Noise Impact Assessment

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NORTHEAST BUSINESS PARK
NOISE IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

A Noise Impact Assessment is required as part of the application for approval to construct and operate the proposed Northeast Business Park (NEBP). The development incorporates a multi-use business park and marina concept that will integrate business, industry, commercial, marina facilities, residential, heritage and recreational greenspace precincts on land within the Caboolture Shire that is surrounded by existing noise sensitive places.

This report has been prepared to determine the following impacts at existing noise sensitive places.

1. Construction impacts.
2. Operational impacts of the NEBP development from marina facilities and associated uses.
3. Off-site impacts due to increased road transportation from haulage of construction materials etc. and Caboolture River dredging.

The methodology for determining impacts is described in section 2 of this report. Noise monitoring and measuring of the separation distances between activities and noise sensitive places was undertaken to describe the existing environmental values to be protected from potential development impacts. Sensitive places have been categorised into 4 areas (Residential Areas A, B, C and D) and impacts on each area from construction works, operation of the development, off-site traffic and dredging activities have been assessed.

Construction impacts were determined by analysing the predicted noise levels of plant and equipment proposed for each activity determined in the CIVIL construction resource framework that is part of the Construction Methodology prepared by Laing O'Rourke (2007). Noise recommendations for the entire construction period have been based on the worst case scenario, being the period when noise levels would be most intrusive at noise sensitive places.

Potential impacts from construction noise at noise sensitive places are expected for those activities requiring heavy plant and equipment in close proximity to the development outline, including:

- site establishment;
- bulk earthworks;
- sub-division works;
- golf course construction; and
- bridge building.

Mitigation measures have been proposed to reduce potential noise impacts from construction works, in particular staging development and standard noise control strategies. Realistic attenuation distances and high background noise levels from existing activities will further reduce potential noise impacts in addition to the progressive acoustic absorption from built-up sub-divisions.

Potential noise impacts resulting from the operation of the development including industrial activities have also been assessed. This assessment concluded that the noise reduction afforded by structures and landforms would mitigate noise from marina operations on sensitive places and operational noise from the Business Park will comply with relevant noise criteria. However recommendations for mitigating noise from the Business Park have been made in accordance with best practice standards due to the close proximity of the precinct boundary to existing residences. Mitigation measures include acoustic timber fencing along the business park boundary facing towards Residential Area B (Coach Road residents) to protect dwellings from potential night time activities (for example deliveries) and 24 hour noise sources (for example air conditioners and ventilation fans).

Noise generated by off-site impacts from road traffic accessing the NEBP project area from the major access point, Buchanan Road, was found to not significantly affect Residential Area A (Trafalgar Drive residents) due to an existing 130 metres separation distance to the closest dwelling. Road works are also not anticipated to adversely affect the internal amenity of existing dwellings, particularly as the quality of the existing environment is already reduced due to the proximity of this area to the Bruce Highway. Simple mitigation measures such as restricting delivery times and work hours during construction phases will be sufficient to prevent any deterioration of amenity.

Off-site impacts relating to noise from the dredging of the Caboolture River were deemed negligible due to the limited number of dwellings in the vicinity of the defined dredge area.

This report concludes that the proposed development will not adversely impact on adjacent existing noise sensitive places primarily due to the staged development plan and associated acoustic absorption from built-up sub-divisions, realistic attenuation distances, and mitigation strategies proposed as part of the construction and operational works.

1. INTRODUCTION

Cardno (Qld) Pty Ltd ("Cardno") has been commissioned by Northeast Business Park Pty Ltd ("the Proponent") to complete a noise impact assessment for the construction and operation of the proposed Northeast Business Park ("NEPB") development. The NEBP development is located on parcels of land totalling 763 hectares within the Caboolture Shire Council ("Council") Local Government Area identified by the following real property descriptions.

- Lot 2 on RP902075.
- Lot 10 on RP902079.
- Lot 24 on SP158298.
- Lot 7 on RP845326.
- Lot 15 on RP902073.
- Lot 12 on RP145197.
- Lot 17 on RP902072.

The site locality is presented in Figure 1.

The NEBP development incorporates a multi-use business park and marina concept that will integrate marina facilities and appropriate business, and residential, heritage and greenspace precincts providing a place to live, to work and to play in a master planned riverside precinct on the Caboolture River. Figure 2 provides an illustration of the development proposal and final land uses.

The Proponent has adopted a 'net benefit' approach as a central tenet of the development philosophy, seeking to achieve important demonstrable net benefits to the community in social, environmental and economic terms, on a sustainable basis.

As such this Noise Impact Assessment has been prepared to ensure the Proponent has minimal acoustic impact on the existing development in the region and inform the Environmental Impact Statement required by the Queensland Coordinator General for the proposed NEBP development. The EIS will form the basis for Local, State and Federal approval decision making.

This report has been prepared to determine the following impacts at existing noise sensitive places.

1. Construction impacts.
2. Operational impacts of the NEBP development from marina facilities and associated uses.
3. Off-site impacts due to increased road transportation from haulage of construction materials etc.. and Caboolture River dredging.

This assessment will recommend appropriate methods for noise attenuation to ensure that the development meets relevant acoustic quality objectives to prevent environmental nuisance.

This report also addresses noise impacts on noise sensitive places from the operation of industrial and commercial land uses within the proposed Business Park by providing an addendum to the existing technical study by Max Winders & Associates titled *Noise Impact Assessment, Proposed Caboolture River Business Park, Parcel 62, 2-32 & 34 Nolan Drive Morayfield* (6 August 2004). This addendum updates the existing technical study based on the new development proposal. This report is attached as Appendix A.

This noise impact assessment was undertaken in accordance with the Caboolture Shire Council Planning Scheme ("the Planning Scheme") and Planning Scheme Policy 15 Noise ("the Policy").

2. METHODOLOGY

The following methodology was employed to determine the impacts from the construction and operation of the NEBP development and recommend appropriate mitigation measures.

1. A review of plans of the NEBP development to determine the locations of potential noise sensitive places adjacent to the site.

2. A review of aerial photography and zoning maps to determine the nature of the surrounding land uses and existing attenuation distances between sensitive places and precinct boundaries where noise from construction and operation is anticipated.

3. A review of the components of the NEBP development to determine the nature of the noise sources at the site including resource analysis of plant and equipment and timing framework(s).

4. Unattended Sound Pressure Level (SPL) monitoring to provide baseline monitoring data to determine the existing daytime and night time background acoustic environment at surrounding sensitive places.

5. A review of relevant planning instruments, legislation and standards to determine relevant acoustic quality objectives.

6. An assessment of the impacts from construction and operational noise by :

   - determining stages (and activities) when noise may adversely impact on sensitive places through assessment of attenuation (separation) distances;
   - determining the quarter of any year within each development stage where construction plant and equipment will potentially affect sensitive places considering attenuation distance and sound power levels of plant and equipment;
   - determining the combined SPL at each noise sensitive place and comparing this to relevant acoustic quality objectives.

7. Recommendation of appropriate noise mitigation strategies where required to protect existing environmental values.

3. EXISTING ENVIRONMENT

3.1 Noise Sensitive places

The noise sensitive land uses adjacent to the proposed NEBP development potentially affected by the development are described below with existing separation distances presented in Table 1.

Noise sensitive places were identified based on the following definition under the EPP Noise which includes:

a) a dwelling;
b) a library, childcare centre, kindergarten, school, college, university or other educational
c) institution;
d) a hospital, surgery or other medical institution;
e) a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest, under the *Nature Conservation Act 1992*;
f) a marine park under the *Marine Parks Act 1982*;
g) a park or garden that is open to the public (whether or not on payment of money).

Figure 3 illustrates noise sensitive places considered by this assessment.

Attenuation distances to noise sensitive places from various development activities have been calculated based on the closest dwelling on that street address to the boundary of the proposed land use as a conservative representative of the most noise sensitive place.

Residential Area “A” includes residential dwellings on Trafalgar/Nolan Drive and for reference to separation distance, Lot 18 on Plan RP145197, Trafalgar Drive, Caboolture has been identified as the closest dwelling.

