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Horsley Drive Business Park - Proposed Warehouse at Lots 5 and 6

Noise and Vibration Impact Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy have been engaged to conduct an acoustic assessment of noise impacts associated with the proposed warehouse facility to be located at Lot 5 and 6 of the Horsley Drive Business Park.

The end user for the facility is currently not known and as such a conservative noise and vibration assessment has been carried out. This assessment will address noise associated with the following:

- Noise emissions from internal warehousing and operations;
- Cars entering and exiting facility;
- Trucks entering and exiting facility;
- Loading dock operations;
- Potential for sleep disturbance associated with heavy vehicle movements between 10pm and 7am; and
- Mechanical plant noise emissions in principle.
- Potential vibration impacts from the site.

Noise impacts have been addressed in accordance with:

- Fairfield Council Development Control Plan;
- Environment Protection Authority (EPA) Industrial Noise Policy; and
- Environment Protection Authority (EPA) Road Noise Policy.

Predicted noise and vibration levels from the operation of the facility as presented in this report indicate that the proposed development can comply with the aforementioned authorities and regulations for all periods of the day, evening and night.

2 PROPOSED DEVELOPMENT AND SITE LOCATION

The proposed site is located on Lot 5 and 6 of the Horsley Drive Business Park located on the parcel of land on the corner of the Horsley Drive and Cowpasture Road intersection, Wetherill Park. It is proposed to install a warehouses and distribution centre, which incorporates the potential for the following uses:

- Warehousing and distribution centre;
- Loading docks and receiving/dispatching areas along the east and western façade of the facility.
- Administration offices.
- Car parking.

The development is proposed to operate 24 hours a day, 7 days a week.

The surrounding uses of the development include the following:

- Industrial uses to the East of the site across Cowpasture Road;
- Allotments as part of the Horsley Drive Business Park to the North and West; and

Sensitive receivers which may have the potential to be impacted by noise and vibration from the operation of the site are as follows:

- Residences approximately 405m to the West of the site located at 1489 The Horsley Drive.

These uses will be used as a basis for the assessment. (Refer Figure 1).

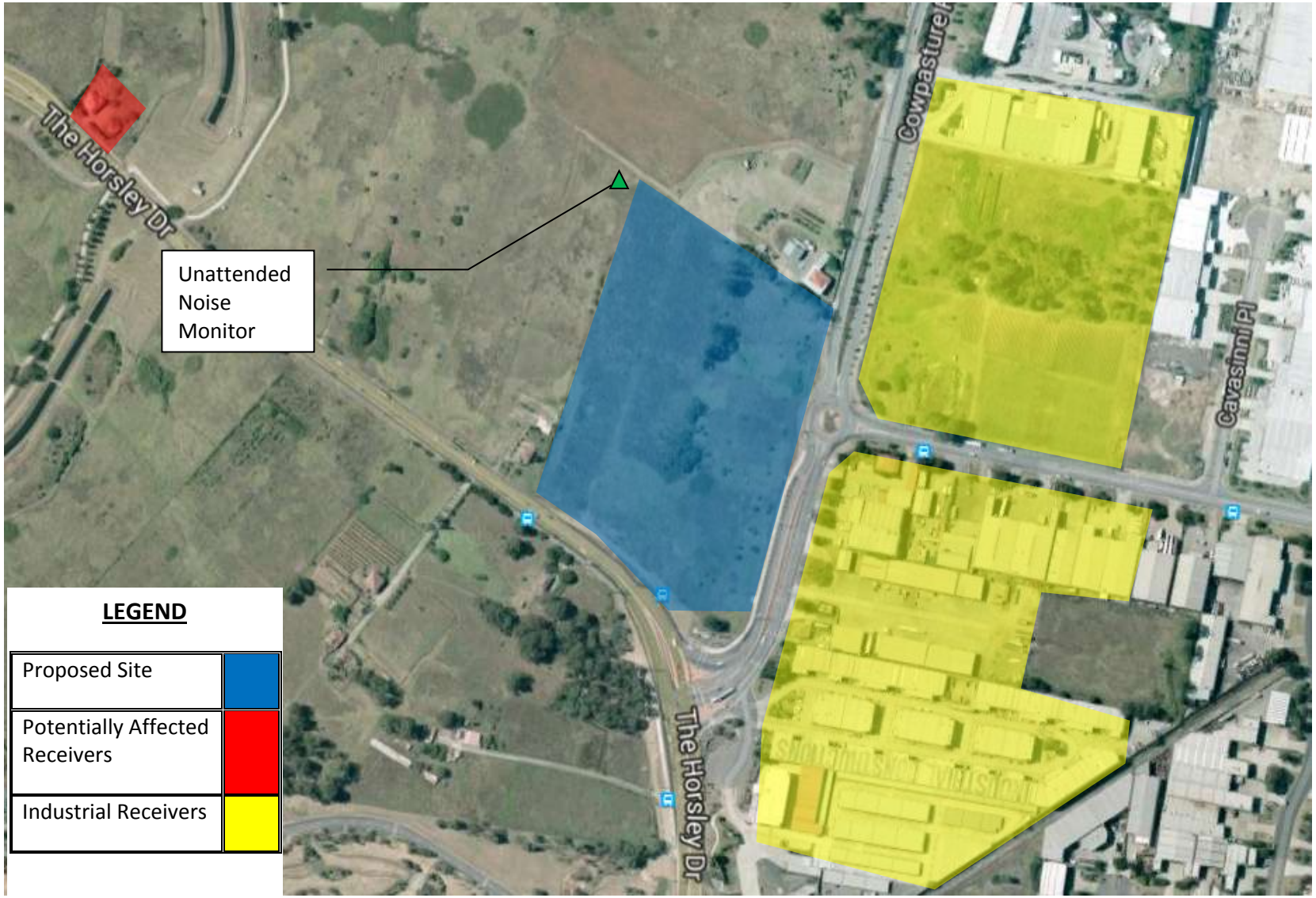


Figure 1: Site Survey and Monitoring Position

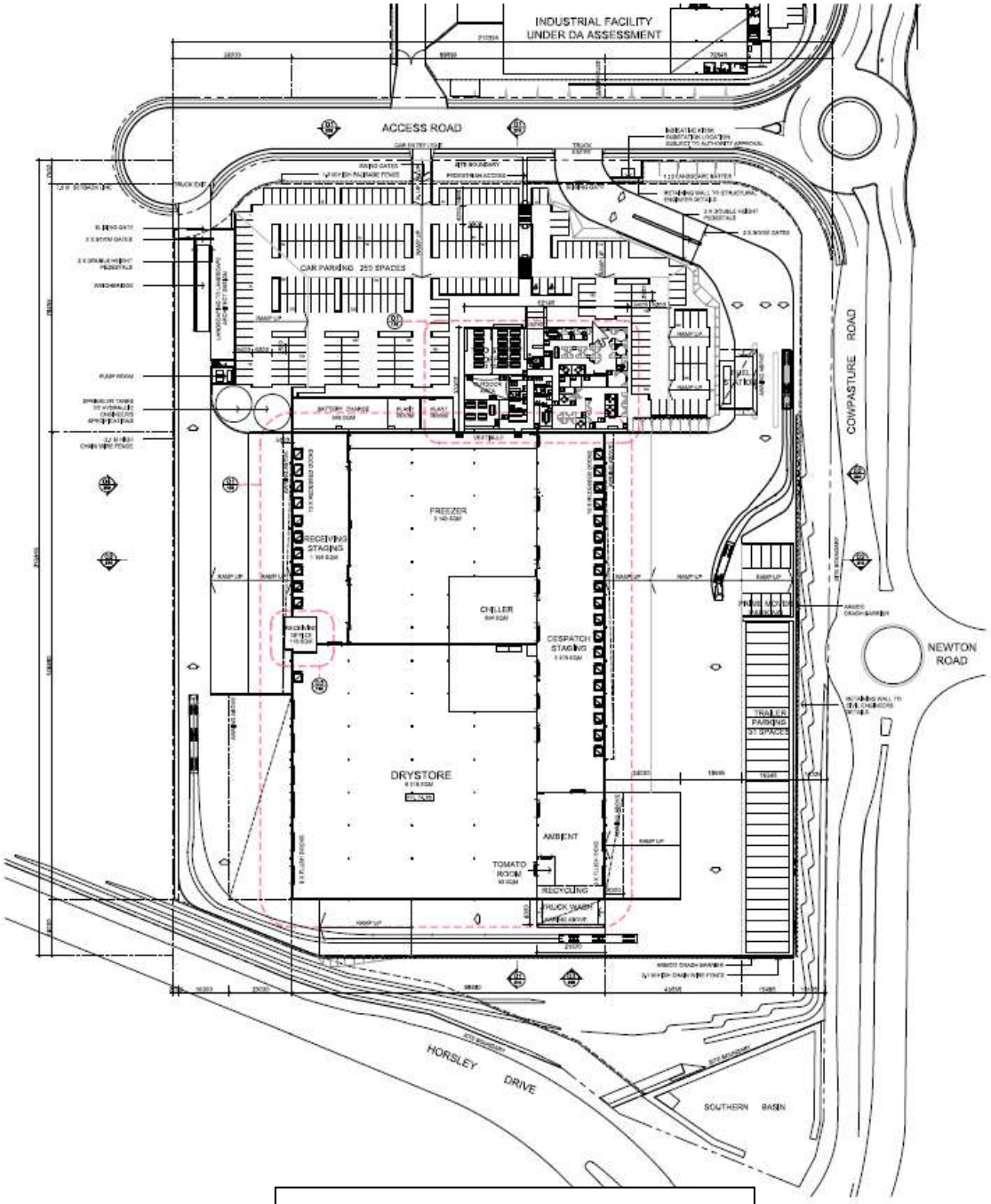


Figure 2 – Proposed Facility

3 EXISTING ACOUSTIC ENVIRONMENT

The acoustic environment is categorised by moderately high background noise levels during the day and evening and moderate background noise levels during the night time period typically associated with an industrial interface and road traffic from Horsley Drive and Cowpasture Road.

Acoustic monitoring was conducted at the site to establish the background noise levels which will be used as basis for this assessment.

