement period have not be used in this assessment.

4.4 RESULTS OF THE ACOUSTIC SURVEY

An acoustic survey was undertaken at the proposed Lake Macquarie Fair site in order to determine the existing acoustic environment. The unattended monitor results will be used to determine the variation between day, evening and night time noise levels. Attended measurements will be compared with the unattended monitoring data during the same measurement period so that relative differences between the attended and unattended locations can be formed thereby providing a comprehensive study of existing noise levels around the proposed site.

4.4.1 Existing Background Noise Levels

Background noise levels during day time are dominated by general vehicular traffic movements. The NSW Environmental Protection Authority (EPA) Industrial Noise Policy (INP) details specific steps in determining the background noise level for assessment of the day, evening and night time periods. Table 1 summarises the background determined at the monitoring location, based on the guidelines set out in the INP and the results of unattended noise monitoring.

Table 1 – Measured Ambient Noise Levels

Location	Description	Day Noise Level 7am to 6pm (dB(A)L_{90})	Evening Noise Level 6pm to 10pm (dB(A)L_{90})	Night Noise Level 10pm to 7am (dB(A)L_{90})
Logger Location 1	Background $L_{90,15min}$	47	43	40

In addition to the background levels obtained at the unattended monitoring position presented above, attended noise monitoring was conducted at 2 locations around the perimeter of the subject site as detailed in Figure 1 of Section 1 above. The results of the attended noise measurements are presented in Table 2 below.

Table 2 – Measured Attended Environmental Noise Levels

Location	Time Period	Measured Noise level dB(A) $L_{eq\ (15\ min)}$
Location 1 – Wilson Road (south west)	Peak Afternoon Period	64
	Night Time	58
Location 2 – Wilson Road (south east)	Peak Afternoon Period	65
	Night Time	57
Location 3 – To the North of the site	Peak Afternoon Period	58
	Night Time	54
Location 4 – Wilson Road (east)	Peak Afternoon Period	66
	Night Time	60

5 NOISE EMISSION LIMITS – NOISE GENERATED ON THE SITE

The NSW Environmental Protection Authority (EPA) Industrial Noise Policy (INP) provides guidelines for assessing noise impacts from development sites. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The EPA's Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion. In addition, the EPA in its Environmental Noise Control Manual states that noise controls should be applied with the general intent to protect residences from sleep arousal.

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the Environmental Criteria for Road Traffic Noise (ECRTN).

5.1 EPA INTRUSIVENESS CRITERION

The EPA guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

5.2 EPA AMENITY CRITERION

The EPA guideline is intended to limit the absolute noise level from all industrial noise sources to a level that is consistent with the general environment.

The EPA's Industrial noise policy sets out acceptable noise levels for various localities. Table 2.1 on page 16 of the policy indicates 4 categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface.

Table 5 of the INP provides the recommended ambient noise levels for the suburban residential receivers for the day, evening and night periods. For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm; and
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Table 3 – EPA Recommended Amenity Noise Levels

Type of Receiver	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}
Residential	Day	55
	Evening	45
	Night	40

5.3 SLEEP AROUSAL

To minimise the potential for sleep arousal the $L_{1\ (1\ minute)}$ noise level of any specific noise source does not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. The L_1 noise level is the level exceeded for 1 per cent of the time and approximates the typical maximum noise level from a particular source. Where the typical repeatable existing L_1 levels exceed the above requirement then the existing L_1 levels form the basis for, sleep disturbance criteria.

5.4 SUMMARY OF ASSESSMENT CRITERIA FOR PROPOSED SITE

The EPA's INP intrusiveness, amenity and sleep arousal criteria for this project have been determined using these guidelines and the noise monitoring results. These are summarised below. We note that the formulation of the assessment criteria has been based on the lowest ambient levels determined from all monitoring data.

5.4.1 Day Time Period

The following table sets out the measured L_{eq} amenity and L_{90} background noise levels, and the assessment criteria based on the suburban criteria. The day period applies between 7am and 6pm Monday to Saturday; and 8am to 6pm Sundays and public holidays.

Table 4 – Measured L_{eq} & L_{90} Noise Levels and Criteria - Daytime

Location	Measured L_{eq} Noise Level dB(A)	Measured L_{90} Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Receivers to the North of the site	58	43	55	48
Receivers to the South of the site	65	47	55	52
Receivers to the West of the site	66	46	55	51

5.4.2 Evening Period

The following table sets out the measured L_{Aeq} and L_{90} background noise levels, and the assessment criteria based on the suburban criteria. The evening period applies between 6pm and 10pm.

Table 5 –Measured L_{eq} & L_{90} Noise Levels and Criteria - Evening Period

Location	Measured L_{eq} Noise Level dB(A)	Measured L_{90} Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Receivers to the North of the site	55	43	45	48
Receivers to the South of the site	65	45	45	50
Receivers to the West of the site	65	45	45	50

5.4.3 Night Time Period

The night period (that is, between 10pm and 7am) is the period where noise emissions can have the most significant effect on residential amenity. In addition to the quasi-steady state criteria the L_1 noise emission level should not exceed the background noise level by more than 15 dB(A) to prevent sleep arousal from intermittent events. The night time period applies between 10pm and 7am.

Table 6 –Measured L_{eq} & L_{90} Noise Levels and Criteria - Night Time Period

Location	Measured L_{eq} Noise Level dB(A)	Measured L_{90} Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}	Night time Sleep Disturbance dB(A) $L_{1\ (1\ Min)}$
Receivers to the North of the site	54	40	40	45	55
Receivers to the South of the site	57	40	40	45	55
Receivers to the West of the site	60	40	40	45	55

5.5 RESULTING NOISE LEVEL CRITERIA

The criteria for the various monitoring locations have been considered and assessed for the surrounding receivers. Table 7 below details the noise level criterion for properties surrounding the proposed development. In all cases, if a discrepancy in attended and unattended noise levels were obtained at two nearby locations within a residential grouping the more conservative noise level criterion has been adopted.

Table 7 – Noise Objectives for Surrounding Receivers

Location	Day time Noise Objective dB(A) L_{eq}	Evening Noise Objective dB(A) L_{eq}	Night time Noise Objective dB(A) L_{eq}	Noise Objective for Intermittent Activities dB(A) $L_{1\ (1\ Min)}$ (Background + 15 dB(A))
Receivers to the North of the site	48	45	40	55
Receivers to the South of the site	52	45	40	55
Receivers to the West of the site	51	45	40	55

Noise level criteria are to be applied to commercial traffic levels generated from vehicle movements on the site only, as presented by the Industrial Noise Policy. Noise levels generated from the movement of vehicles entering and exiting the site on surrounding roadways are required to comply with levels presented in the presented tables for surrounding receivers.

5.6 ASSESSMENT CRITERIA – ADDITIONAL TRAFFIC GENERATION

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the EPA Road Noise Policy. Criteria applicable to the development are detailed below. If existing noise levels exceed those in Table 8 a 2 dB increase in noise is allowed.

The proposed development includes the use of a carpark located to the south of the site which will be assessed against the criteria detailed in the table below.