Residential Area “B” includes residential dwellings on Coach Road and for reference to separation distance, Lot 6 on Plan SP188297, Coach Road, Caboolture has been identified as the closest dwelling.

Residential Area “C” includes residential dwellings on Buckley Road, Caboolture and for reference to separation distance, Lot 1 RP87747, Buckley Road, Caboolture has been identified as the closest dwelling.

Residential Area “D” includes residential dwellings on Farry Road and for reference to separation distance, Lot 3 on Plan RP847078, Farry Road, Caboolture has been identified as the closest dwelling.

No separation distance has been tabulated between some activities and noise sensitive places. In these instances no predicted impact is expected from the activity on that sensitive place due to the significant attenuation distances, generally more than 1200 metres.

Table 1 Noise sensitive places and Attenuation Distances

Sensitive Place	Development Activities											
	Establishment	Bulk Earthworks and Marina Excavation		Subdivision Work - Construction				Major Road, Entry and Interchange Construction	Golf Course Construction	Boulevard Bridge Construction	Minor Bridge(s) Construction	Marina Operation including Shipyard
				Industry	Commercial	Residential	Marine Residential					
	Stage 1	Stages 1-3		Stages 1-6	Stages 4-6	Stages 4-11	Stages 5 -11	Stages 1- 2	Stages 2 & 7	Stages 2-5	Stages 7-9	Stage 3+
		Fill	Cut									
Residential A	80m	210m	1100m	80m	900m	NA	NA	100m	NA	NA	NA	NA
Residential B	130m	150m	370m	130m	700m	700m	NA	NA	400m	NA	NA	NA
Residential C	NA	220m	500m	1100m	NA	130	NA	NA	450m	1000m	NA	NA
Residential D	NA	130m	350m	NA	NA	130m	NA	NA	130m	NA	NA	NA

3.2 Ambient Noise Levels

Monitoring has been undertaken at locations representative of the closest noise sensitive places over a 5 day monitoring period (including week and weekend days) to determine existing representative background noise levels. Monitoring locations are shown in Figure 3.

Monitoring locations were selected to represent three noise sensitive places identified in this assessment as shown below.

Monitoring Location 1 – Residential A Area
Monitoring Location 2 – Residential B Area
Monitoring Location 3 – Residential D Area

No monitoring occurred by datalogging at Residential Area C due to the nature of the area being serviced by a single local road and as such would be similar to those levels recorded at Residential D given the comparable land uses. Max Winders & Associates recorded the background noise at this location with results presented in Attachment 1 of the existing report.

Results from unattended SPL monitoring for daytime, evening and night time periods are presented in Table 2 with graphical illustrations attached as Appendix B.

Monitoring was undertaken in a period of fine weather. Noise levels were measured using three calibrated ARL 315 dataloggers.

The details of dataloggers used in recording SPLs at monitoring locations are given below including description of observed existing environment.

1. Monitoring Location 1 (Residential Area A)
   - Area surrounded with rural residential development.
   - Road traffic noise from Trafalgar Drive and Bruce Highway was audible.
   - Other noise sources in the vicinity of the monitoring location included a horse training premise opposite.
   - Noise logger was located 4.8 metres from the roadway secured to an electricity pole.
   - Monitoring started from 11.45am on 28 July 2007.
   - Datalogger Serial Number was 15299425.
   - Pre-calibration recording was 94.0 dB(A).
   - Post-calibration recording was 93.6 dB(A).

2. Monitoring Location 2 (Residential Area B)
   - Area surrounded by rural residential development.
   - Road traffic noise from the Bruce Highway was audible.
   - Other noise sources in the vicinity of the monitoring location included penned animals (eg. goats).
   - Noise logger was located onto private property with vegetation only separating it from the development project area.
   - Monitoring started from 12.00pm on 28 July 2007.
   - Datalogger Serial Number was 15299422.
   - Pre-calibration recording was 93.9 dB(A).
   - Post-calibration recording was 93.8 dB(A).

3. Monitoring Location 3 (Residential Area C)
   - Area surrounded by residential development.
   - Road traffic noise from Farry Road was audible.

- Noise logger was located 11.5 metres from the roadway secured to the fence of the development site.
- Monitoring started from 12.15pm on 28 July 2007.
- Datalogger Serial Number was 15233418.
- Pre-calibration recording was 94.0 dB(A).
- Post-calibration recording was 93.6 dB(A).

Table 2 Background Sound Pressure Levels from Baseline Noise Monitoring

Noise Monitoring Statistics						
Date	**Sensitive Place**	**Period**	**L_{Amax}**	**L_{A10}**	**L_{A90}**	**L_{Aeq}**
28/07/2007	Residential A	6am-6pm				
	Residential A	6pm-10pm	73	56	51	55
	Residential A	10pm-6pm	70	53	44	51
	Residential B	6am-6pm				
	Residential B	6pm-10pm	62	54	49	52
	Residential B	10pm-6pm	62	52	44	50
	Residential D	6am-6pm				
	Residential D	6pm-10pm	59	45	41	44
	Residential D	10pm-6pm	55	45	42	44
29/07/2007	Residential A	6am-6pm	78	55	49	56
	Residential A	6pm-10pm	73	57	51	55
	Residential A	10pm-6pm	67	53	43	51
	Residential B	6am-6pm	68	53	48	52
	Residential B	6pm-10pm	64	56	51	54
	Residential B	10pm-6pm	58	51	41	48
	Residential D	6am-6pm	63	47	41	45
	Residential D	6pm-10pm	58	43	40	43
	Residential D	10pm-6pm	49	41	40	40
30/07/2007	Residential A	6am-6pm	78	57	50	57
	Residential A	6pm-10pm	75	58	52	57
	Residential A	10pm-6pm	66	57	48	55
	Residential B	6am-6pm	69	53	47	51
	Residential B	6pm-10pm	62	56	51	54
	Residential B	10pm-6pm	64	57	47	54
	Residential D	6am-6pm	64	47	40	46
	Residential D	6pm-10pm	60	47	40	45
	Residential D	10pm-6pm	59	47	44	47
31/07/2007	Residential A	6am-6pm	78	55	48	57
	Residential A	6pm-10pm	77	57	52	57
	Residential A	10pm-6pm	71	57	47	54
	Residential B	6am-6pm	68	53	47	52
	Residential B	6pm-10pm	63	56	52	54
	Residential B	10pm-6pm	65	57	47	53
	Residential D	6am-6pm	65	48	39	46
	Residential D	6pm-10pm	59	46	40	45
	Residential D	10pm-6pm	52	50	47	49
1/08/2007	Residential A	6am-6pm	79	56	50	57
	Residential A	6pm-10pm	76	54	48	55
	Residential A	10pm-6pm	67	54	44	52
	Residential B	6am-6pm	69	56	51	55
	Residential B	6pm-10pm	62	55	50	53

	Residential B	10pm-6pm	65	57	46	54
	Residential D	6am-6pm	63	48	42	47
	Residential D	6pm-10pm	58	45	41	38
	Residential D	10pm-6pm	51	43	41	42

Noise levels recorded at Residential A and Residential B sensitive places indicate that the ambient noise environment at residences east and south of the development project area are currently significantly affected by road traffic noise from the Bruce Highway, and experience additional noise impact from vehicular traffic on Trafalgar Drive and Nolan Drive.

Noise levels decrease significantly at Residential Area D which is further from the Bruce Highway than Residential Areas A and B.

An average SPL for each statistical noise characteristic over the entire monitoring period is presented in Table 3.

Table 3 Background SPLS over Monitoring Period from 29 July 2007-1 August 2007

Sensitive Place	SPL L_{Amax} dB(A)	SPL L_{A10} dB(A)	SPL L_{A90} dB(A)	SPL L_{Aeq} dB(A)
Residential Area A	75	56	48	55
Residential Area B	65	54	48	52
Residential Area D	59	46	41	45

4. ACOUSTIC QUALITY OBJECTIVE

In Queensland, the *Environmental Protection (Noise) Policy 1997* (EPP Noise) provides the framework for assessing and managing noise and vibration from developments such as the Northeast Business Park under the *Environmental Protection Act 1994* (EP Act). The *EP Act's* objective is to protect environmental values through development and implementation of environmental protection policies. This is achieved in part by regulation of environmentally relevant activities prescribed in the *Environmental Protection Regulation 1998* (EP Regulation).