3.1 ENVIRONMENTAL NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is 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 analysing 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 will depend 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 15 minute period. L_{eq} is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

3.2 BACKGROUND NOISE LEVELS

Background noise levels which will be used as a basis for this assessment are detailed in the following sections.

3.2.1 Measurement Equipment

Unattended noise monitoring was conducting using Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was 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.

3.2.2 Measurement Location

Monitoring was conducted the centre of the Horsley Drive Business Park (refer Figure 1). The business park is currently vacant land.

3.2.3 Measurement Period

Unattended noise monitoring has previously been undertaken at the boundary of the from 9th December to 16th December, 2014 and remans suitable for the purpose of this assessment.

3.2.4 Background Noise Levels

The background noise levels established from the unattended noise monitoring are detailed in the Table below.

Table 1 – Rating Background Noise Level

Time of Day	Rating Background Noise Level dB(A) L_{90}
Day	51
Evening	49
Night	46

4 NOISE EMISSION CRITERIA

There are no specific noise requirements contained within the Fairfield Council Development Control Plan. On this basis, ALC have adopted the requirements of the Environment Protection Authority (EPA) Industrial Noise Policy (INP).

4.1 EPA - INDUSTRIAL NOISE POLICY

The INP provides guidelines for assessing noise impacts from industrial developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The INP has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion.

4.1.1 Intrusiveness Criterion

The 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).

Rating background noise levels for the area have been established from long term unattended noise monitoring as detailed in Section 3.2. Intrusive criteria based on the noise monitoring conducted at the site are detailed in Table 2.

Table 2 – INP Intrusiveness Criteria

Time of day	Background Noise Level dB(A)L_{90}	Intrusiveness Criteria (Background+5dB(A)) dB(A) $L_{eq\ 1hour}$
Day	51	56
Evening	49	54
Night	46	51

4.1.2 Amenity Criterion

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

The Industrial Noise Policy sets out acceptable noise levels for various land uses. Table 2.1 on page 16 of the policy has four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface.

Pursuant to the INP, the residential receivers in the vicinity would be considered urban given:

- Is dominated by an urban hum or industrial source noise; and
- Is near an industrial district;
- Adjacent to Cowpasture Road and Horsley Road which carry high volumes of heavy and passenger vehicles.

Corresponding Amenity Criteria noise emission goals are presented below.

Table 3 – INP Amenity Criteria

Type of Receiver	Time of day	Recommended Acceptable Noise Level dB(A) $L_{eq\ period}$
Residential (Urban)	Day	60
	Evening	50
	Night	45

4.2 SLEEP AROUSAL CRITERIA

Potential sleep arousal impacts should be considered for noise generated after 10pm or before 7am. Sleep arousal is a function of both the noise level and the duration of the noise. To assess potential sleep arousal impacts, a two stage test is carried out:

- Step 1 - An "emergence" test is first carried out. That is, the L_1 noise level of any specific noise source should 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. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The guideline level is set out below.

Table 4 - Sleep Arousal Emergence Criteria (6am-7am)

Location	Background Noise Level (6am-7am) - dB(A) $L_{90\ night}$	Emergence Level dB(A) $L_{1(1min)}$
All Potentially Affected Residential Properties	46	61

- Step 2 - If there are noise events that could exceed the emergence level, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA Industrial Noise Policy, this more detailed sleep arousal test is conducted using the guidelines in Section 5.4 of the EPA Road Noise Policy (RNP).

Section 5.4 of the RNP states that:

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

ALC have adopted the 55dB(A) L_{Max} internal noise level as a basis for assessing the potential for sleep arousal during the night time period of operation, typically 6am to 7am.

4.3 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

Council has no specific noise criteria with respect to traffic generation associated with developments. In the absence of this, EPA guidelines can be used for assistance.

For land use developments with the potential to create additional traffic the development should comply with the requirements for new developments detailed in the EPA Traffic Noise Policy, when measured at the façade of the nearest residences.

Table 5 - Criteria for Traffic Noise for New Developments

Time of day	Criteria for Acceptable Traffic Noise Level Sub-arterial Roads - dB(A)
Day (7am to 10pm)	60 $L_{Aeq\ (15hr)}$
Night (10pm to 7am)	55 $L_{Aeq\ (9hr)}$

However, if existing noise levels exceed those in the table above, the provisions of section 3.4 of the Road Noise Policy will apply.

If practicable, noise on public roads as a result of increased traffic generation should not result in an increase in traffic noise level of more than 2dB(A). In this regard, the Policy relevantly states "*an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person*".

5 ASSESSMENT OF NOISE IMPACTS

Noise impacts associated with the development have been assessed for the following:

- Internal warehouse operations;
- Cars entering and exiting the parking lot;
- Heavy vehicle movements and loading dock and receiving/dispatching operations; and
- Emissions associated with mechanical plant in principle.

Each of these noise sources will be discussed in detail. Noise predictions are presented in Table 8.

5.1 TYPICAL WAREHOUSE OPERATIONAL NOISE LEVELS

Internal noise levels within the proposed warehouse using general warehouse operations associated with a warehouse and distribution facility have been established from measurements by ALC on previous projects. This Section discusses the noise levels measured at the existing facility and methodology of assessing internal operations with the proposed facility.

5.1.1 Noise Measurements

Equipment and operations measured as a sound pressure level within the warehouse and production areas included:

- Air compressors and generators;
- Forklifts manoeuvring throughout the warehouse;

The typically loudest noise level from the aforementioned equipment running consecutively was a sound pressure level of 76dB(A) L_{eq}.

5.1.2 Discussion

The noise level of 76dB(A) L_{eq} will typically represent the worst case continuous sound pressure level from the movement of vehicles such as forklifts within the facility. It should be noted that this level has been adopted as a sound pressure level within the entire facility (excluding offices and administration areas) for this assessment.

This assumption will result in a conservative predicted noise level at receiver locations due to the fact that the sound pressure level in the majority of the building will be substantially lower, including periods when the vehicles are not in operation.

5.1.3 Warehouse Noise Assumptions.

Internal activities within the warehouse have been assessed using the noise levels above. The following has been assumed:

- A sound pressure level of 76dB(A) L_{eq} adopted within the entire warehouse except for the offices and admin areas.
- Doors to the facility from the receiving and dispatch areas are open.
- The walls are constructed from 0.42mm BMT sheet metal.
- The roof has been modelled as 0.42mm BMT sheet metal with 50mm reflective foil insulation blanket underneath.

5.2 CARS AND TRUCK ENTERING / EXITING THE DEVELOPMENT

Cars and heavy vehicle entering and exiting the facility have been based on the following noise levels as per measurements previously conducted by ALC.

Table 6 – Assumed Vehicle Operational Noise Levels

Noise Source	Sound Power Level dB(A)	Speed	Area of Noise Generation
Semi trailer / B-Doubles	105	5km/h	Loading dock and internal road
Light rigid dual axle trucks	95	10km/h	Loading dock and internal road
Cars/Lt Vehicles	84	10km/h	Carpark

The following movements have been assumed for a worst 1 hour period in relation to loading dock operations and heavy vehicle movements. The number of vehicles entering / exiting the facility has been based on the following:

Table 7 – Assumed Traffic Movements

Time of Day	Vehicle Type	Vehicles Movements Per Hour (vph)
Day and Evening 7am – 10pm	Semi-trailer / B-Doubles	Up to 36 (18 in / 18 out)
	Light rigid dual axle trucks	Up to 40 (20 in / 20 out)
	Cars	Up to 81
Night 10pm – 7am	Semi-trailer / B-Doubles	Up to 10 (5 in / 5 out)
	Light rigid dual axle trucks	Up to 20 (10 in / 10 out)
	Cars	Up to 81

Predicted noise levels are presented in Table 8.

5.3 LOADING DOCK OPERATIONS

The receiving and dispatching areas on the eastern and western boundary of the development with an entry via the estate access road of Cowpasture Road to the north of the facility. The loading dock exits via the same access road.

Noise emissions from this use have been predicted to surrounding receiver locations in conjunction with noise associated with cars and heavy vehicles entering and exiting the facility.

The operation of the loading dock assumes the following as a worst case:

- Vehicle movements as per Section 5.1.
- Each semi-trailer will idle for up to 2min with a sound power level of 95dB(A).
- 9 x forklifts working for 30min within a 1 hour period (i.e. 15min per truck) with a sound power level of 90dB(A).

Predicted noise levels are presented in Table 8.

5.4 PREDICTED NOISE LEVELS

The predicted noise levels from the aforementioned noise sources are presented in the following Table.

Table 8 – Predicted Noise Levels

Noise Source	Time of Day	Receiver	Predicted Noise Level, dB(A) $L_{eq\ 15min}$	Noise Criteria dB(A) $L_{eq\ 15min}$	Complies
- Cars entering / exiting - Trucks entering / exiting - Forklift in loading dock area - Internal warehouse operations	Day	West Residence	<35	56	Yes
	Evening	West Residence	<35	50	Yes
	Night	West Residence	<30	45	Yes

Noise criteria for the day has been based off the INP intrusiveness criteria and the evening and night have been assessed against the amenity criteria. This will provide the strictest assessment criteria for the respective periods.

5.5 TRAFFIC NOISE GENERATION

ALC notes that there are no residential receivers in the immediate vicinity which may be potentially affected by additional road traffic using Cowpasture Road.

On this basis, ALC conclude the traffic noise generated by the development will be compliant with the requirements of the Road Noise Policy.

5.6 SLEEP DISTURBANCE

Given the site will be used during the night time period a sleep disturbance assessment has been conducted.

Sleep disturbance to residences to the West and North has been assessed for a semi-trailer travelling along the hardstand from the access road to Cowpasture Road.

An instantaneous noise level of 110dB(A) sound power level has been assumed for the truck, with the primary noise source being the short duration, peak noise event associated with an air brake discharge.

Noise levels are predicted to the façade of the nearest residential dwelling, with each source of the noise at the worst case location relative to the receiver (i.e. each receiver location assessed for worst case noise source location).