Table 8 - Criteria for Additional Traffic Noise for New Developments

Time of day	Criteria for Acceptable Traffic Noise Level dB(A)
Day (7am to 10pm)	60 $L_{Aeq(1hr)}$ – Collector Road 55 $L_{Aeq(1hr)}$ – Local Road
Night (10pm to 7am)	55 $L_{Aeq(1hr)}$ – Collector Road 50 $L_{Aeq(1hr)}$ – Local Road

Attended and unattended traffic noise levels measurements were conducted at a number of locations surrounding the development including locations as detailed in the table below. The resulting noise levels have been used to generate the resulting noise level criterion for additional traffic movements which been used in this assessment.

Table 9 - Criteria for Additional Traffic Generation

Location	Criteria for Acceptable Traffic Noise Level dB(A) $L_{eq\ (1hr)}$	
	Day (7am to 10pm)	Night (10pm to 7am)
Wilson Road – South	66	60
Wilson Road – West	68	62

Note: Noise levels calculated to potentially worst affected residential facades from results of on site testing.

6 ADDITIONAL TRAFFIC NOISE GENERATION ASSESSMENT

The proposed development includes carpark spaces for upto 128 cars as detailed in Figure 1.

Potential noise impacts from traffic movements generated by the development on public roads have been assessed for residents surrounding the site and future tenancies within the development, including the potential for noise impact generated from the proposed additional roadways on the perimeter of the site. The assessment is based on the maximum traffic flow periods using FHWA and CORTN traffic noise prediction models and noise level measurements conducted at the site and presented in this report.

6.1 ADDITIONAL TRAFFIC NOISE ON LOCAL STREETS

Traffic noise generated by the proposed development was assessed using current and predicted traffic numbers based on the potentially worst case condition of half the carpark replenishing itself in any 1 hour day or evening period.

The predicted worst case noise increases on each of the streets surrounding the development are summarised in the following table.

The calculated potential noise from additional traffic movements from the site are displayed in the table below at the potentially worst affected residential receivers located on Wilson Road.

Table 10 – Calculated Noise Associated with Traffic Generation

Roadway	Time Period	Current Traffic Noise Levels	Criteria for Acceptable Traffic Noise Level dB(A) $L_{eq\ (1hr)}$	Calculated Future Traffic Noise $L_{eq\ (1\ hr)}$	Compliance
Wilson Road South	Day (7am to 10pm)	64	66	No Noise Increase	Yes
	Night (10pm to 7am)	58	60	Approximately 60.8 dB(A)	Yes
Wilson Road West	Day (7am to 10pm)	66	68	No Noise Increase	Yes
	Night (10pm to 7am)	62	64	Approximately 62.6 dB(A)	Yes

Note: All calculations were conducted using FHWA and CORTN traffic modelling.

The investigation into noise associated with additional traffic movements revealed that any increased traffic flows will cause either no noise increase to existing roadways or compliance with INP criteria for increased traffic volumes on surrounding roadways and would not adversely impact on the acoustic amenity of surrounding residential receivers.

7 MECHANICAL PLANT TREATMENTS

A detailed mechanical noise assessment will be conducted once plant selections and services drawings have been finalised as part of the construction documentation to ensure noise levels comply with the criteria detailed in this report. Details will be provided as part of the CC submission of the project.

Based on experience with similar development acoustic treatments are both possible and practical using acoustic treatments such as lining of ductwork, acoustic silences, variable speed controllers, time switches, acoustic screens etc. General requirements for a number of potential plant items on the site are expanded on below.

7.1 CHILLERS / AIR HANDLING UNITS

Units can be located on roof tops with an acoustic screen or in basement areas, with acoustic treatment to intake and exhaust as necessary.

These units would predominantly operate during the day, with the potential to operate with extended hours. Acoustic treatment to these units may be required to ameliorate noise impact to the surrounding residents and to comply with the criteria specified in this report and verified at CC stage.

7.2 SUPPLY / EXHAUST FANS

Supply and exhaust fans may be located within the underground plant rooms or in rooftop plant areas. These units typically emit high noise levels and require acoustic treatment such as silencers and internal lined ductwork. Silencer requirements would be determined once fan selections have been completed at CC stage.

7.3 CONDENSER UNITS

Condensing units typically emit relatively low noise levels and with careful selection, it is possible that no further acoustic treatment would be necessary.

7.4 MINOR PLANT

Other minor plant items, such as bathroom or kitchen exhaust fans, will be required. These items typically emit relatively low noise levels and may require minimal acoustic treatment of a standard nature, such as internally lining of ductwork.

7.5 SELECTED EQUIPMENT

As part of this assessment a review of the proposed plant and equipment to be installed on the site as part proposed Coles tenancy. The proposed equipment and recommended acoustic treatments are detailed below to ensure all noise level criteria are complied with at all surrounding receivers.

1. AHU's – Internally line a minimum of 4m of the supply and return air ductwork with 50mm insulation.

2. Compactor, Model S1500 – install compactor within the building envelope. Compactor not to be operated during night time hours.

3. Pumps – All pumps associated with the normal operation of the building are to be located within a plantroom, in which case no additional acoustic treatments are required.

4. Roof top fans – the proposed roof top fans selected for the project have been reviewed and no additional acoustic treatments for are required to ensure noise levels at all surrounding receivers comply with the relevant environmental noise level criteria as detailed in this report. The proposed fans for the project are detailed in the figure below.

	Product ID Description	Qty	Mot (KW)/RPS V/Hz/Ph	Selected Vol Prs	Duty Vol Prs	Sound Spectrum (Khz) 63	125	250	500	1k	2k	4k	8k	dB(A) @ dist.
	**Reference** EF-1 **RCV355-6D** RCV - Roof Centrifugal Vertical	1	**Location** 0.21/17 415/50/3	300 l/s 160 Pa	327 l/s 190 Pa	68	65	65	59	52	47	45	41	**40 @ 3m**
	**Reference** EF-2 **RCV355-4D** RCV - Roof Centrifugal Vertical	1	**Location** 0.17/23 415/50/3	600 l/s 80 Pa	603 l/s 81 Pa	76	74	71	62	54	52	50	43	**45 @ 3m**
	**Reference** EF-3 **RCV315-6D** RCV - Roof Centrifugal Vertical	1	**Location** 0.09/18 415/50/3	250 l/s 80 Pa	284 l/s 103 Pa	67	65	59	59	53	47	43	41	**38 @ 3m**
	**Reference** EF-4 **VD80HD34P-6CAF** VDA - 6 Pole, Roof Mounted Vertical Discharge Axial	1	**Location** 0.82 (AOM)/16 415/50/3	4,000 l/s 80 Pa	4,069 l/s 83 Pa	73	71	69	70	71	70	70	65	**56 @ 3m**
	Reference **NRD-009** FC080 Non Return Damper	1	**Location** 0.00/0 0/0/0		0 l/s 0 Pa									
	**Reference** EF-5A, 5B **KMV450-6DD** KMV - Kitchen Metal Exhaust	2	**Location** 0.37/15 415/50/3	420 l/s 220 Pa	439 l/s 240 Pa	74	75	68	65	59	58	55	50	**46 @ 3m**
	**Reference** EF-6A, 6B **KMV400-6DD** KMV - Kitchen Metal Exhaust	2	**Location** 0.37/16 415/50/3	420 l/s 160 Pa	433 l/s 170 Pa	70	72	67	63	58	55	52	47	**44 @ 3m**
	**Reference** EF-7 **RCV315-6D** RCV - Roof Centrifugal Vertical	1	**Location** 0.09/15 415/50/3	150 l/s 80 Pa	205 l/s 150 Pa	67	65	59	60	53	47	43	41	**39 @ 3m**
	**Reference** EF-8 **RCV355-6D** RCV - Roof Centrifugal Vertical	1	**Location** 0.21/18 415/50/3	400 l/s 120 Pa	426 l/s 136 Pa	68	65	65	59	52	47	45	41	**40 @ 3m**
	**Reference** EF-9 **KMV400-6DD** KMV - Kitchen Metal Exhaust	1	**Location** 0.37/15 415/50/3	600 l/s 80 Pa	646 l/s 93 Pa	70	72	67	63	58	55	52	47	**44 @ 3m**
	**Reference** SAF-1 **DS80JL36P-6DAF** DQAS - 6 Pole, Roof Mounted Supply Air Axial	1	**Location** 1.21 (AOM)/16 415/50/3	4,000 l/s 80 Pa	4,019 l/s 81 Pa	72	69	66	67	67	68	68	61	**53 @ 3m**
	**Reference** SAF-2 **CS400-6D** CS - Supply Air Centrifugal	1	**Location** 0.39/16 415/50/3	400 l/s 160 Pa	499 l/s 249 Pa	63	68	65	59	55	49	49	45	**41 @ 3m**
	Reference SAF-2 Filter Filter for SAF-2 G4 Fire Rated	1	**Location** 0.00/0 0/0/0		0 0									