The environmental values to be enhanced or protected during the construction and operation of the NEBP development are identified in the EPP Noise as being the qualities of the acoustic environment that are conducive to—

a. *the wellbeing of the community or a part of the community, including its social and economic amenity; or*
b. *the wellbeing of an individual, including the individual's opportunity to have sleep, relaxation and conversation without unreasonable interference from intrusive noise.*

The EPP Noise identifies an acoustic quality objective which is the objective of achieving an ambient level of 55 dB(A) $L_{Aeq\ (24\ hours)}$ or less for most of Queensland's population living in residential areas. This long term objective aims to ensure achievement the object of the EPP Noise.

This acoustic quality objective is consistent with the relevant Local Government Planning Scheme which has identified that to maintain acoustic amenity within residential zones, the ambient noise level in all habitable rooms must not exceed 55 dB(A) at any time.

Specific construction noise level guidelines are provided under section 6W of the EP Regulation which defines time restrictions for construction, building and maintenance activities which may impact on sensitive places. Such works are restricted to the hours of 6:30am to 6:30pm Monday to Saturday. Outside of these hours the works must not cause audible noise at noise sensitive places.

There are no specific Queensland guidelines for vibration assessment from developments of this type and therefore vibration management which prevents environmental nuisance will be considered as part of the general environmental duty required of all developers to take all reasonable and practicable measures to prevent and/or minimise environmental harm.

The EIS process provides the ability for Council under its Planning Scheme and the Environmental Protection Agency to impose conditions relating to noise levels in so far as the jurisdiction of each agency extends.

Under Part 3 of the EPP Noise, matters for consideration in deciding noise conditions which are reasonable and relevant are specified including:

- the characteristics of the noise from the noise relevant activity;
- the order in which the applicant and affected persons started to occupy land at or near the relevant site;
- the order in which the applicant and affected persons started to carry out the noise relevant activity and other activities that may be affected by noise from the noise relevant activity;
- the views of affected persons about noise from the noise relevant activity; and
- other noises ordinarily present at or near the relevant site.

This noise impact assessment has considers such matters and proposes the following relevant criteria for construction and off-site works and the Business park and marina operation.

4.1 Construction and Off-site Works

For the purposes of this assessment, the background plus excess criteria is deemed appropriate to determine construction and off-site noise impacts at sensitive places based on:

- noise sensitive places firstly occupying the locality;
- proximity to the Bruce Highway and influence of road traffic noise;
- ambient noise monitoring results;
- stead-state emissions from proposed plant and equipment used on and off site;
- minor concerns of neighbouring properties relating to noise in comparison to other development elements such as traffic; and
- net economic, social and environmental benefit of the development.

The proposed background plus excess noise criteria is presented in Table 4 and is relevant in the event of a complaint considering noise impacts are subjective and primarily complaint driven.

In the event noise from construction and operation of the development is disturbing sleep within a habitable dwelling, an internal objective of 55 dB(A) $L_{Aeq,\,T}$ will apply.

Table 4 Background plus Excess Noise Criteria (dB(A))

Period	Noise Level at Noise Sensitive Place measured as the $L_{Aeq,T}$	Noise Level at Commercial Premise measured as the $L_{Aeq,T}$
Daytime 7.00am – 6.00pm	Background noise level plus 5 dB(A)	Background noise level plus 10 (dB(A)
Evening 6.00pm – 10.00pm	Background noise level plus 5 dB(A)	Background noise level plus 10 (dB(A)
Nighttime 10.00pm – 7.00am	Background noise level plus 3 dB(A)	Background noise level plus 8 (dB(A)

The background Sound Pressure Level (SPL) $L_{A90,T}$ is the A-weighted SPL obtained using time-weighting 'F' exceeded for 90% of the measuring period 'T'. The background SPL is commonly denoted as background noise level.

4.2 Operational Activities

For the purposes of interpreting proposed operational impacts of the development proposal, noise levels have been planned in accordance with the Ecoaccess Guideline (2004) for "Planning for Noise Control" as this procedure takes into account three factors:

- control and prevention of background creep in the case of steady noise level from equipment such as that caused by ventilation fans and other continuously operating machinery;
- containment of various noise levels and short-term noise events, such as those caused by forklift trucks and isolated hand tools, to an 'acceptable' level above background noise level; and
- the setting of noise levels that should not be exceeded to avoid sleep disturbance.

The setting of long-term noise criteria for planning purposes is best met by adopting the adjusted equivalent continuous A-weighted SPL as the basic noise descriptor ($L_{Aeq,T}$).

The first step in stetting noise criteria for a new development is to calculate the specific noise level or component level $L_{Aeq\ (1\ hour)}$.

For a proposed new noise source(s) the planning noise level (PNL) is based on a forecast of the specific noise level ($L_{Aeq\ (1\ hour)}$ = min $L_{A90\ (1\ hour)}$ +3) to which corrections are subtracted if either tonal or impulsive character is expected to be present as follows:

(PNL = ($L_{Aeq\ (1\ hour)}$ - K_1 – K_2).

Where:
$L_{Aeq\ (1\ hour)}$ means the equivalent continuous A-weighted SPL over the reference time interval of one hour
K_1 means tonal adjustment (if just detectable subtract 2, if prominent subtract 5)
K_2 means impulsive adjustment (if just detectable subtract 2, if prominent subtract 5)

Residential Area A has been used in this determination due to proximity to the development outline and the Business Park.

Residential Area A has the following existing noise levels measured as minimum $L_{A90,\ 1\ hour}$.

- 46.5 dB(A) day, 50.5 dB(A) evening and 42.8 dB(A) night.

The PNL for Residential Area A has been calculated for each time period as follows.

- 45.5 dB(A) day, 49.6 dB(A) evening and 41.8 dB(A) night.

Based on the description of the existing environment whereby road traffic noise primarily influences existing L_{Aeq} noise levels, the recommended maximum noise levels for “low density transportation” apply as per Table 3 of the Guideline.

- 55dB(A) day, 50 dB(A) evening and 45 dB(A) night.

As the existing level of noise from proposed noise sources is deemed negligible due to the separation distances there is no need to reduce the planning noise levels.

The planning noise level applicable for marina and industrial operations is presented in Table 5 over 24 hours.

Table 5 Planning Noise Levels

Time Period	Specific/component noise level ($L_{Aeq,1\ hour}$ RBL + 3) adjusted for tonality	Maximum hourly sound pressure level, $L_{Aeq,1\ hour}$ (PNL)
7.00am – 6.00pm	45.5 dB(A)	55 dB(A)
6.00pm – 10.00pm	49.6 dB(A)	50 dB(A)
10.00pm – 7.00am	41.8 dB(A)	45 dB(A)

Raw calculations for determining the PNL and specific/component noise are presented in Appendix C.

5. NOISE ASSESSMENT

5.1 Construction Impacts

The potential noise sources from proposed development activities as outlined in Table 1, has been determined based on the construction methodology and timing listed below.

- Vehicle movements from heavy vehicles (trucks).
- Sheet pile driving using vibratory hammer and conventional hammer and cranes for marina and bridge building.
- Heavy plant/equipment used to dry excavate the marina and fill land, such as excavators, loaders, dump trucks, graders, compactors and scrapers.

Plant and equipment used for construction of the proposed development have been predicted for each quarter of each year across the entire construction period for each activity.

Activities include:

- site establishment.
- bulk earthworks and marina excavation;
- dredging;
- sub-division works (including industrial, commercial and residential);
- major road, entry and interchange (infrastructure);
- golf course;
- boulevard bridge;
- marina construction and
- minor bridges.

The plant and equipment type and quantity proposed for the construction of each activity is presented in spreadsheet format and is attached as Appendix D.

Sound Power Levels (SWLs) for example plant and equipment types are presented in Table 6. SWLs for each type of equipment was obtained from the Australian Standard 2436 –1981: *Guide to Noise Control on Construction, Maintenance and Demolition Sites* (AS 2436) in the absence of noise monitoring actual emissions.