Table 9 – Predicted Noise Levels (Sleep Disturbance)

Noise Source	Receiver	Predicted Noise Level dB(A) $L_{1\ 1min}$	Sleep Emergence Level, dB(A) $L_{1\ 1\ min}$
Truck brake discharge	West Residence	<45	61

5.7 MECHANICAL PLANT

The proposal will include ancillary mechanical services plant *(e.g. cooling towers, condensing units, exhaust fans, etc.).* As detailed plant selections and plans are not available at this stage, it is not possible to carry out a detailed examination of the ameliorative measures that may be required in order to achieve the project acoustic objectives.

5.8 DISCUSSION

An assessment of noise emissions from the operation of the facility has been conducted. The assessment of noise associated with the aforementioned uses has determined that noise associated with:

- cars entering and exiting the facility;
- light rigid and semi –trailer trucks entering and exiting the facility to the receiving/dispatch areas; and
- loading dock operations.

All the areas above will comply with the noise emission requirements without the need for additional acoustic treatments. Noise predictions have been based on all of the worst case operation of each noise source occurring currently during a worst 1 hour period.

Traffic generation along Cowpasture Road will comply with the traffic noise generation requirements as determined in the EPA Road Noise Policy.

The potential for sleep disturbance has been assessed in accordance with the Road Noise Policy and it has been determined that noise associated with the loading dock during the night time period will not have a significant detrimental impact on surrounding receivers.

Noise from mechanical plant should be assessed at a later stage once mechanical selections are made available to ensure compliance with the noise emission objectives.

6 RECOMMENDED TREATMENTS

The noise modelling has been conducted using the architectural documents as a basis for construction, as detailing in Figure 2 above. There are no additional acoustic treatments proposed above those presented in Section 5.1.3.

Analysis indicates that the site is capable of meeting EPA and Council noise emission requirements for 24 hour operations.

7 VIBRATION IMPACT ASSESSMENT

Potential vibration generated on the site may be transmitted a as tactile vibrations to surrounding receivers and is required to comply with the relevant standards as detailed in this sections of the report.

7.1 PROJECT VIBRATION OBJECTIVES

Human comfort is normally assessed with reference to the British Standard BS 7385 Part 2 1993 and the German Standard DIN 4150-3 (1999-02): *"Structural Vibration – Effects of Vibration on Structures"*, which are detailed in this section of the report.

7.1.1 British Standard BS 7385

The British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)".

Human response to vibration has been shown to be biased at particular frequencies, which are related to the orientation of the person. This standard provides curves of equal annoyance for various orientations. These curves are applied as correction filters such that an overall weighted acceleration level is obtained. As the orientation of the resident is unknown or varying the weighting filter used is based on the combined base curve as given in ISO 2631 & Australian Standard 2670 "Evaluation of Human Exposure to Vibration and Shock in

Buildings (1 to 80Hz)" which represents the worst case of the X, Y and Z axes. Filtered measurements are made in all three co-ordinate axes and the highest value axis used.

This standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (6am-10pm) and "Night time" (10pm-6am). The overall value is then compared to the levels in Table 5. For this project the aim will be for a low probability of adverse comment.

Table 10 - Vibration Dose Values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16hr day (Daytime)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night (Night time)	0.13	0.26	0.51

7.1.2 German Standard DIN 4150-3 (1999-02)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 1.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 11 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

	TYPE OF STRUCTURE	PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			**Plane of Floor of Uppermost Storey**
		< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**	**All Frequencies**
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

7.2 VIBRATION IMPACTS

Based on the proposed location of the Lot 5 and 6 of the Horsley Drive Business Park development and its proximity to surrounding receivers vibration generated on the site will comply with the relevant standards as detailed above without additional acoustic treatments or controls.

8 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

This section of the report presents the noise and vibration management plan to be implemented to manage noise and vibration emissions from the proposed construction process associated with the Horsley Drive Business Park - Proposed Warehouse at Lots 5 and 6 development site.

This report includes the assessment of noise and vibration associated with the works required to complete the required infrastructure on the site. The report does not include any building works which includes bulk earthworks associated with the development of individual allotments following completion of the Estate.

In recognition of the requirement to minimise noise emissions from the site to neighbouring land uses this study has been undertaken. The principal objective is to undertake detailed evaluation of all work to be performed during the construction work processes of the development phase and to forecast the potential impact. The noise forecasts will be used to formulate and streamline effective regulation and mitigation measures.
The principal issues that will be addressed in this document are:

1. Specific activities that will be conducted and the associated noise sources,
2. Identification of all potentially affected noise sensitive receivers,
3. Hours of work,
4. Noise objective specified in the conditions of consent,
5. Appropriate noise objectives for each identified potentially affected noise sensitive receiver,
6. Noise monitoring, reporting and response procedures,
7. Assessment of potential noise from the proposed activities,
8. Contingency plans to be implemented in the event of non-compliances and/or noise complaints.
9. Compliance with Councils' Code for the Control and Regulation of Noise on Building Sites
10. Compliance with Australian Standard 2436-1981" Guide to Noise Control on Construction, Maintenance and Demolition Sites" and Environmental Protection Authority (EPA).
11. Activities to be conducted and the associated noise sources

8.1 PROJECT DESCRIPTION

The development involves the construction of the Horsley Drive Business Park - Proposed Warehouse at Lots 5 and 6 at the location detailed in Figure 1 above.

8.2 CONSTRUCTION TRAFFIC

Construction traffic access to the site will occur from The Horsley Drive and Cowpasture Road.

Heavy vehicle traffic will include large rigid and articulated trucks. Heavy vehicle trips expected each day will vary and these will be distributed during the day without any peak hour period. It is anticipated that there would be an average of up to 10 truck movements every hour.

Given the existing traffic movements on the existing road network, it is considered that the expected number of vehicle movements departing or accessing the site will have minimal adverse impacts in surrounding residents.

8.3 CONSTRUCTION NOISE CRITERIA

The relevant standards which have been used in the development of the Construction Noise and Vibration Management Plan including the following:

- *NSW Industrial Noise Policy (EPA)*
- *Interim Construction Noise Guideline (EPA)*

It is proposed to adopt criteria from the New South Wales Construction Noise Guideline developed by The NSW Environmental Protection Authority (EPA) and with the Australian Standard AS2436-1981 *"Guide to Noise Control on Construction Maintenance and Demolition Sites"*.

8.3.1 NSW EPA "Interim Construction Noise Guideline" (ICNG)

The NSW Environmental Protection Authority has developed a construction noise guideline specifically to manage construction noise impacts.

The guideline provides two methods of assessment which are detailed in the following sections.

As part of this extended hours assessment an investigation into the compliance of potential noise impacts from the proposed development with the quantitative noise level criteria has been conducted in the first instance. Compliance with the quantitative criteria represents compliance with the guideline and no further assessment is required.

In the event noise levels are not expected to comply with the quantitative criteria, a further qualitative assessment will be conducted.

8.3.1.1 EPA Construction Noise Guideline - Quantitative Assessment Method

This quantitative assessment method outlined in the ICGN specifies criteria which can be used in the effort of minimising noise from construction related activities. The quantitative noise levels presented in the guideline are detailed in the following tables.

Table 12 - ICGN Recommended Construction Noise Management Levels – Normal Hours (Quantitative)

Receiver	Management Level	External Sound Level, $L_{eq\ 15\ min}$ dB(A)	Where Applied
Residential	Noise Affected Level[1]	Background + 10dB(A)	Externally
	Highly Noise Affected Level[2]	75dB(A)	Externally
Commercial Office	Noise Affected Level	70dB(A)	Externally (When in use)

1: Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. (EPA CNG, 2008).

2: Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided. (EPA CNG, 2008).

Table 13 - ICGN Recommended Construction Noise Management Levels – Outside Normal Hours (Quantitative)

Receiver	Management Level	External Sound Level, $L_{eq\ 15\ min}$ dB(A)	Where Applied
Residential	Noise Affected Level[1]	Background + 5dB(A)	Externally
	Highly Noise Affected Level[2]	Negotiate with Community	Externally
Commercial Office	Noise Affected Level	70dB(A)	Externally (When in use)

8.3.2 Sleep Disturbance at Residences

The EPA Construction Noise Guideline includes the following guidance for the assessment of sleep disturbance from construction activities during night time hours:

> *Where construction works are planned to extend over more than two consecutive nights, and a quantitative assessment method is used, the analysis should cover the maximum noise level, and the extent and the number of times that the maximum noise level exceeds the RBL. Some guidance indicating the potential for sleep disturbance is in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA 1999).*
>
> *Factors that may be important in assessing the extent of impact on sleep include how often high noise events occur at night, the predicted maximum noise levels at night, whether there are times when there is a clear change in the noise environment (such as during early morning shoulder periods), and the degree of maximum noise levels above the background noise level at night.*

As the proposed development is not proposing night time works the potential for sleep disturbance is not required to be discussed.

8.3.2.1 Qualitative Assessment

The guidelines qualitative assessment method in which construction noise is assessed on a case by case basis with regard to various activities which are to be conducted on the site. This assessment method was developed for smaller scale projects.

Essentially this method of assessment requires that the proponent take into consideration and employ all reasonable and feasible measures to ensure that the impact on noise receivers is minimised. This is generally conducted in the following manner:

- The assessment of noise producing equipment such as rock-hammers and sheet piles for lower noise producing methods of construction/excavation to determine which activities/processes will emit noise exceeding the management levels;
- The drafting of a noise management plan outlining all reasonable and feasible mitigation methods for the reduction of noise impact including:
    - The implementation of a complaints handling register and community consultation system;
    - Employee (builders, contractors etc) education in effective noise reducing techniques and site etiquette; and
    - The operation of plant in a quiet and efficient manner (ie turning off machinery when not in use, ensuring plant is maintained, etc).
    - Physical barriers, etc

8.3.3 Australian Standard 2436-1981 "Guide to Noise Control on Construction Maintenance and Demolition Site"

The Australian Standard 2436-1981 "Guide to Noise Control on Construction Maintenance and Demolition Site" states that care shall be taken in applying criteria that normally would be used to regulate noise emitted from industrial, commercial and residential premises to construction, particularly for those activities which are transitory and of short duration.