Figure 3 – Selected roof top fans

8 ASSESSMENT OF LOADING DOCK ACTIVITIES

This section of the report presents the assessment of noise associated with the operation of the loading docs (including the small specialty loading dock and the larger Coles loading dock) associated with the project which is located to the north east of the proposed coles tenancy. The assessment was conducted in conjunction with the EPA criteria presented in this report.

Acoustic assessment of noise generated by the loading dock has been undertaken based on the hours nominated below:

- The proposed covered loading dock will potentially be operational outside of nigh time hours on any given day.
- The loading dock will include up to 1 truck in any given hour and up to 3 van movements within the same hour.

8.1 POTENTIAL LOADING DOCK NOISE SOURCES

The potentially significant loading dock noise sources are listed in Table 11 below long with noise emission levels. The emission levels in Table 11 have been obtained from noise monitoring carried out at similar loading dock facilities. Noise measurements were obtained using a Norsonics SA 110 sound level meter, set to fast response. The sound level meter was calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was recorded.

Table 11 - Noise Source Emission Levels

Noise Source	Sound Emission Level dB(A) at 7m	Type of Noise Source
Truck Reversing alarm	75(1)	Quasi-Steady, tonal
Trucks Manoeuvring/Reversing (including medium size non-reticulated trucks)	75	Quasi-Steady
Truck Brakes	89	Transient
Truck Door Closing	75	Transient
Truck Starting	72	Transient

(1) A 5 dB(A) penalty has been applied to this source to account for the tonal characteristic of noise produced.

8.2 PREDICTED NOISE LEVELS AT MOST AFFECTED RECEIVERS

Noise levels at the residences were predicted based on the noise emission levels in Table 11, which are typical for this type of development.

The acoustic assessment has been conducted to include the accumulative assessment of noise from the small specialty loading dock and the Coles loading dock in operation simultaneously. The noise level assessment above includes the accumulative noise level from a small truck/van servicing the specialty loading dock and a large truck (including a reticulated truck) servicing the large Coles loading dock including associated activities with loading and unloading such as forklifts.

Table 12 summaries the predicted noise levels at the nearest residence to the north (town houses) of the proposed loading dock and within the proposed development. The noise levels below assume the acoustic treatments detailed in this report are adopted.

Table 12 – Assessment of Loading Dock Noise Emissions

Location/Activity	Receiver	Predicted Noise Level at Residence $L_{eq,15min}$	Noise Level Criteria at Residence $L_{eq,15min}$
Truck Loading/Unloading(1) Within the Loading Dock	Worst affected residence to the north of the site	43 dB(A) Day Evening– 43 dB(A) Night – Not in operation	Day - 50 dB(A) Evening– 45 dB(A) Night – Not in operation

1 - These activities include activities such as the delivery truck being idle in the dock, movement of pallet trucks, operation of compactors, etc.

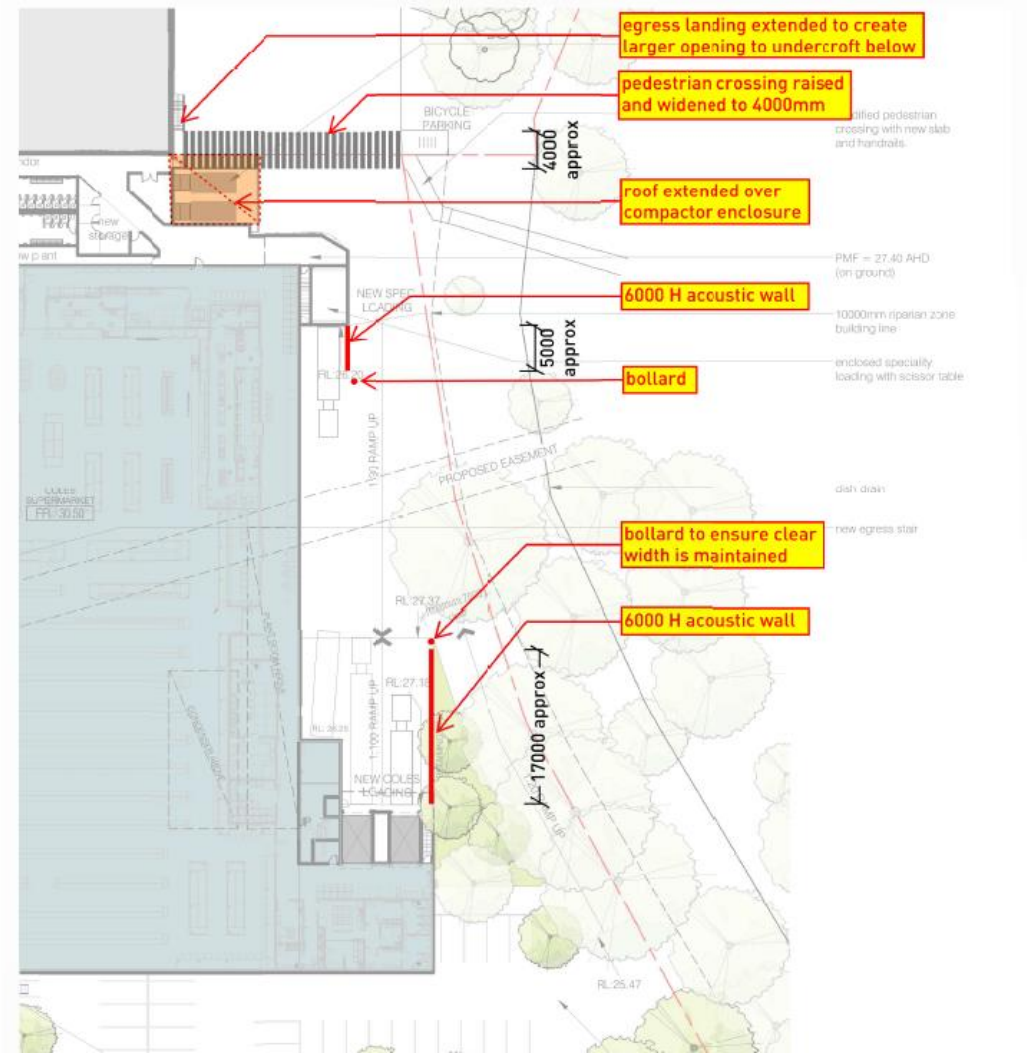
8.3 RECOMMENDED LOADING DOCK DEVELOPMENT CONTROLS TO THE LOADING DOCK

It is recommended that the following management and physical controls be implemented into the design and operation of the proposed loading dock associated with the development to the north east of the site include the following:

- Operating hours for the loading docks, deliveries, garbage removals, etc will be restricted within the hours of 7.00am to 10.00pm.

- Loading dock to include an acoustic screen to the north east of the boundary of the site. The screen is to be a minimum of 2.2m in height and constructed from a solid material such as a lapped and capped timber fence or the like. The location of the screen is detailed in the figure below.

- In addition to the above a screen to the small loading dock to the north of the facility is also required which is to be of solid construction. The possible location of the screen is detailed in the figure below to the specialty loading dock. The screen should be constructed from a solid material (such as FC sheet, masonry or the like) to a minimum height of 2.2m.



- A detailed assessment of noise emissions from any plant and equipment associated with the loading dock is required to be conducted prior to installation in conjunction with noise level requirements detailed in this report.

- Vehicles associated with the loading dock should not be parked within the vicinity of the loading dock outside of the hours of 7am to 10pm.

- Vehicle engines should be switched off during loading and unloading within the dock.

8.3.1 Sample Calculations

As part of this assessment a number of sample calculations including the use of the two loading docks simultaneously has been conducted which are detailed below.

1. Operation of the Coles Loading Dock

The following is a sample calculation used to predict the noise level from the operation of the Coles loading dock during a large reticulated truck arrival and unloading. The source noise level include the noise from the truck arrival (75 dB(A) @7m) and the operations to unload (65dB(A) @ 7m) with a resulting noise level of 76 dB(A) @7m SPL.

Coles Loading Dock

1. Source noise level 76dB(A) @7m SPL: 101 dB(A) SWL
2. Distance Correct to the affected residential receiver (60m): -44 dB
3. Barrier effect from the proposed screening: -9 dB
4. Time correct for nosiest activities being in operation for half of the 15min assessment period: -5 dB

Resultant Noise level at façade (Criteria 45 dB(A) worst case evening period): 43 dB(A)

The following is a sample calculation used to predict the noise level from the operation of the small loading dock during a small truck/van arrival and unloading. The source noise level includes the noise from a small truck arrival (73 dB(A) @7m) and the operations to unload (65dB(A) @ 7m) with a resulting noise level of 76 dB(A) @7m SPL.

Small Loading Dock

5. Source noise level 74dB(A) @7m SPL: 99 dB(A) SWL
6. Distance Correct to the affected residential receiver (60m): -44 dB
7. Barrier effect from the proposed screening: -9 dB
8. Time correct for nosiest activities being in operation for half of the 15min assessment period: -5 dB

Resultant Noise level at façade (Criteria 45 dB(A) worst case evening period): 41 dB(A)

Accumulative noise Level – Based on the predicted noise levels of 43 dB(A) And 41 dB()A the accumulative noise level at the affected residential receiver is 45 db(A) (10*LOG(10^(43/10)+10^(41/10)) which is complaint with the overall noise level criterion of 45 dB(A).

9 CONCLUSION

This report provides the results of Environmental Noise Study for the proposed Lake Macquarie Fair development. Noise at the site has been measured and noise goals have been set in accordance with the requirements of the relevant statutory/regulatory authorities including Local Council and the Environmental Protection Authority.

Determination of noise assessment criteria based on the EPA's Industrial Noise Policy and Road Noise Policy have been determined based on both unattended and attended noise monitoring conducted at the proposed development.

Based on the assessment detailed in this report the proposed development will comply with all relevant noise and vibration criteria.

We trust this information is satisfactory. Please contact us should you have any further queries.