Table 6 Sound Power Level of Construction equipment

Reference Number	Type of Equipment	Sound Power Level (SWL) in dB (A)
1	Compactors (220 kW)	117 to **124**
2	Cranes, crawler	
	40 kW	112 to 123
	60 kW	98 to 92
	50 kW	< **115**
	100 kW	102 to 115
	120 kW	102 to 110
	75 t steam	< 106
3	Crane, tower (20 kW)	104 to **108**

4	Crane, lorry mounted (10 t)	118 to **120**
5	Dump Trucks 25 t, 120 kW	 < **114**
6	Excavators 0 to 100 kW 100 to 200 kW 200 to 300 kW	 114 to 118 108 to 112 114 to **118**
7	Graders 0 to 100 kW >100kW	 114 to 118 114 to **120**
8	Hoists (Pneumatic, silenced)	< **108**
9	Loaders Tracked (200 to 300 kW)	118 to **122**
10	Loaders Wheeled (> 300kW)	**120**
11	Piling Diesel Hammer (sheet piles) 2 t drop hammer (precast concrete piles)	 126 to **147** 114 to 128
12	Scrapers >200 kW	 116 to **121**

The SPL in dB(A) at sensitive places to compare noise levels with the relevant acoustic quality objective can be derived from the following equation:

$$Lp(A) = Lw(A) - 20\log10R - 8$$

Where:
Lw(A) = A - weighted sound power level of the source, in dB ref. 10-12 W
Lp(A) = A - weighted sound pressure level at the distance R from the source, in dB(A)
R= Distance from the source in metres.

The A-weighted equivalent continuous SPL has been calculated for each plant and equipment combined for when the majority of activities are occurring at each sensitive place. This means the highest noise levels generated in any one quarter across the construction period at each sensitive place have been calculated.

It is proposed that the attenuation effect from soft ground will be offset by reflection of sound at the building façade(s) of existing dwellings.

Noise from plant and equipment is expected to be emitted continually during daytime operations as steady state emissions. Pile driving is expected to be a short-term impulsive impact, considering length of construction and buffering distance to the majority of sensitive places.

Where activities have not been included (that is noise levels of plant and equipment) the separation distance and noise reduction afforded by the staged development has been considered sufficient to attenuate impacts. In these cases the separation distances are greater than 1200 metres and in some instances up to 2300 metres.

5.1.1 Residential A

Residential Area A is located nearest to the major site entrance and will potentially be affected during multiple stages of the NEBP construction from undertaking the following activities:

- site establishment;
- major road entry and interchange construction;
- bulk earthworks; and
- industrial and commercial sub-division works.

It is anticipated that the above construction activities will occur over Stages 1-6 with the majority of works taking place between 2009 and 2014.

The worst case scenario is the use of all plant and equipment listed in Table 6 (with the exception of Item 11).

The predicted noise levels resulting from each construction activity at Residential Area A are presented in Table 7.

Table 7 SPLs for Construction Activities at Residential Area A

Reference	Construction Activity	Resultant SPL ($L_{Aeq,T}$)
1	Site establishment	83 dB(A)
2	Major road entry and interchange construction	81 dB(A)
3	Bulk earthworks – CUT areas	60 dB(A)
4	Bulk earthworks – FILL areas	75 dB(A)
5	Industrial sub-division works	83 dB(A)
6	Commercial sub-division works	62 dB(A)

At worst case scenario construction activities 2 - 6 will occur simultaneously. The combined SPL $L_{Aeq,T}$ from these activities is approximately 85 dB(A) at Residential Area A.

The predicted SPL $L_{Aeq,T}$ of 85 dB(A) exceeds the background SPL plus 5 dB(A). Mitigation measures will be therefore required to minimise impacts within Residential Area A.

5.1.2 Residential B

Residential Area B is located nearest to the proposed industrial sub-division and will potentially be affected during multiple stages of the NEBP construction from undertaking the following activities:

- site establishment;
- bulk earthworks;
- industrial, commercial and residential sub-division works; and
- golf course construction.

It is anticipated that the above construction activities will impact on Residential Area B throughout the entire construction period of the NEBP development proposal however it is expected that noise emissions from plant and equipment will vary significantly due to the staged development proposals and noise reduction afforded by structures and landforms as they are developed as shown in concept plans attached as Appendix E.

The worst case scenario is the use of all plant and equipment listed in Table 6 (with the exception of Item 11).

The predicted noise levels resulting from each construction activity at Residential Area B are presented in Table 8.

Table 8 SPLs for Construction Activities at Residential Area B

Reference	Construction Activity	Resultant SPL ($L_{Aeq,T}$)
1	Site establishment	79 dB(A)
2	Bulk earthworks – CUT areas	70 dB(A)
3	Bulk earthworks – FILL areas	77 dB(A)
5	Industrial sub-division works	79 dB(A)
6	Commercial sub-division works	64 dB(A)
7	Residential sub-division works	69 dB(A)
8	Golf Course	64 dB(A)

At worst case scenario construction activities 2 - 8 will occur simultaneously. The combined SPL $L_{Aeq,T}$ from these activities is approximately 81 dB(A) at Residential Area B.

The predicted SPL $L_{Aeq,T}$ of 81 dB(A) exceeds the background SPL plus 5 dB(A). Mitigation measures will be therefore required to minimise impacts within Residential Area B.

5.1.3 Residential C

Residential Area C is located nearest to the proposed industrial and residential sub-division and will potentially be affected during multiple stages of the NEBP construction from undertaking the following activities:

- bulk earthworks;
- industrial and residential sub-division works;
- golf course construction; and
- major bridge construction.

It is anticipated that the above construction activities will impact on Residential Area C throughout the entire construction period of the NEBP development proposal however it is expected that noise emissions from plant and equipment will vary significantly due to the staged development proposals and noise reduction afforded by structures and landforms as they are developed as shown in concept plans attached as Appendix E.

The worst case scenario is the use of all plant and equipment listed in Table 6.

The predicted noise levels resulting from each construction activity at Residential Area C are presented in Table 9.

Table 9 SPLs for Construction Activities at Residential Area C

Reference	Construction Activity	Resultant SPL($L_{Aeq,T}$)
1	Bulk earthworks – CUT areas	67 dB(A)
2	Bulk earthworks – FILL areas	74 dB(A)
3	Industrial sub-division works	60 dB(A)
4	Residential sub-division works	79 dB(A)
5	Golf Course	68 dB(A)
6	Boulevard Bridge construction	79 dB(A)

At worst case scenario construction activities 1 - 6 will occur simultaneously. The combined SPL $L_{Aeq,T}$ from these activities is approximately 82 dB(A) at Residential Area C.

The predicted SPL $L_{Aeq,T}$ of 82 dB(A) exceeds the background SPL plus 5 dB(A). Mitigation measures will be therefore required to minimise impacts within Residential Area C.

5.1.4 Residential D

Residential Area D is located nearest to the proposed residential sub-division and golf course and will potentially be affected during multiple stages of the NEBP construction from undertaking the following activities:

- bulk earthworks;
- commercial and residential sub-division works;
- golf course construction; and
- minor bridge construction.

It is anticipated that the above construction activities will impact on Residential Area D throughout the entire construction period of the NEBP development proposal however it is expected that noise emissions from plant and equipment will vary significantly due to the staged development proposals and noise reduction afforded by structures and landforms as they are developed as shown in concept plans attached as Appendix E.

The worst case scenario is the use of all plant and equipment listed in Table 6.

The predicted noise levels resulting from each construction activity at Residential Area D are presented in Table 10.

Table 10 SPLs for Construction Activities at Residential Area D

Reference	Construction Activity	Resultant SPL($L_{Aeq,T}$)
1	Bulk earthworks – CUT areas	70 dB(A)
2	Bulk earthworks – FILL areas	79 dB(A)
3	Residential sub-division works	79 dB(A)
4	Golf Course	79 dB(A)

At worst case scenario construction activities 1 - 3 will occur simultaneously. The combined SPL $L_{Aeq,T}$ from these activities is approximately 83 dB(A) at Residential Area D.