For the control and regulation of noise from construction sites AS2436 nominates the following:

- That reasonable suitable noise criterion is established.
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting on noisy static processes parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

8.3.4 Proposed Noise Level Objectives

Based on the detailed standard above the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers based on the quantitative noise level criteria of the EPA.
- Where noise emissions exceed the EPA quantitative noise goals, a qualitative assessment including an investigation and implement o all practical and reasonable techniques to limit noise emissions will be conducted.
- If the noise goal is still exceeded after applying all practical engineering controls to limit noise emissions investigate management and other techniques to mitigate noise emissions.

8.3.5 Construction Hours

Construction hours should be carried out in accordance with recommended construction hours detailed in the standard hours for construction sites as detailed within the EPA's Construction Noise Guidelines which details the following:

- 7am to 6pm Monday to Friday; and
- 8am to 1pm Saturday.

8.3.6 Construction noise procedures

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- If noise levels exceed "background + 10 dB(A)" noise goal at sensitive receiver locations, investigate and implement all practical techniques to limit noise emissions. For residential receivers, a background + 10 dB(A) goal has been adopted at all times. When these noise levels can not be met all possible and practical acoustic treatments/management controls will be investigated.
- If the noise goal is still exceeded after applying all practical engineering controls to limit noise emissions, review the management techniques to mitigate noise emissions in accordance with AS2436.

8.4 STUDY OVERVIEW

This report presents evaluation of potential noise emissions from the Horsley Drive Business Park - Proposed Warehouse at Lots 5 and 6, Leppington development site relating to construction works (including demolition, excavation and construction) of the internal roads and warehouses.

The aim of this study is to undertake an analysis of noise impact arising from site activities undertaken in normal construction hours, i.e.

1. 7am - 6pm on weekdays.
2. Between 8:00 am and 1:00 pm, Saturdays;
3. No work on Sundays and public holidays
4. Unless otherwise approved by local council.

Activities will be carefully managed and appropriate noise mitigating measures will be strictly implemented where required. The formulation of noise management plans for the various activities will arise from the assessment carried out in this report and the strict enforcement of all determined control measures.

8.5 BACKGROUND NOISE LEVELS

In order to assess noise impact from this development it is first required to determine the prevailing noise environment in the absence of construction noise at all potentially affected receiver locations.

Background noise levels in this area are principally determined by traffic on the surrounding roadways including The Horsley Drive and Cowpasture Road which carry medium to high traffic volumes during most hours of the day.

Noise level measurements conducted at the site as part of this investigation are detailed below.

Measurements were performed generally in accordance with the Australian Standard AS 1055 - “Description and measurement of environmental noise - General Procedures”.

8.5.1 Measurement Location

Environmental noise levels were measured in the vicinity of the subject development. The measurement locations were determined to be representative existing background noise levels.

8.5.2 Time of Measurements

Attended noise measurements were conducted at the site during a typical daytime period as detailed in Section 3 of this report.

8.6 MEASURED NOISE LEVELS

Table 14 lists the measured L_{eq} dB(A) noise levels that were recorded at the site and will be used as the basis of this report.

Table 14 - Measured Background Noise

Period	$L_{90\ (15\ min)}$ dB(A)
Day time background noise level	51

8.7 POTENTIALLY AFFECTED NOISE SENSITIVE RECEIVERS

The surrounding uses of the development include the following:

- Industrial uses to the East of the site across Cowpasture Road;
- Allotments as part of the Horsley Drive Business Park to the North and West; and

Sensitive receivers which may have the potential to be impacted by noise and vibration from the operation of the site are as follows:

- Residences approximately 405m to the West of the site located at 1489 The Horsley Drive.

8.8 CONSTRUCTION ACTIVITIES AMELIORATIVE MEASURES

The analysis indicates that most of the construction work activities will not adversely impact the surrounding receivers, with the exception of the following:

- High noise activities such as hammering, sawing and concrete pumping and the like.

Recommendations are made to reduce noise emissions to the noise goals, and to implement other measures to minimise noise emissions where practicable:

- In the event noise levels at receivers exceed criteria the following recommended treatments may be used to minimise noise from hydraulic hammering:
    - Acoustically screen activities from surrounding receivers by using building structures or a specifically constructed screen.
    - Acoustic testing to plant and equipment to confirm if site noise levels comply with nominated manufacturing noise levels.
    - Regular maintenance of equipment.
    - Locating concrete pumps at a maximum distance from neighbouring residential receivers.

8.9 VIBRATION ASSESSMENT

Construction vibration criteria associated with works on the site when measured at the potentially affected receivers should not exceed the following sets of vibration criteria to ensure no architectural or structural damage to surrounding buildings. These standards have been selected as they are widely used in the assessment of vibration associated with construction activities within Australia, namely:

- German Standard DIN 4150-3 (1999-02): "Structural Vibration – Effects of Vibration on Structures"; and
- British Standard BS 6472:1992 "Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz).

The criteria and the application of these Standards are discussed in separate sections below.

8.9.1 German Standard DIN 4150-3 (1999-02)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in the Table below.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 15 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			**Plane of Floor of Uppermost Storey**
		< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**	**All Frequencies**
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

8.9.2 British Standard BS 6472:1992

British Standard BS 6472:1992 develops criteria relating to levels of building vibration that may be expected to give rise to "adverse comment", in the frequency range most applicable to impacts associated with construction, which is 1 to 80Hz. These threshold values are used as criteria for assessing the loss of amenity and are presented below in Table 3.

Table 16 – BS 6472:1992 Criteria to Avoid "Adverse Comment"

Type of Occupancy	Time of Day	Peak Particle Velocity (mms^{-1}) between 1Hz to 80Hz Likely to Cause *"Adverse Comment"*			
		Continuous Vibration		Intermittent Vibration and Impulsive Vibration Excitation with Several Occurrences per day	
		Vertical	Horizontal	Vertical	Horizontal
Residential	Day	0.3 to 0.6	0.8 to 0.6	8.4 to 12.6	24 to 36
	Night	0.2	0.6	2.8	8
Offices	Day	0.6	1.6	18	51
	Night	0.6	1.6	18	51
Workshops	Day	1.2	3.2	18	51
	Night	1.2	3.2	18	51

The limits indicate that people in buildings are significantly less susceptible to horizontal vibration than to vertical vibration. Furthermore, Section 4.1 of BS 6472 notes that situations can exist where vibration magnitudes above those generally corresponding to minimal "adverse comment" levels can be tolerated, particularly for temporary disturbances and infrequent and intermittent events such as those associated with construction projects.

8.10 CALCULATED NOISE AND VIBRATION IMPACTS

This section of the report predicts the potential noise and vibration impact on the surrounding residential receivers based on the expected equipment to be operated on the site.

8.10.1 Vibration impact

Based on the distances between the boundary of the proposed site and the surrounding residential receiver's vibration will not exceed the project criteria as detailed in this report.

8.10.2 Noise Emission Assessment

Noise generated by plant and equipment throughout the duration of the project will be managed to generally comply with the background +10dB(A)+ 5 dB(A) or criterion (as applicable), and where this noise goal may be exceeded noise will be managed in strict compliance with the EPA Interim Construction Noise Guideline and AS2436.

Predictions of noise levels impacting surrounding receivers from excavation processes have been assessed.

The excavation and construction activities which will potentially be operational on the site which have been assessed as being operational simultaneously.

8.10.3 Assessment of Potential Noise Emissions

Noise impact assessment will be determined from the processes and equipment with the potential to generate high levels of noise. The A-weighted sound power levels for all the component parts of the above-described activities are outlined in the table below.

Table 17 - Excavation and Construction Activities – Sound Power Levels

ACTIVITY	EQUIPMENT /PROCESS	SOUND POWER LEVEL – AVERAGE MAXIMUM dB (A)
Excavation Activities	Excavators with Hammers	115
	Excavators without hammers	105
	Bobcat	105
	Trucks	108
	Scissor Lift	100
	Excavators	105
Construction Activities	Drilling	94
	Hammering	110
	Concrete Vibrator	100
	Cement Mixing Truck	105
	Concrete Pumps	107

The noise levels presented in the above table are derived from the following sources, namely:

1. On-site measurements
2. Table D2 of Australian Standard 2436-1981
3. Data held by this office for other similar studies.

8.10.4 potentially affected receivers

A survey of potentially affected sensitive residential receivers has been conducted and identified the following locations which have been indicated in the table below.

Table 18 – List of Nearest Receivers

Receiver Number	Description
1	Industrial Revivers
2	Residential Receiver to the west of the site

8.10.5 Noise EMISSION ASSESSMENT

Noise generated by plant and equipment throughout the duration of the project will be managed to generally comply with the background + 10dB criterion, and where this noise goal may be exceeded noise will be managed in strict compliance with the EPA Interim Construction Noise Guideline and AS2436 as detailed within the DGR requirements.

Noise level predictions have been conducted to the potentially worst affected façades of the surrounding receivers over a typical 15min working period.

8.10.5.1 Receiver 1 – Industrial Receivers

The following table presents a summary of airborne noise levels which will occur externally at the industrial receivers surrounding the site.

Table 19 – Predicted Construction Noise Levels to Industrial Receivers

EQUIPMENT /PROCESS	EXTERNAL SOUND LEVEL dB(A) $L_{Aeq\ (15min)}$	RECEIVER GOAL NOISE LEVEL dB(A) $L_{Aeq\ (15min)}$	COMMENTS
Excavation Activities	Up to 66	Background + 10 dB(A) or 75 dB(A)	Compliance with relevant criteria
Construction Activities	Up to 62		

8.10.6 Receiver 2 – Residential Receiver to the West of the Site

The western residential receiver is a significant distance from the proposed site boundary (in excess of 400m). The construction noise levels have been predicted based on the proximity of the receiver to the proposed site. The predictions also included distance losses and the equipment noise levels as tabled above.

The following table presents a summary of airborne noise levels which will occur externally at the residential receiver to the west of the site.