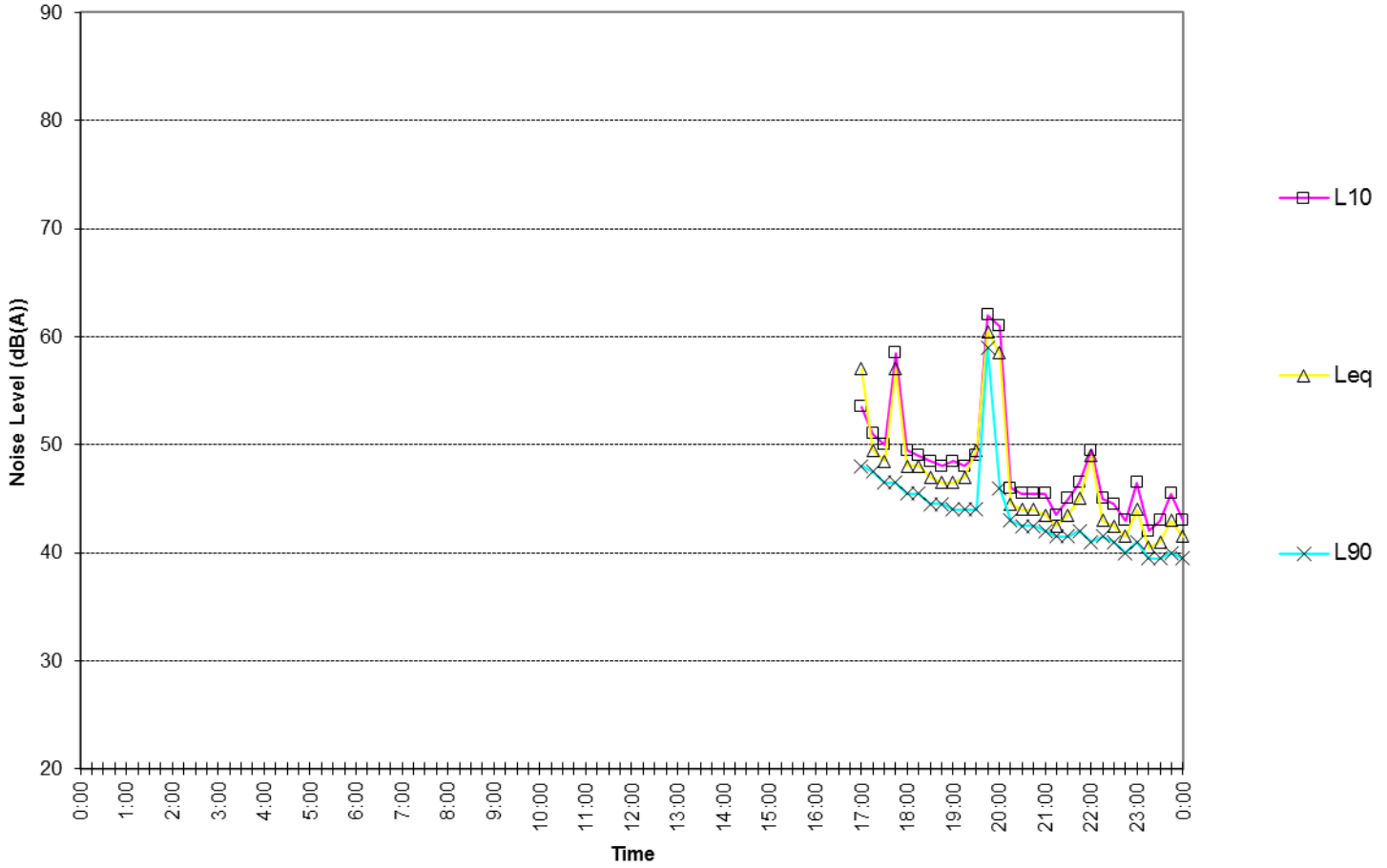
Report prepared by,

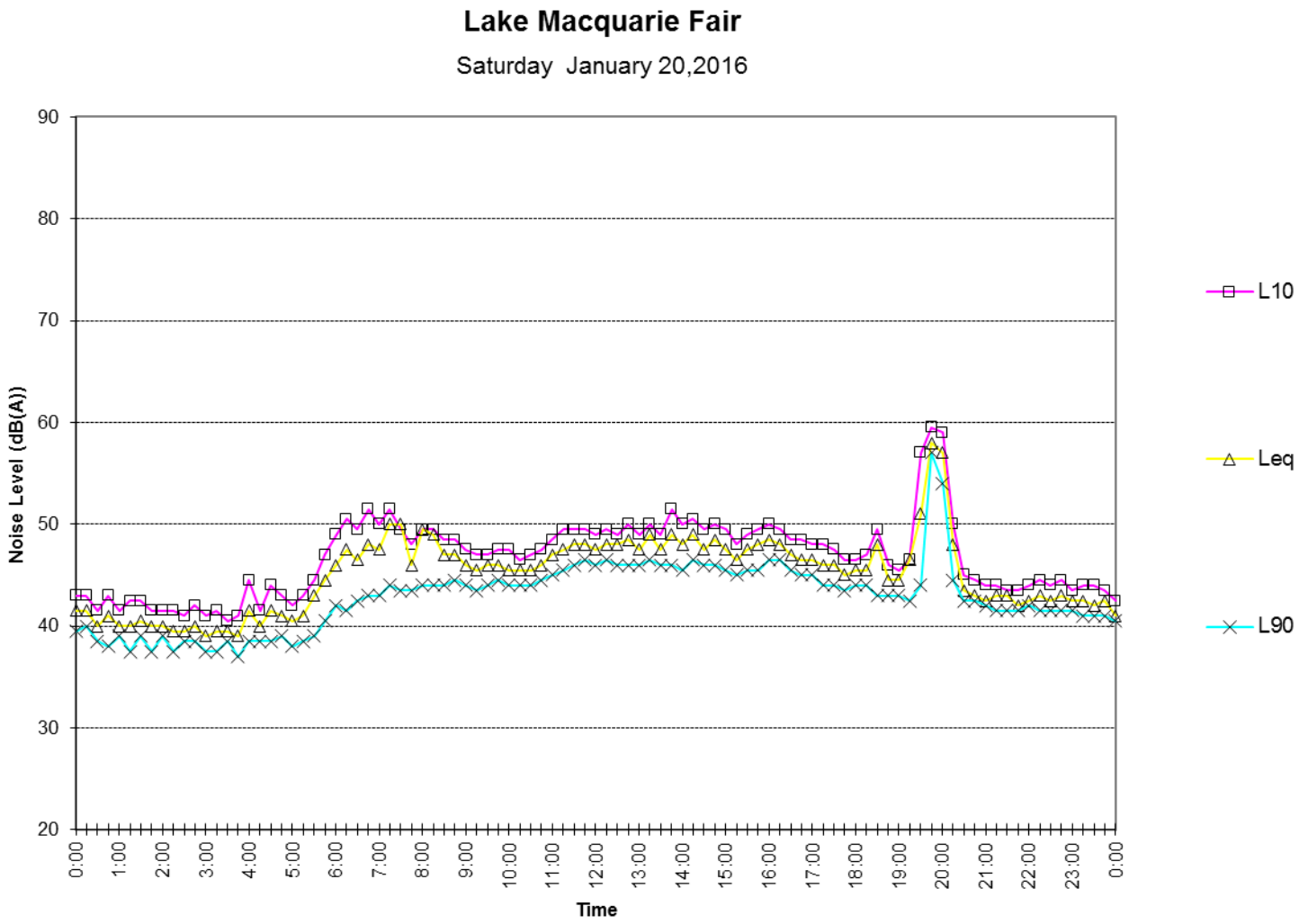
ACOUSTIC LOGIC CONSULTANCY PTY LTD
Ben White