The predicted SPL $L_{Aeq,T}$ of 83 dB(A) exceeds the background SPL plus 5 dB(A). Mitigation measures will be therefore required to minimise impacts within Residential Area D.

5.2 Construction Mitigation Measures

Predicted noise emissions at sensitive places have not considered the typical reduction in noise from building components of existing residential dwellings. A reduction of 10dB(A) is expected with windows open and, providing the noise sensitive place is built of standard construction in accordance with AS 3671 with alternative ventilation installed, with windows closed a 25 dB(A) reduction in SPL from external levels is expected.

Taking into account the predicted noise emissions and the conservative reduction from building materials, the following mitigation measures to achieve a reduction in noise impacts at all sensitive places are recommended. In particular, mitigation strategies are proposed to prevent noise complaints during the construction period which is desirable and in accordance with the guiding principles of ecologically sustainable development.

- All plant and equipment shall be used in accordance with manufacturer's instructions.
- All plant and machinery to be in good working order with operational mufflers where required.
- Machines used intermittently, including cranes, dozers, graders, back hoes, and loaders shall be shut down in the intervening periods between work.
- Where machines are fitted with engine covers, these shall be kept closed when the machine is in use.
- Materials shall not be dropped from a height onto either trucks/barge/hardstand.
- Regular and effective maintenance of stationary and mobile plant and equipment including off-site vehicles shall be undertaken.
- A builder or building contractor must not carry out building work on a building site in a way that makes or causes audible noise to be made from the building work:
    - On a Sunday or public holiday, at any time; or
    - On a Saturday or business day, before 6.30am or after 6.30pm.
- If required use temporary barricades/screens in line of sight of noisy plant/equipment to provide noise attenuation.

A significant amount of community consultation has occurred under the EIS process and limited concerns regarding noise have been raised. It is considered that these mitigating strategies will be sufficient to reduce and limit impacts. However in the event of a complaint regarding construction noise, a Complaint Management and Resolution Procedure shall be implemented in accordance with the section 6 of this report.

5.3 Operational Impacts and Mitigation Measures

5.3.1 Marina Operations

It is not expected that operational noise from the marina and marine facilities will negatively impact on noise sensitive places given the proposed development, particularly in the first stages of its operation due to ongoing sub-division works until 2021.

Potential noise sources associated with the operation of the marina are described below with mitigation measures proposed to protect the acoustic amenity of new residential dwellings associated with the development proposal given they will be constructed in close proximity to the marina.

- Motor boats, including ferries.
- Boat rigging (generally on windy days).
- Entertainment noise (crowds and music).
- Refrigeration units.
- Air-conditioners and ventilation fans.
- On-site vehicular movements in the car parking areas.
- Delivery vehicles to the resort tourism and commercial mixed use precincts.
- Noise associated with transferring boats, lowering/raising boats.
- Noise associated with ship yard operations and boat repairing including activities such as abrasive blasting.

Impacts associated with marina operations can be mitigated by a range of strategies including:

- restricting boat speed limits within the marina precinct;
- restricting road traffic speed limits within the precinct, particularly along the riverside boulevard;
- limiting operational hours of retail facilities;
- acoustically attenuating air conditioning units and refrigeration equipment;
- installation of acoustic treatments (such as noise barriers) with regard to land area, the character of the use relative to its setting and to prominent views; and
- adherence with noise conditions of relevant approvals required for conducting environmentally relevant activities 69 ‘Boat maintaining or repairing facility’, 23 ‘Abrasive Blasting’ and 25 ‘Metal surface coating’.

5.3.2 Sport Fields and Associated Use

There may be potential impacts from use of the proposed sporting fields on Residential Area A. No noise levels have been predicted from use of the sporting fields as this depends on type of use and related equipment such as sirens and crowd numbers.

In Queensland, legislation regulates open-air events to prevent environmental nuisance in addition to the use of regulated devices such as amplifiers.

Open air events include sporting events. Under section 6ZC(1) of the EP Regulation an occupier of premises must not use or allow the use of the premise for an open-air event:

a) before 7a.m. on any day if the use causes audible noise; or
b) from 7a.m. to 10p.m. on any day if the use causes noise of more than 70dB(A); or
c) after 10p.m. on any day if the use causes noise of more than the lesser of the following -
    (i) 50dB(A);
    (ii) 10dB(A) above the background noise level.

However, subsection 6ZC(1)(b) does not apply if:

a) the premises is, or is part of, an educational institution; and
b) the use of the premises for an open-air event is organised by or for the educational institution for its purposes.

Under section 6ZD(2) a person must not operate an amplifier device in a way that makes audible noise or causes audible noise to be made at an open-air event —

a) on a Saturday, Sunday or public holiday, before 8a.m. or after 6p.m.; or
b) on a business day, before 7a.m. or after 10p.m.

Under section 6ZD(3) the person must not operate the device in a way that makes noise or causes noise to be made of more than 10 dB(A) above the background noise level –

a) on a Saturday, Sunday or public holiday, from 8a.m. to 6p.m; or
b) on a business day, from 7a.m. to 10p.m.

However 6ZD(3) does not apply if the noise is made or caused to be made by an amplifier device operated by anyone at an educational institution.

Where an amplifier device means any of the following:
a) a loudhailer;
b) a megaphone;
c) a public address system, other than for a railway;
d) a remote telephone bell;
e) a telephone repeater bell.

It is considered that this legislation is sufficient to ensure future operators of the sports fields prevent environmental nuisance at Residential Area A.

5.3.3 Business Park – Addendum to Max Winders Report (2004)

As part of the response to an information request by Council (Reference RCU875 dated 16 August 2002) Max Winders & Associates was engaged by Lensworth Group Ltd to prepare a noise impact assessment ("the existing report") for the proposed Caboolture River Business Park at Morayfield (attached as Appendix A). This report assessed the impacts of the proposed business park on nearby sensitive places adjacent to Lot 2 on RP902075 and Lot 10 on RP902079 formerly known as Parcel 62.

Since the issuing of this report both the Proponent and proposed development has changed to that described in Section 1 of this noise impact assessment. Therefore to ensure a relevance to the current proposal, a reassessment of the impacts associated with the industrial sub-division on sensitive places was undertaken.

The existing report identified relevant noise criteria based on known industrial emissions likely to occur over 24 hours from the business park for Lots 2 and 10 and assessed the impact at noise sensitive places based on separation distances and potential noise sources. No adverse impact from operation of the business park was predicted.

Due to the changes in the development proposal which have since occurred an assessment as to the relevance of this prediction in relation to the new master plan has been undertaken by Cardno. A desktop study was commenced to determine the noise sources associated with the new development proposal, and their associated SPLs at sensitive places.

Noise levels for plant and equipment expected to be used on site were obtained through various means including monitoring, manufacturer specifications and AS 2346.

Idling Truck:	85 dB(A) at 1 metre
Slow moving Truck:	85 dB(A) at 1 metre
Unloading Truck:	90 dB(A) at 1 metre
Forklift:	83 dB(A) at 1 metre (with tonality correction)
Reversing Beeper:	80 dB(A) at 1 metre
Large Air Compressor:	95 dB(A) at 1 metre
Car Start / Door slam:	85 dB(A) at 1 metre
Air-conditioners:	83 db(A) at 1 metre (based on a combined SWL of 91 dB(A))
Refrigeration Condenser:	87 dB(A) at 1 metre (based on a combined SWL of 95 dB(A))

The locations of the noise sources in relation to the sensitive places are not defined until building space has been sold or leased. Therefore the noise levels reported are taken to be the noise source at the land use boundary in direct line of sight from the sensitive dwelling (as measured from 1 metre from the most exposed façade). As such the amended noise levels from anticipated noise sources in relation to noise sensitive places are provided in Table 13 given the new separation distances as worst case scenario.

Based on the relevant noise criteria of 55 dB(A) the noise sensitive places will not be adversely affected by the operation of the proposed business park during daytime operations. This is in accordance with the findings of the existing report.

Potential noise sources which may operate throughout the night (such as compressors and air conditioners and late deliveries) will not negatively affect sensitive places causing sleep disturbance assuming realistic noise source locations and building components of existing dwellings.