Table 20 – Predicted Construction Noise Levels to Residential Receiver to the South

EQUIPMENT /PROCESS	EXTERNAL SOUND LEVEL dB(A) $L_{Aeq\ (15min)}$	RECEIVER GOAL NOISE LEVEL dB(A) $L_{Aeq\ (15min)}$	COMPLIANCE
Excavation Activities	Up to 53	Background + 10 dB(A) or 61 dB(A)	Compliance with the relevant noise level criteria
Construction Activities	Up to 51		

8.10.7 Proposed Monitoring Equipment

Monitoring of the proposed construction should be conducted as follows:

Noise - Noise measurements/monitoring should be conducted during periods with the potentially greatest impact to neighbouring receivers. In the event compliance with noise goals is achieved no additional monitoring is required unless alternative work practices are adopted. If exceedances are found noise monitoring should be conducted during periods when this process is in operation.

Vibration- Vibration measurements/monitoring should be conducted at potentially worst affected receivers during periods impact is greatest from construction activities, when activities may have the potential to impact surrounding receivers. If this is found to be compliant no additional monitoring is required. If exceedances are likely continuous noise monitoring should be conducted during the period when this activity is in operation.

8.11 NOISE AND VIBRATION MONITORING, REPORTING AND RESPONSE PROCEDURES

Noise and vibration monitoring will either consist of manned and/or unmanned measurements.

Active monitoring will be conducted by Acoustic Logic during the construction work phase of the project if required. In the event complaints are received from neighbours the following process will be followed:

1. Determining the offending plant/equipment/process
2. Locating the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implementing additional acoustic treatment in the form of localised barriers, silencers etc
4. Selecting alternative equipment/processes

Where monitoring is required and indicates exceedences of the noise limits immediate action should be taken to identify any further controls as required to reduce noise emissions so that the noise limits are complied with. Monitoring of the activities following the implementation of these additional controls will be undertaken to confirm compliance.

8.11.1 Discussion

Based on the location of the proposed development and the proposed activities to be conducted on the site noise and vibration is expected to generally comply with the criteria detailed in this report.

8.12 REPORTING REQUIREMENTS

The following shall be kept on site by the builder.

1. A register of complaints received/communication with the local community with information as detailed below.
2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring.
3. Any noise exceedences occurring including, the actions taken and results of follow up monitoring.
4. A report detailing complaints received and actions taken shall be presented.
5. All monitoring and reporting shall be conducted in conjunction with the conditions of consent.

8.12.1 Response Procedures

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager and the general public and their contact telephone number

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

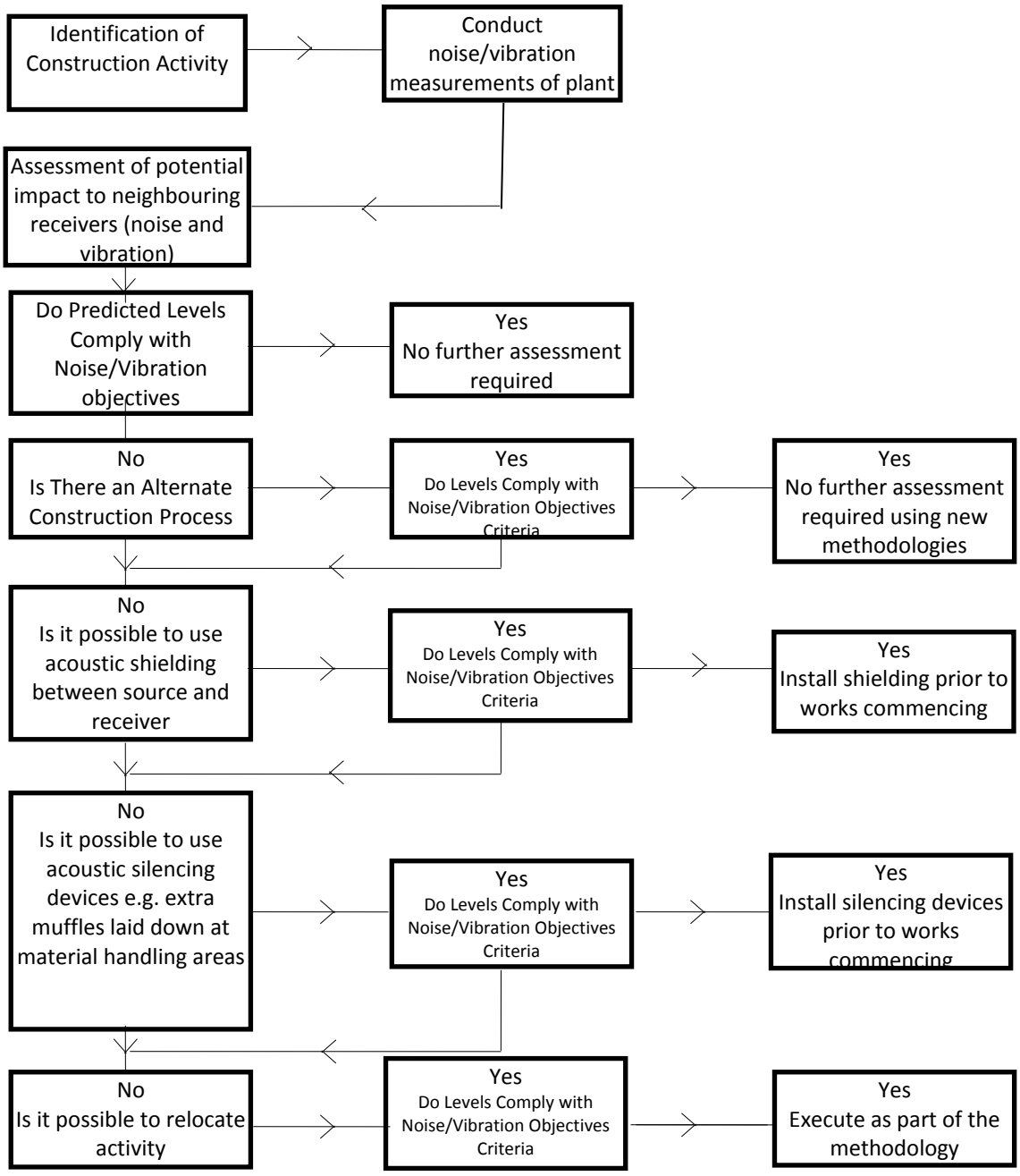
- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint and a summary of the results of the investigation.
- What operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Validation of the remedial action.
- Summary of feedback to the complainant.

8.12.2 Control of Construction Noise

As a part of the noise management plan a detailed study has been undertaken of each of the proposed activities that will occur as a part of the construction work on this project. The execution of this work will facilitate the formulation of noise control strategies for this project.

The flow charts that follow illustrate the process followed to assess construction activities prior to the start of work on site and well as the ongoing investigation into noise during the construction period.

Chart 1 – Initial Assessment of Procedures



8.13 NOISE CONTROL METHODS

The determination of appropriate additional noise control measures will be dependent on the particular construction appliances identified as exceeding noise level criteria and requiring future acoustic treatments to those already identified in this report. This section provides an outline of available methods which have previously been used on similar construction sites and may be possible on this site.

8.13.1 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate noise levels that exceed the criteria, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying this activity by use of pneumatic hammers, bulldozers ripping and/or milling machines lower levels of noise will result.

8.13.2 Acoustic Barriers

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant (tower cranes). Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

Barriers can also be placed between the source and the receiver. The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10 or 15mm plywood would be acceptable for the barriers. A double paled or lapped and capped fencing construction is recommended for such barriers.

8.13.3 Silencing Devices

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding or special industrial silencers fitted to exhausts.

8.13.4 Treatment of Specific Equipment

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted. Examples of specific treatments include the following:

1. Wrapping of hydraulic hammers.

2. Screening of areas of impact from excavation equipment.

3. Treatment to saw or impact equipment using shrouds.

8.13.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers.

8.14 PROCEDURES - NOTIFYING RESIDENTS

As a part of the on-going process of compliance on this project it is proposed to undertake a programme of community consultation. Continual communication is required between all parties which may be potentially impacted upon, the builder and the regulatory authority. On this basis it is recommended that the Site Manager liaise directly with potentially affected parties. This also establishes a dynamic response process, which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation process is to:

- Inform and educate the groups about the project and the noise controls being implemented.

- Increase understanding of all acoustic issues related to the project and options available.

- Identify group concerns generated by the project, so that they can be addressed.

- To ensure that this process is effective, regular scheduled meetings will be required for a finite period, until all issues have been addressed and all parties embrace the evidence of successful implementation.

- An additional step in this process is to inform residents specifically where construction activities are likely to affect their amenity from noise and/or vibration.

8.15 CONTINGENCY PLANS

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager and a contact telephone number

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Indicate what operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Monitoring conducted if required.
- Validation of the remedial action.
- Summary of feedback to the complainant.

9 CONCLUSION

This report presents the assessment of potential noise impacts associated with the proposed warehousing and distribution facility to be located on Lot 5 and 6 of the Horsley Drive Business Park development.

Predicted noise levels from the operation of the facility have indicated that the development will be in full compliance with the EPA Industrial Noise Policy, Road Noise Policy and the requirements of Fairfield Council without the need for additional acoustic treatment for 24 hour operation.