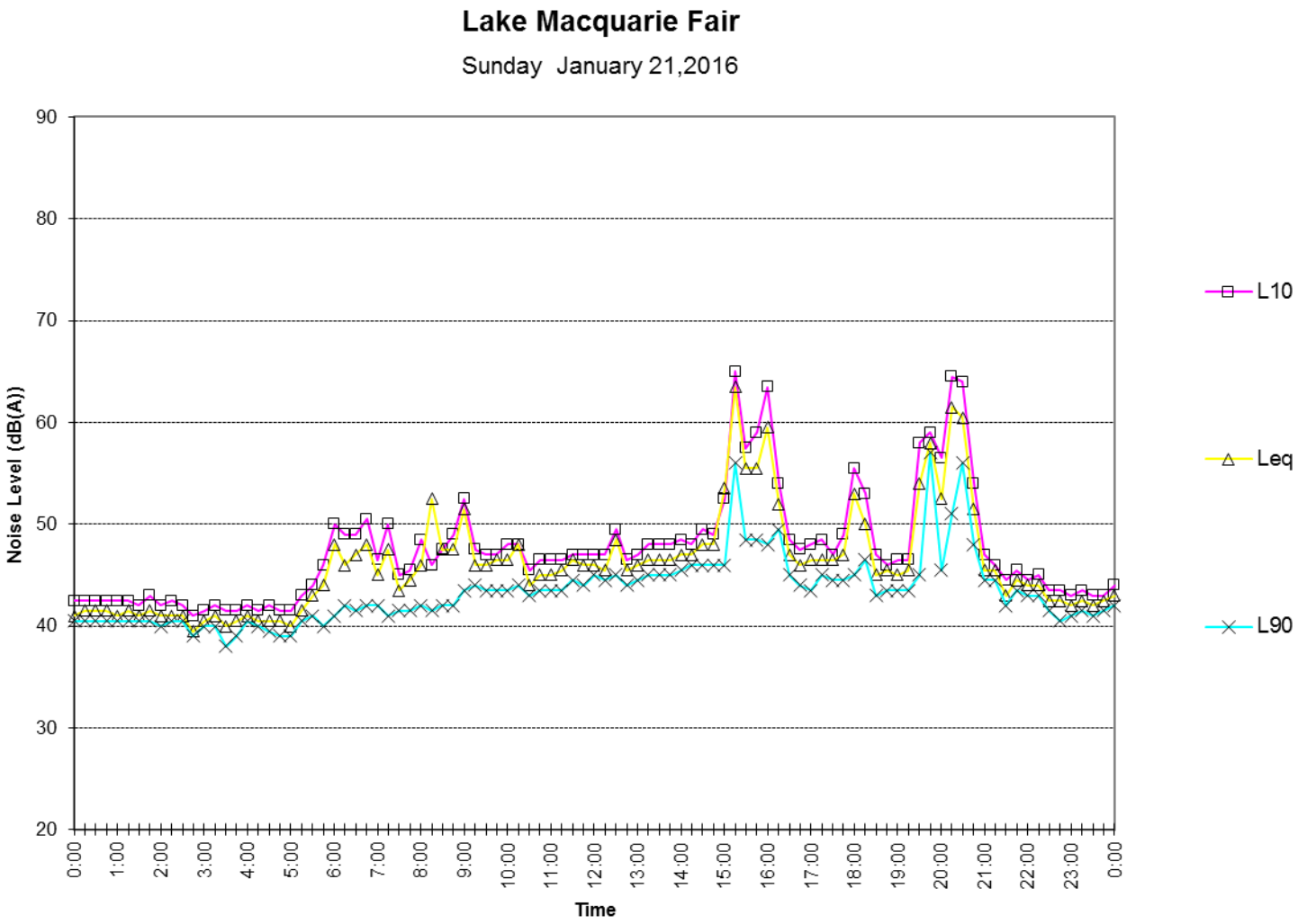
Appendix A – Noise Logging Results

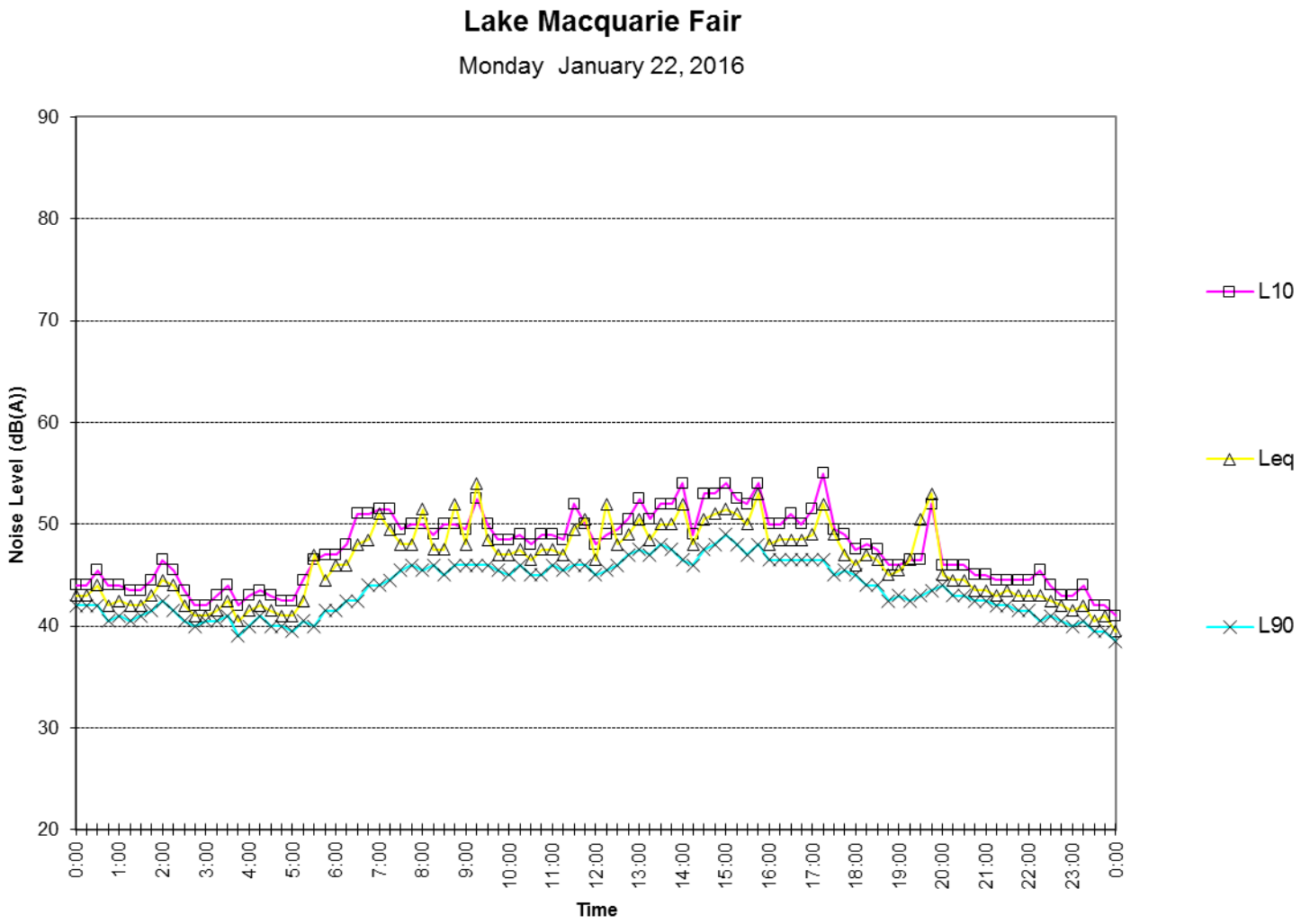
Lake Macquarie Fair

Friday January 19, 2016




Lake Macquarie Fair
Saturday January 20,2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Lake Macquarie Fair