Table 11 Noise Levels at Noise Sensitive Places

Noise Source	Noise Sensitive Places								
	Residential A (at 80 m)			*Residential B (at 130 m)*			*Residential C (at 1100 m)*		
	Source SPL @ 1m dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL db(A)	Source SPL @ 1m dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL db(A)	Source SPL @ 1m dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL db(A)
Idling Truck	85	38	47	85	42	43	85	60	25
Slow moving Truck	85	38	47	85	42	43	85	60	25
Unloading Truck	90	38	52	90	42	48	90	60	30
Forklift	83	38	45	83	42	41	83	60	23
Reversing Beeper	80	38	42	80	42	38	80	60	20
Large Air Compressor	95	38	**57**	95	42	53	95	60	35
Car Start / Door slam	85	38	47	85	42	43	85	60	25
Air-conditioners	83	38	45	83	42	41	83	60	23
Refrigeration Condenser	87	38	42	87	42	45	87	60	27
Criterion			**55 db(A)**			**55 db(A)**			**55 db(A)**

5.4 Off-site Impacts

5.4.1 Road Traffic

Noise emissions from heavy vehicles transporting equipment to site is expected to negatively impact on Residential Area A which is in close proximity to the major entry and interchange off the Bruce Highway and Residential Areas B and C where minor access points to the project area from Buckley Road will be constructed.

Traffic volumes for the Buchanan Road interchange, the major site access which will primarily be used by construction traffic, have been determined by Cardno Eppell Olsen and are attached as Appendix F. The Average Annual Daily Traffic (AADT) volumes have been presented for the year 2006 and ultimate traffic volumes calculated for the years 2020 and 2030 and for peak periods. A significant increase in heavy vehicles off the Bruce Highway at the interchange is predicted.

Modelling of predicted future traffic noise at the site was undertaken using the Calculation of Road Traffic Noise (CORTN) equation (HMSO, London 1988) which showed that the attenuation distance between the interchange and access point to Residential Area A is sufficient to comply with road traffic noise criteria of 68 dB(A) (façade corrected) SPL $L_{A10(18hour)}$ external to the dwelling using ultimate development daily traffic volumes in the year 2020 and 2030. In addition development volumes on Uhlmann Road will not adversely impact on Residential Area B using ultimate daily traffic volumes in the year 2020 and 2030. This criterion has been set by the Department of Main Roads for new road works adjacent to existing dwellings and for existing residences on existing roads and is considered reasonable for the purposes of this assessment. The modelling analysis is attached in Appendix G.

While distance prevents noise impacts at Residential A from ultimate road traffic at the interchange from the Bruce Highway and NEBP major entry point, construction traffic will be limited to accessing the site between the times of 6.30 am and 6.30 pm Monday to Saturday as a conservative approach in protecting the existing acoustic amenity at Residential Area A, particularly that internally to comply with the Queensland acoustic quality objective.

New residential dwellings that are associated with the NEBP development are of a sufficient distance from the Bruce Highway, a state-controlled road, to not require assessment against DMR criteria for new development.

5.4.2 Caboolture River Dredging

Dredging the Caboolture River to provide sufficient draft for boats to access the proposed marina and flood mitigation will not generate nuisance emissions given the low density of dwellings in close proximity to the defined dredge area however Moreton Bay Marine Park and the adjacent RAMSAR wetlands may be affected.

Noise impacts from dredging on marine fauna are expected however research studies generally conclude marine fauna vacate areas of dredging and return on completion of works. Nonetheless noise impacts to marine fauna are being assessed by aquatic ecology experts and any recommendations for inclusion in the relevant environmental management plans are supported.

In the event a noise complaint is received from offsite dredging the *Complaint Management and Resolution Procedure* outlined in section 6 is recommended.

6. COMPLAINT MANAGEMENT AND RESOLUTION PROCEDURE

The issue of nuisance from noise is subjective and generally complaint driven and, in the event of a noise complaint being received by management, the following process steps area recommended.

- Step 1: Validating the complaint.
- Step 2: Complaint investigation and resolution.
- Step 3: Close off.

Step 1: Validating the complaint by:

- recording complaint and complainant details in a dedicated Complaints Register; and
- liaising with the site manager to validate the complaint.
    - Determine what was happening at the time.
    - Identify plant and equipment that were operating at the time.
    - Determine if a condition of an approval for the site may have been breached.

Step 2: Complaint investigation and resolution.

- Investigating the complaint through:
    - a site inspection; and
    - monitoring, if required.
- Resolving the complaint through:
    - determining possible mitigation measures in consultation with the Site Management;
    - liaising with the complainant(s) throughout the investigation;
    - implementing any mitigation measures, where required; and
    - recording investigation details including completing a Corrective Action Request (CAR) form where required. .

Step 3: Closing the complaint.

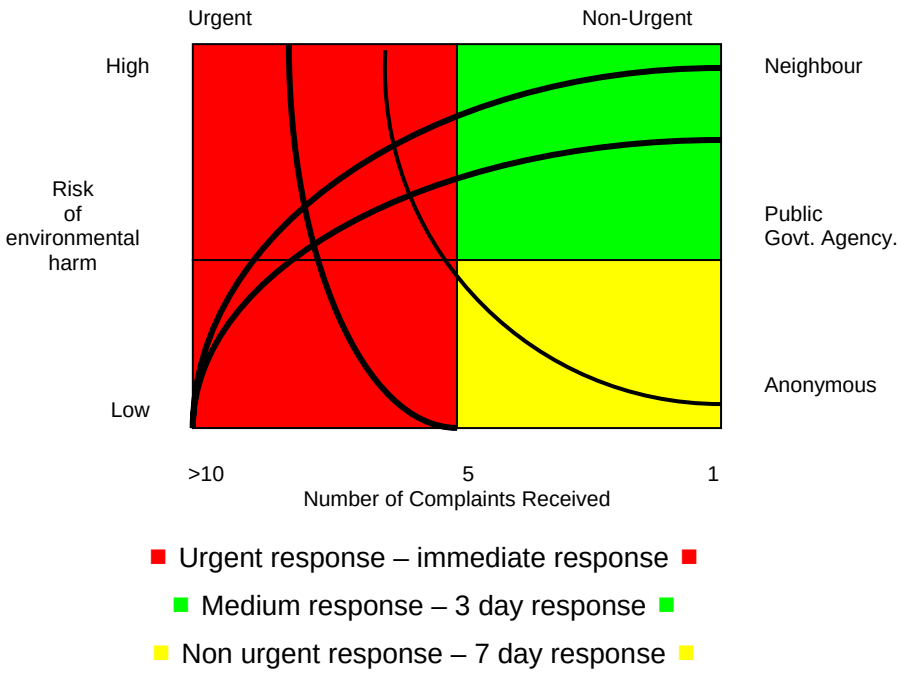
- Undertaking relevant validation monitoring to confirm that the nominated mitigation measures have been effective, if required.
- Notifying the complainant(s) that the investigation has been completed and what measures have been implemented.
- Reviewing and amend any policies or procedures, where required.
- Determine any need for training.
    - Design and implement training, if required.
- Recording complaint outcomes.

All complaints will be risk managed using complaint indicators presented in Tables 11 & 12.

Table 12 Complaint Indicators

Urgency • Urgent (health driven including nuisance) • Non-urgent (primarily nuisance driven)	**No. of Complaints Received** • 10 or more (extreme) • 5 – 10 (high) • <5 (medium) • 1 (low)
Risk of environmental harm • High • Medium • Low	**Complainant** • Neighbour • Public • Agency/ government authority • Anonymous

Table 13 Risk assessment matrix



The purpose of this procedure is to ensure that all complaints are:

- investigated within a timely fashion;
- mitigation and corrective measures are implemented, where appropriate;
- information regarding the investigation and resolution of the complaint is provided to the complaint (s) during the process and at conclusion; and
- registered.

7. CONCLUSION

This noise impact assessment has been prepared to inform the EIS and support subsequent development applications for the proposed NEBP development over various lots in the Caboolture Shire, Queensland.

Predicted noise levels from plant and equipment at all sensitive places will, at worst case scenario, negatively affect sensitive places from construction of activities associated with the NEBP development proposal where activities are development components and includes site establishment, construction of entry interchange, and bridge building.