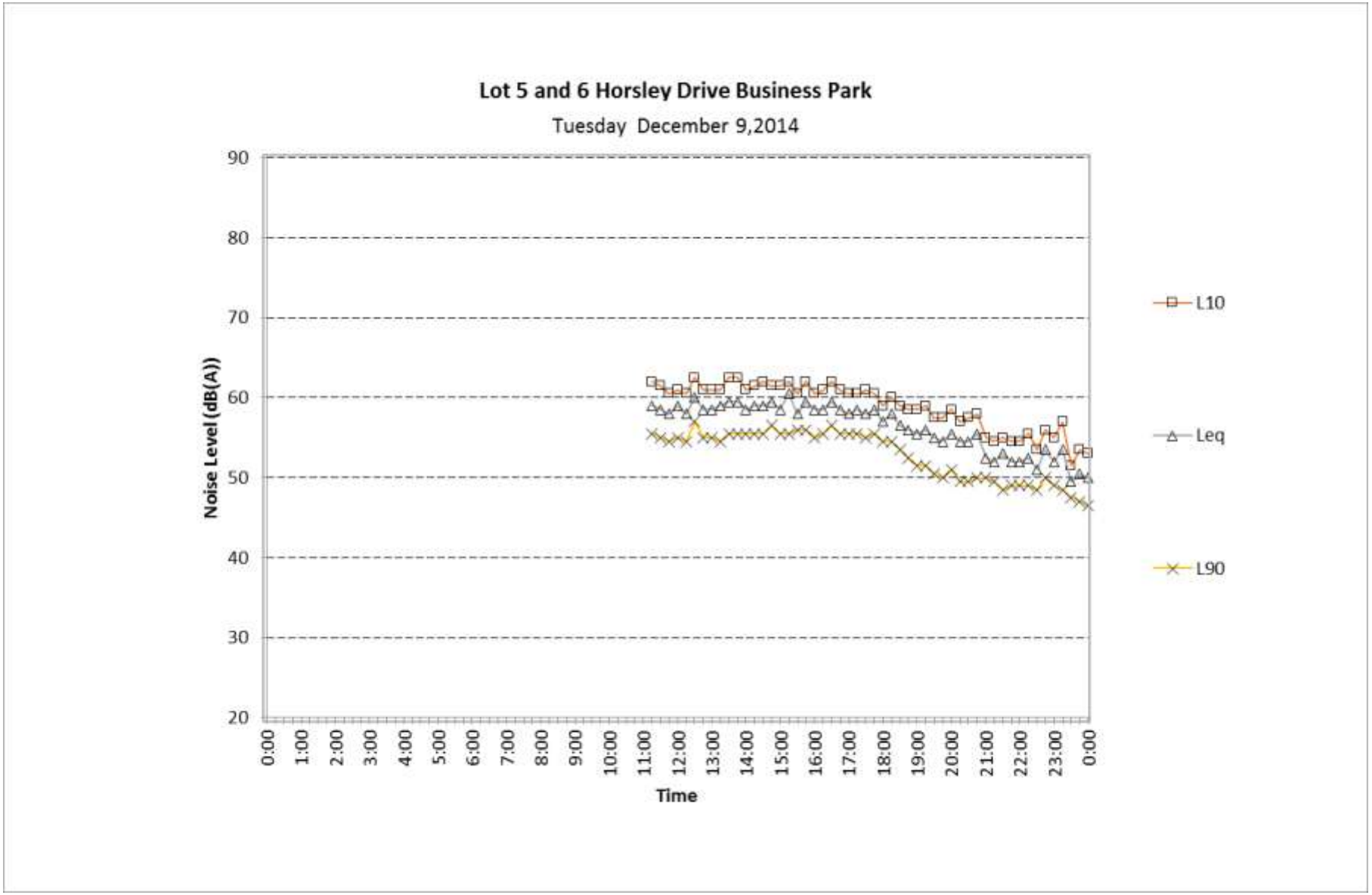
The Construction Noise and Vibration Management for the site has also been presented including the relevant noise and vibration criteria during this period.