Sunday January 21,2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Lake Macquarie Fair
Monday January 22, 2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
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19:00
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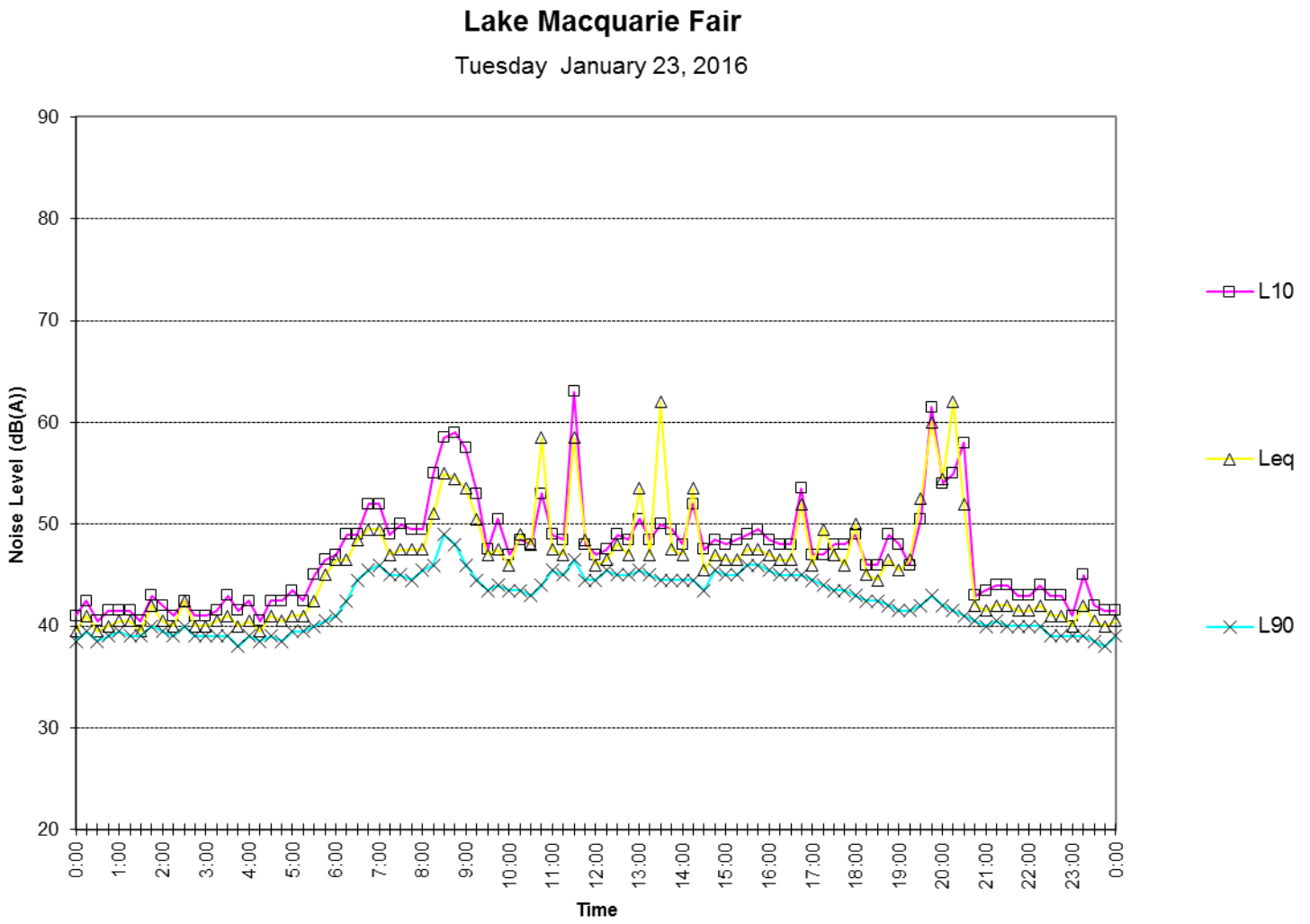
22:00
23:00
0:00
Time
L10
Leq
L90