The highest predicted noise level is 85 dB(A) at Residential Area A from site establishment and interchange and major entry access construction occurring a short separation distance from the closest sensitive dwelling within Residential Area A.

Predicted noise levels measured as SPL $L_{Aeq,\ T}$ exceed the background plus 5 dB criteria without noise attenuation due to the SWL of noise sources and existing separation distances between activities and noise sensitive places.

However predicted noise levels from construction activities over a longer time period will be significantly reduced at sensitive places because of the following aspects of the construction methodology and development proposal.

- Staged Development.
- Realistic Attenuation Distances.
- Noise reduction afforded by built-up subdivisions.
- Proposed mitigation strategies including a documented Complaint Management and Resolution procedure.

Activities are staged over time meaning that the worst case noise levels will apply for the time period when the majority of construction activities overlap and various plant and equipment are operated simultaneously. The stages have been designed to ensure development components progressively meet the needs of the community with the marina operating first.

And in reality separation distances will be much larger as known distances are those taken from the works boundary and therefore not representative of where plant and equipment will primarily operate over time.

Noise will also be progressively reduced due to the staged completion of the industrial, commercial and residential sub-division(s) as the predicted SPL $L_{Aeq,\ T}$ is a greenfield measurement and does not take into account absorption and reflection from newly constructed buildings and landforms.

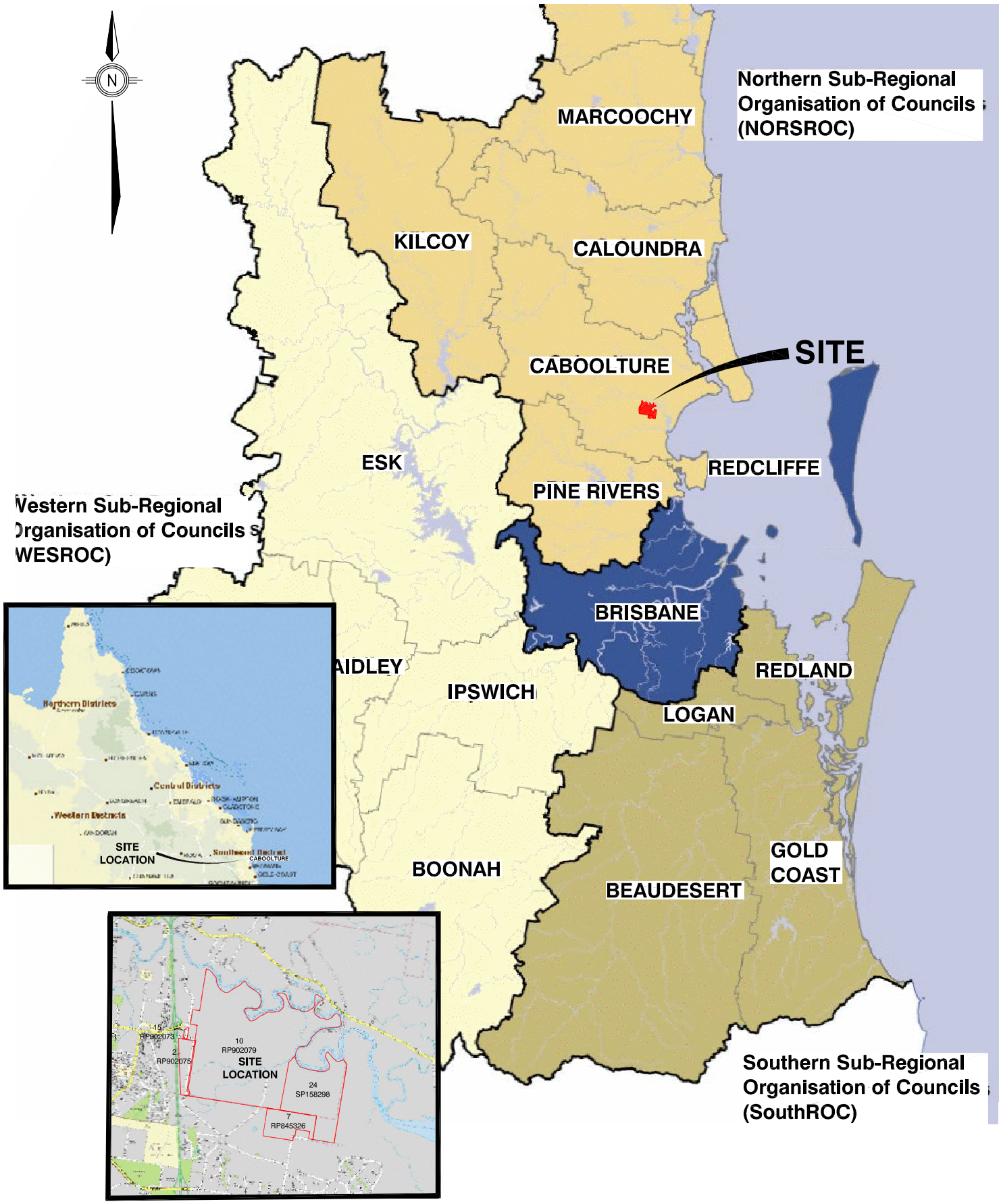
Mitigation strategies have been proposed for inclusion in the relevant management plans (construction environmental management plan and site based management plan) to avoid negative impacts from noise at sensitive locations and in particular, a complaint management and resolution procedure has been developed. Noise is subjective and primarily complaint driven and it is recommended specific mitigation strategies are developed in response to valid complaints.

FIGURES

Figure 1 Locality Plan

Figure 2 Development Proposal

Figure 3 Sensitive Places and Monitoring Locations



Queensland Map sourced from "South East Queensland Regional Plan 2005-2006"