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

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Ben White

APPENDIX ONE – UNATTENDED NOISE MONITORING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70
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2:00
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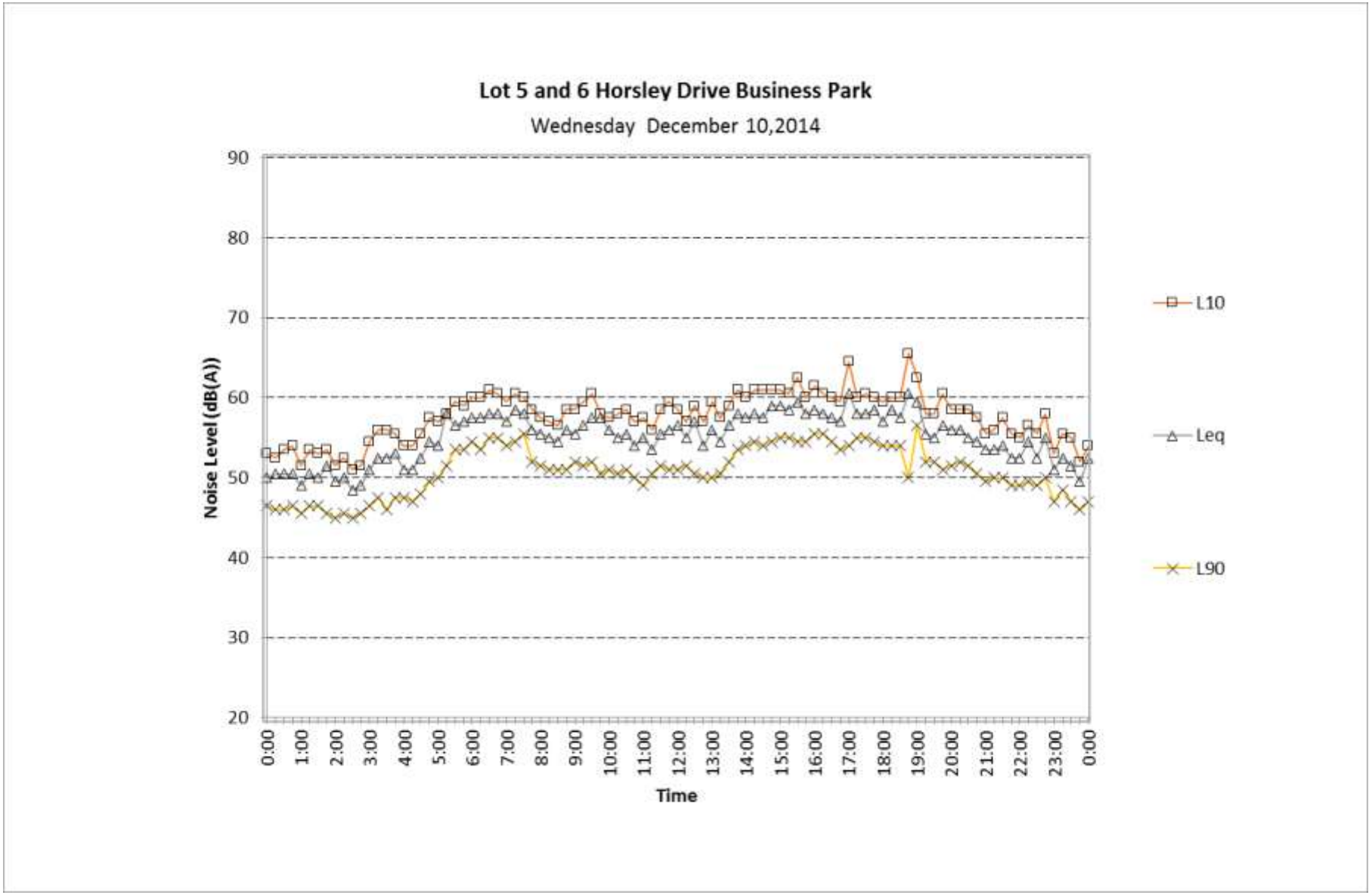
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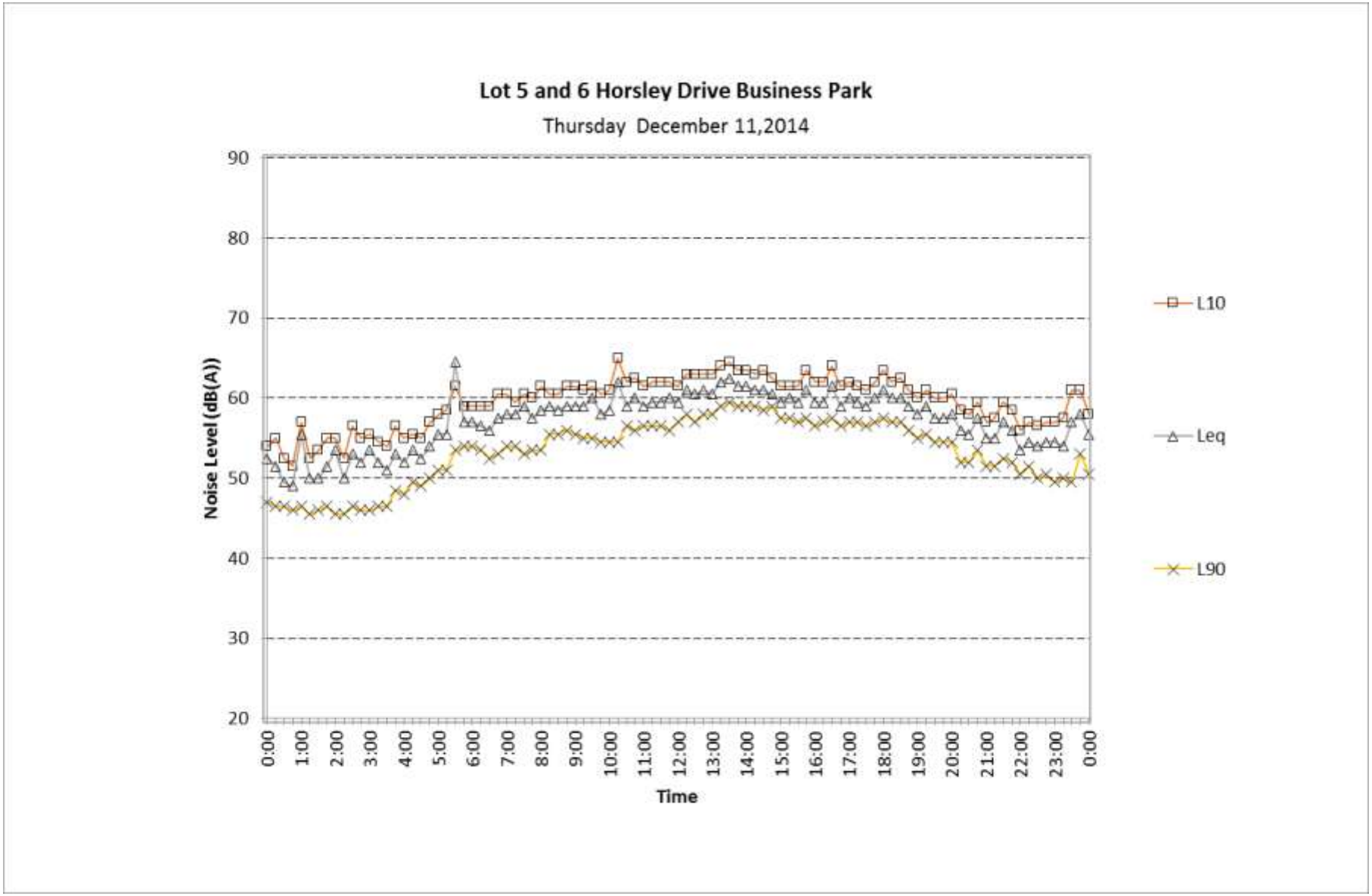