Lake Macquarie Fair
Tuesday January 23, 2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
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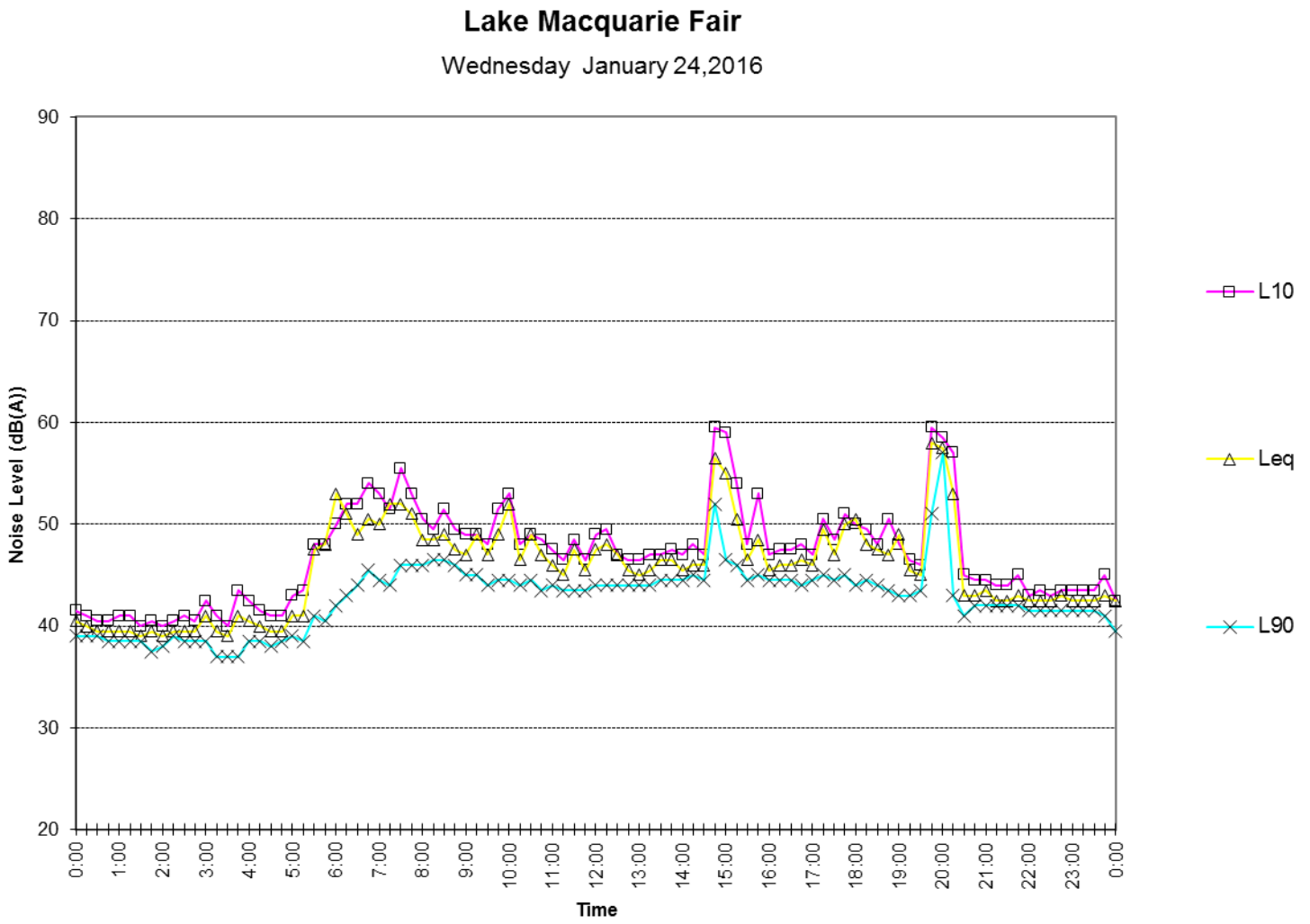
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Lake Macquarie Fair
Wednesday January 24,2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
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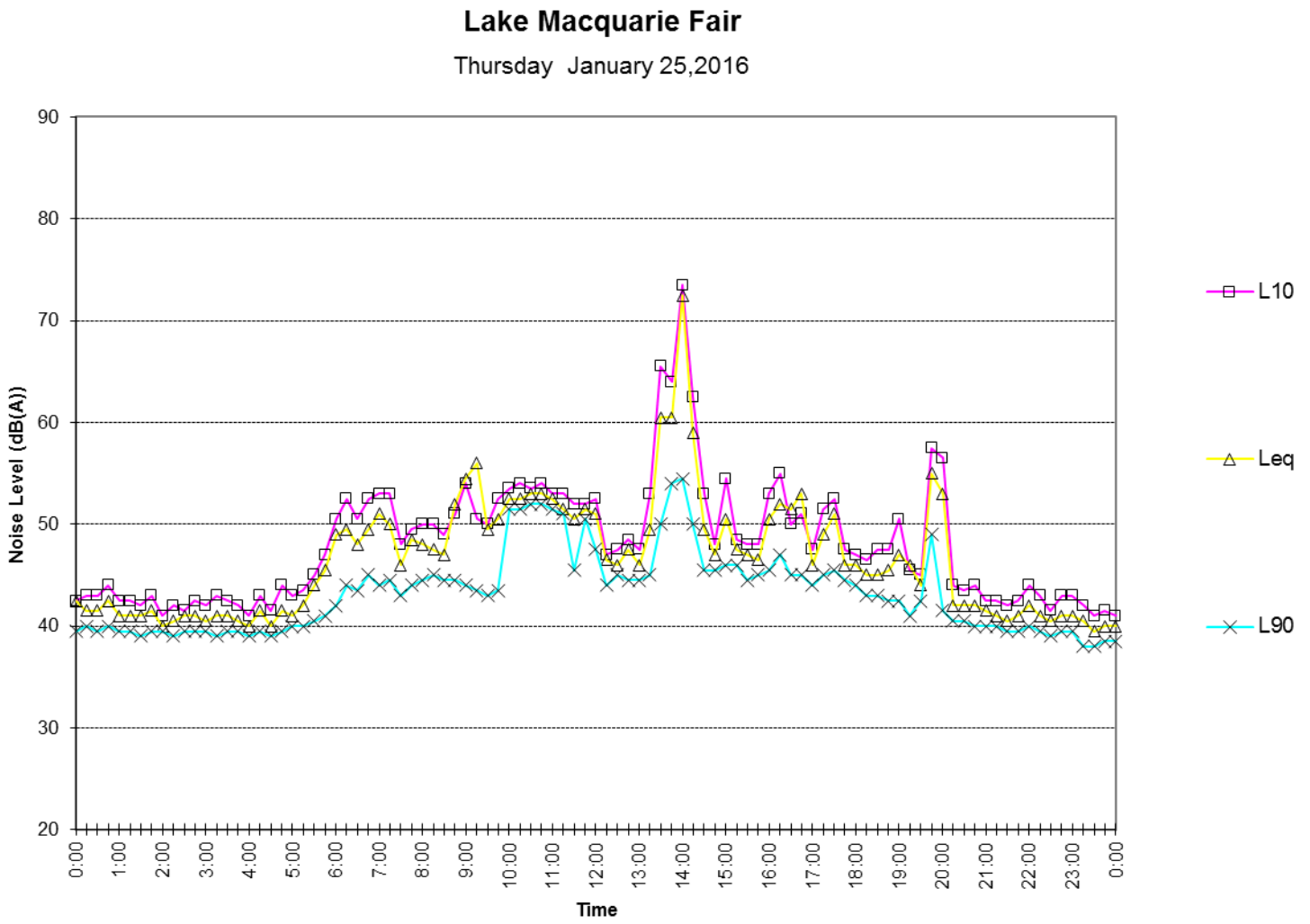
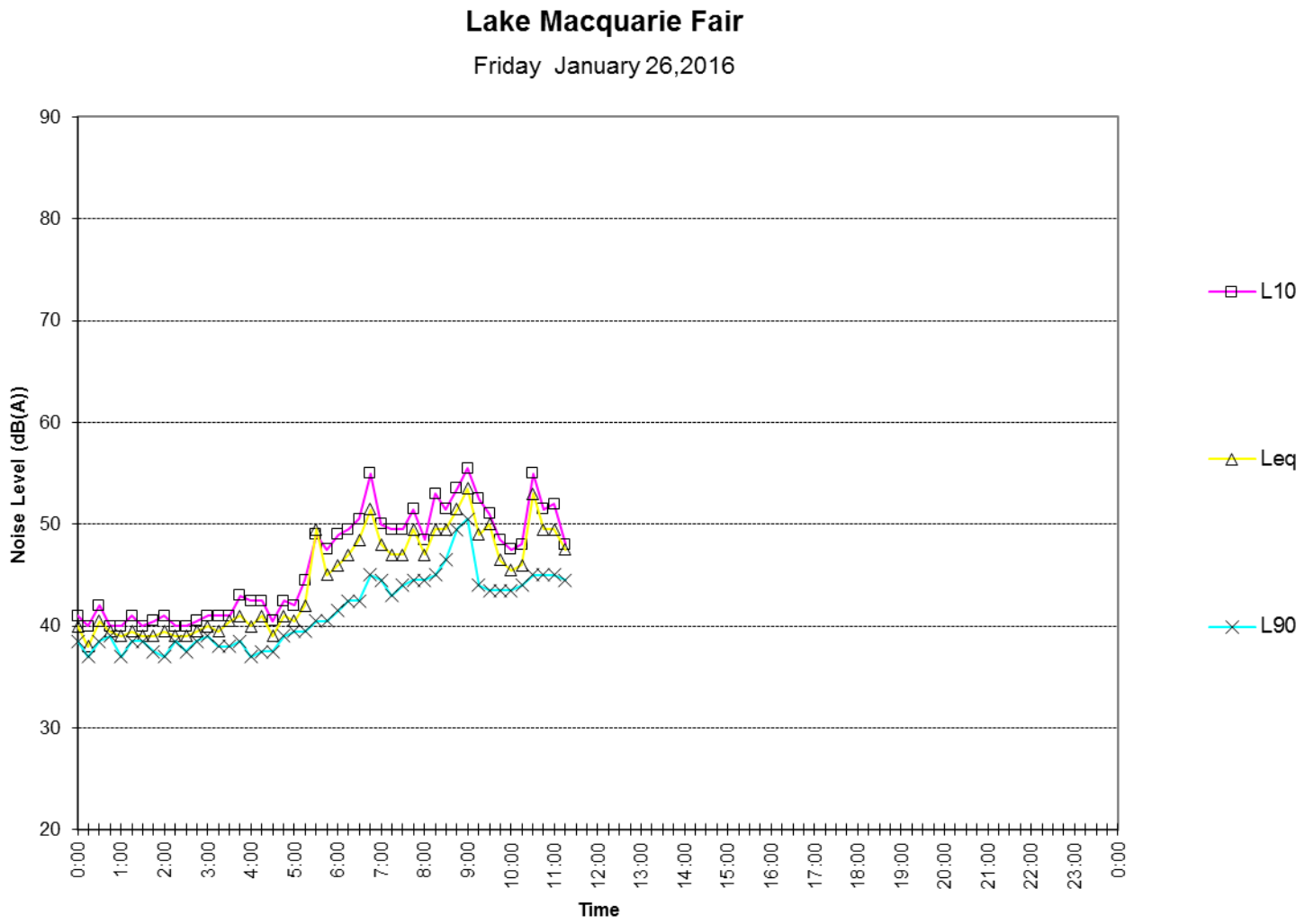
22:00
23:00
0:00
Time
L10
Leq
L90


Lake Macquarie Fair
Thursday January 25,2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Lake Macquarie Fair
Friday January 26,2016
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90