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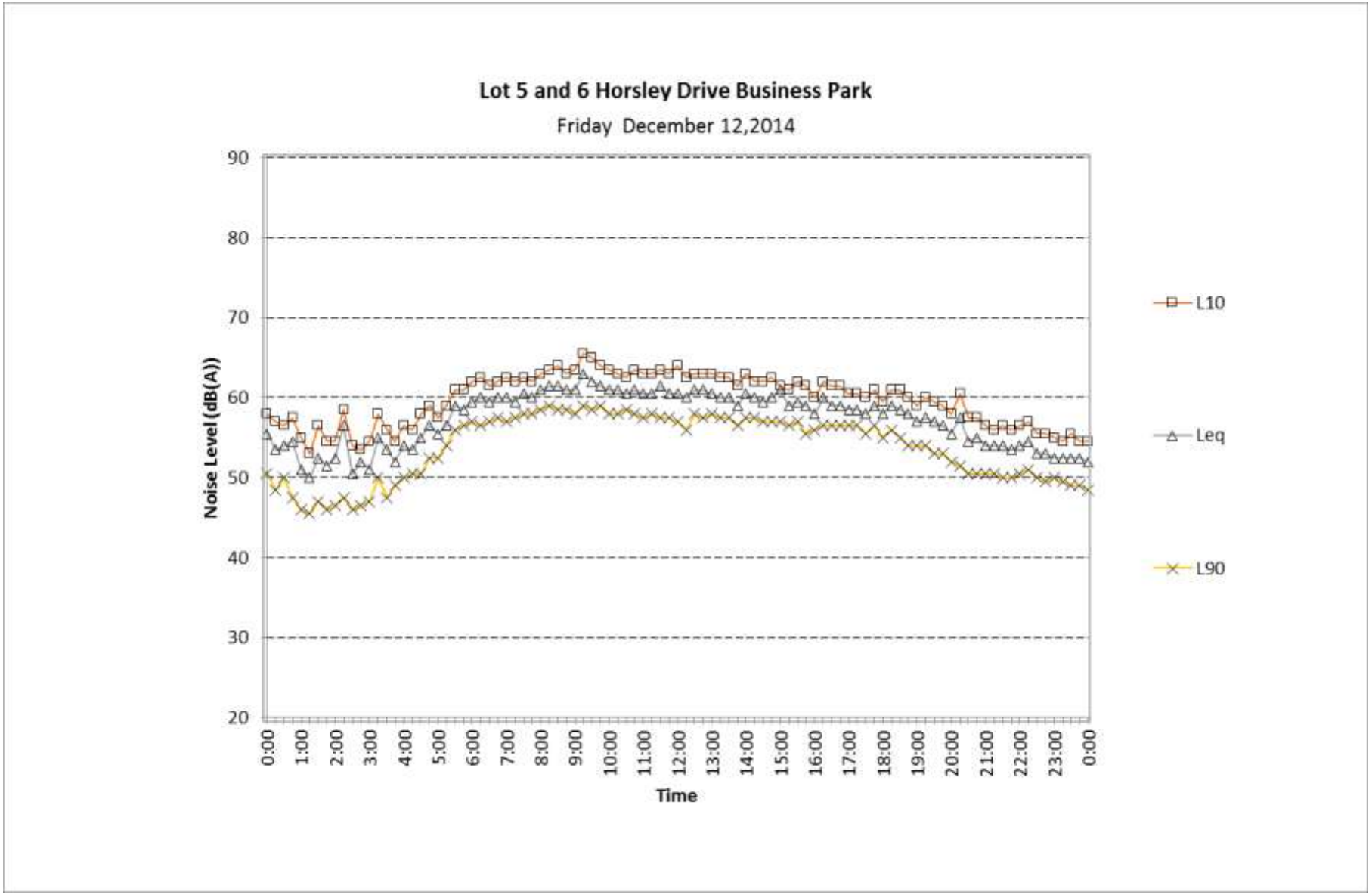
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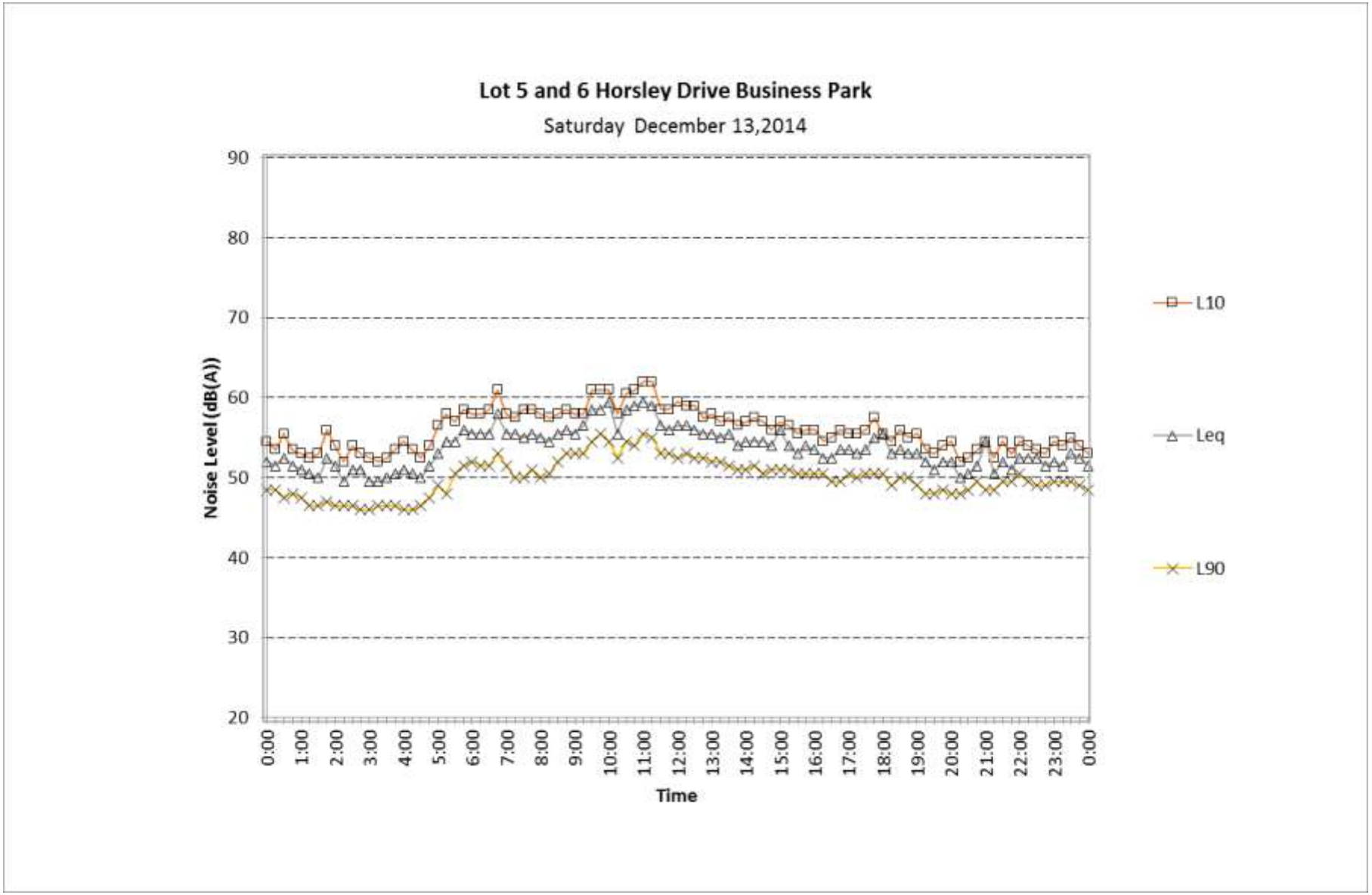
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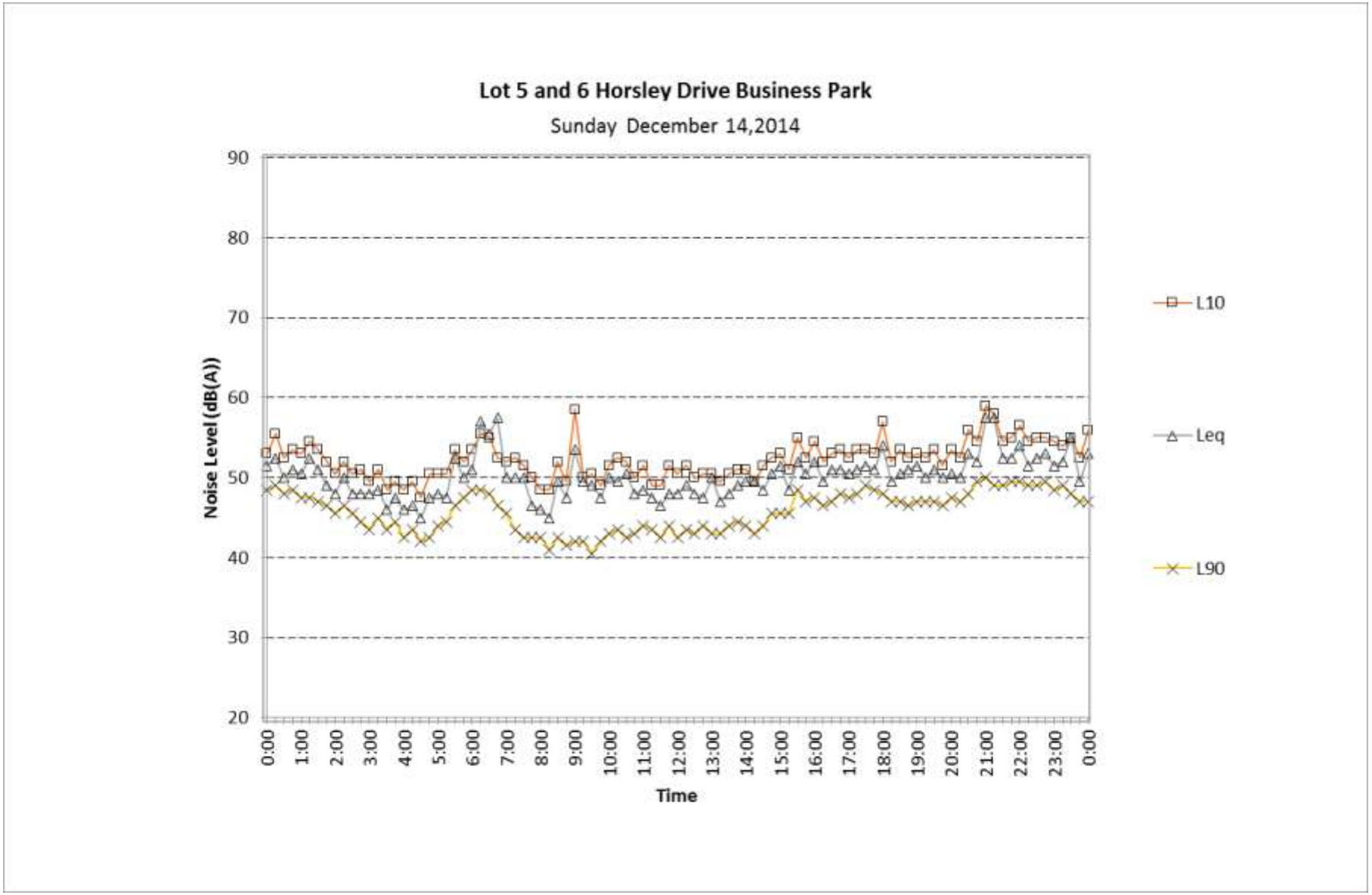
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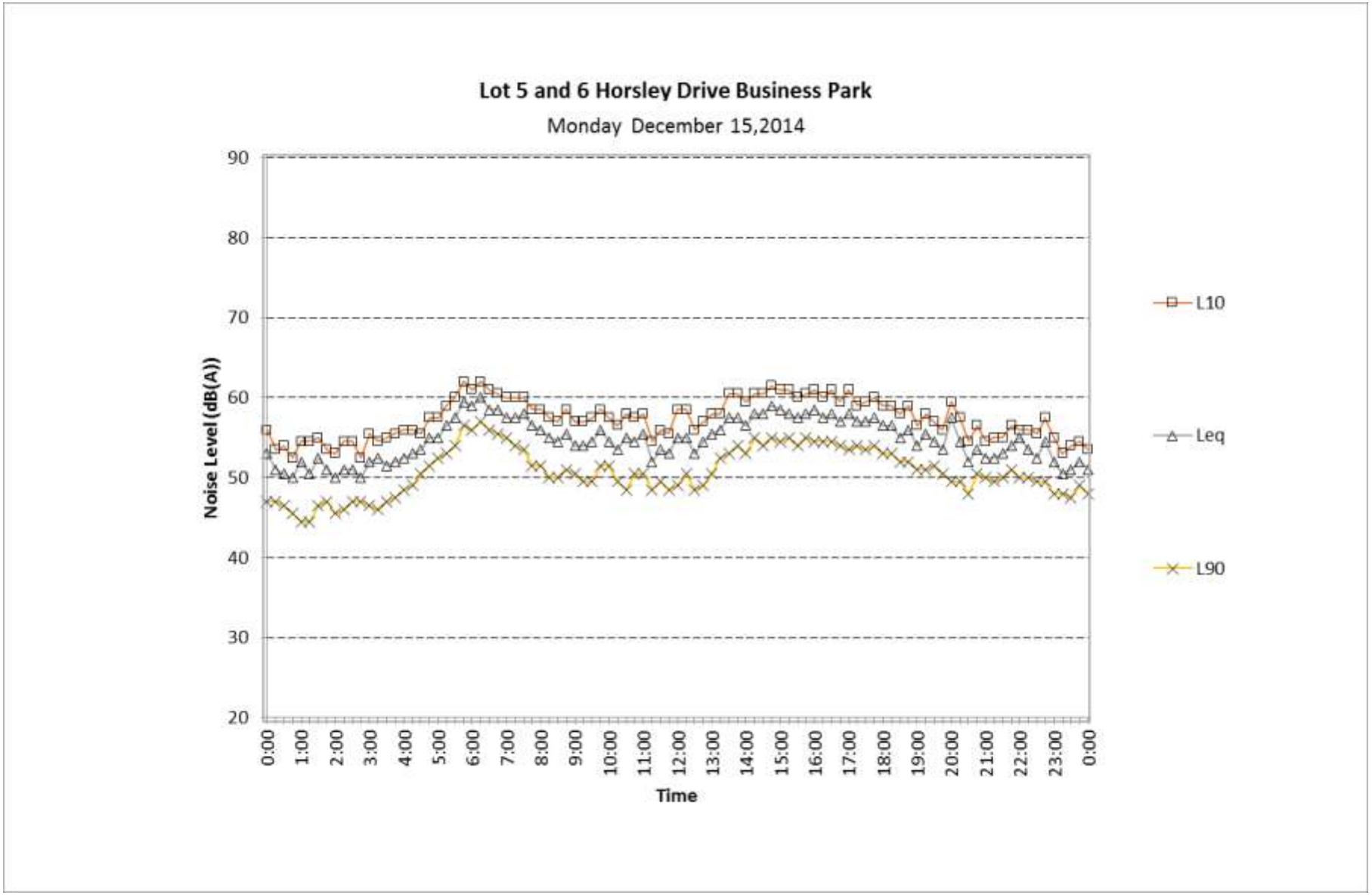
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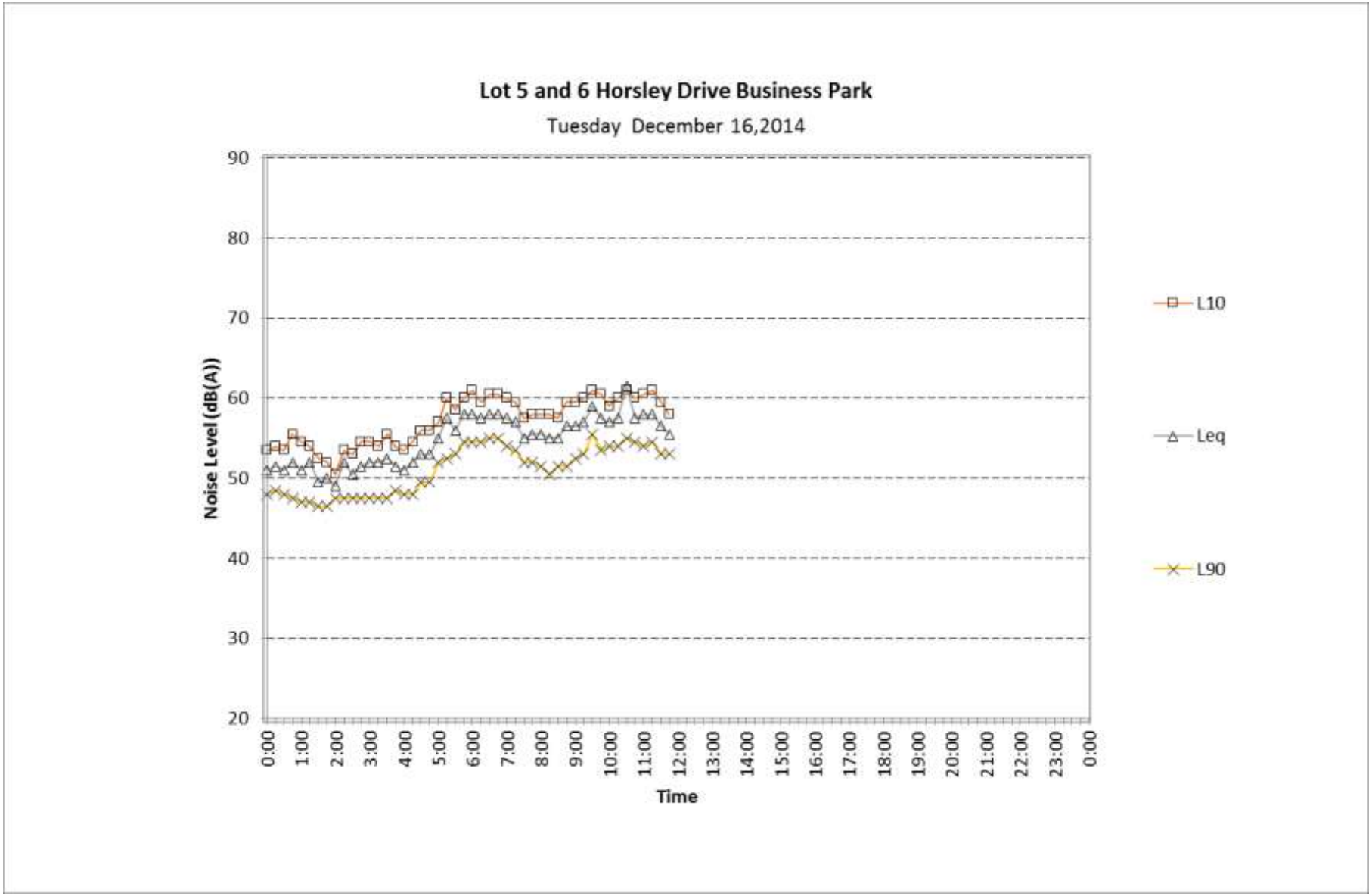
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