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Not To Scale

FIGURE 1
SITE LOCALITY

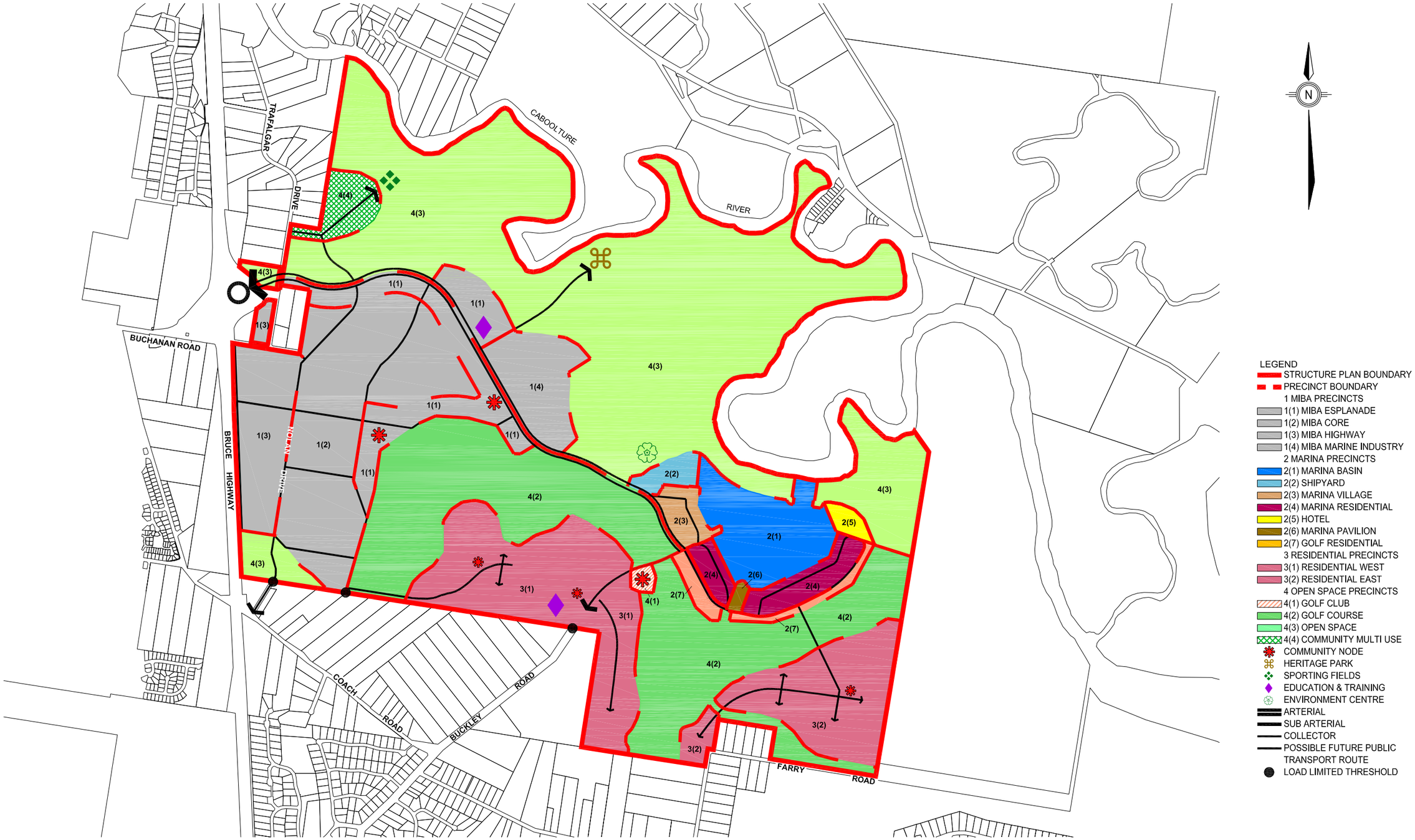
Rev: Orig. Date: 17 August 2007

Project No.: 7900/33

Northeast Business Park Pty Ltd

PRINT DATE: 22 August, 2007 - 11:46am

CAD FILE: I:\7800-40\ACAD\Noise Impact Assessment\Figure 1 - Site Locality.dwg
XREF's: Caboolture_mga94



Plan sourced from PMM Brisbane Pty Ltd, Dwg name 20430STRUCTURE, Plan Ref 20430-10F, 26 September 2007.

200 0 200 400 600 800 1000m
1:20,000

Scale 1:20,000 (A3)

FIGURE 2

DEVELOPMENT PROPOSAL

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Northeast Business Park Pty Ltd

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XREF's:

PRINT DATE: 05 October, 2007 - 2:15pm

APPENDIX A

Max Winder & Associates Report (6 August 2004)

Max Winders & Associates
Consulting Engineers & Environmental Scientists

NOISE IMPACT ASSESSMENT

PROPOSED CABOOLTURE RIVER BUSINESS PARK

PARCEL 62

2-32 & 34 NOLAN DRIVE

MORAYFIELD

Prepared for:

Lensworth Group Ltd

Prepared by:

Max Winders & Associates Pty Ltd

6 August 2004

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1.0 INTRODUCTION

1.1 Study Brief

Max Winders and Associates have been commissioned by Lensworth Group Ltd to prepare a Noise Impact Assessment for the proposed Caboolture River Business Park at Morayfield.

The proposed development shall provide a range of land uses including commercial, industrial, warehousing and accommodation precincts.

The potential for noise amenity impacts upon existing surrounding and potential future residential land uses is considered in this report. The report has been prepared to address the requirements of a Queensland Department of Local Government and Planning Coordinated Information Request (Reference RCU875, dated 16 August, 2002). The relevant extract from the Information Request is as follows:

4.0 Noise

4.1 Provide an acoustic report from a suitably qualified person to:

a. Determine the potential noise impacts of any proposed activity on adjoining or neighbouring premises. Special consideration should be given to the conference centre and commercial areas that will be closest to residential homes.

b. Demonstrate how any unreasonable noise impacts will be controlled or managed with the use of building materials, acoustic barriers and the like.

The assessment is based on noise monitoring conducted at the subject site and surrounding areas and noise measurements previously conducted on typical sources associated with the proposed industrial and commercial uses.

1.2 Site Description

The subject site is described as 'Parcel 62' at 2-32 & 34 Nolan Drive, Morayfield. The site covers an area of approximately 544.074 hectares and has the following real property descriptions:

- Lot 10 on RP902079;
- Lot 2 on RP902075;

The site is bounded by the Caboolture River to the north and east and the Bruce Highway to the west. Low-density and rural residential areas are located to the west and south of the subject site, along Nolan Drive, Trafalgar Drive, Coach Road and Buckley Road.

The location and extent of 'Parcel 62' and the existing land use is shown on the aerial photograph included as **Figure 1**.

1.3 Proposed Development

It is proposed to develop the site to provide the following land uses:

- Accommodation / Conference Precinct;
- Business Park / High Tech Precinct;
- General Industry Precinct;
- Warehouse / Logistics Precinct;
- Commercial Industry / Showroom Precinct;

The proposed development plan is included as **Figure 2**.

The proposed land uses adjoining existing and proposed future residential areas with the potential to impact on amenity are the Commercial Industry / Showroom Precinct, the Accommodation / Conference Precinct and the Business Park / High Tech Precinct. The proposed General Industry Precinct is generally well separated from the existing and potential future residential areas. However, due to the prospective uses within this precinct, the potential impact on residential amenity is considered in the assessment.

Access to the commercial / industrial development is proposed to be from Nolan Drive.

The proposed development will generate noise emissions from passenger vehicle and heavy vehicle movements, industrial, commercial and distribution activities, carparking and plant and equipment associated with future uses. The impact of the above noise emissions may be adequately controlled at the existing and potential future residential areas through the application of noise control measures that may include:

- appropriate buffer distances to residential areas;
- acoustic barriers and/or building form to shield noisy activities;
- industrial / commercial building design and layout to minimise external noise;
- acoustic treatment of plant and equipment in proximity to residential areas;
- restriction of operating hours for noisy activities adjacent to residential areas.

The indicative nature of the noise controls that may be required are determined in this assessment but will be dependant upon the ultimate form of the development.

2.0 EXISTING NOISE LEVELS

In order to determine the existing ambient noise levels at the site and surrounds a noise datalogger was placed at a location on the site as indicated on **Figure 3**. This monitoring location was considered to be representative of noise levels experienced at a majority of the residences adjacent to the western site boundary due to similar setbacks to the Bruce Highway. The noise datalogger was programmed to provide a statistical noise level analysis based on 15-minute sampling periods, and monitored continually for a 3-day period over 29 June to 1 July, 2004.

The L_{eq} (24 hour) recorded at the datalogger location was 54.3 dB(A). Further recorded free-field statistical noise level ranges are provided in **Table 1** below:

Table 1: Range of Datalogger Recorded Statistical Noise Levels 29 June to 1 July, 2004

Parameter	Period	Recorded Noise Levels – dB(A)		
		Minimum	Maximum	Average
L_1	Daytime (7am-6pm)	59.5	69.0	63.3
	Evening (6pm-10pm)	58.0	66.5	62.0
	Nighttime (10pm-7am)	55.5	67.5	60.7
L_{10}	Daytime (7am-6pm)	53.5	64.0	57.1
	Evening (6pm-10pm)	55.0	60.5	57.8
	Nighttime (10pm-7am)	52.0	62.5	57.1
L_{90}	Daytime (7am-6pm)	46.5	60.0	51.8
	Evening (6pm-10pm)	49.0	56.0	52.5
	Nighttime (10pm-7am)	32.5	59.5	48.6
L_{eq}	Daytime (7am-6pm)	51.5	62.0	55.3
	Evening (6pm-10pm)	52.5	58.5	55.6
	Nighttime (10pm-7am)	48.0	61.0	54.1

Where: L_1 Noise level exceeded for 1% of the sampling period, regarded as the adjusted maximum noise level

L_{10} Noise level exceeded for 10% of the sampling period, regarded as the average maximum noise level

L_{90} Noise level exceeded for 90% of the sampling period, regarded as the background noise level

L_{eq} The average, or more precisely equivalent noise level, the value of the sound pressure level of a continuous steady state that within a measurement interval has the same mean square sound pressure as a sound under consideration whose level varies with time

The complete results are presented as a trace of noise level versus time for the statistical noise level descriptors L_1, L_{10}, L_{90} and L_{eq} as ***Attachment 1***.

The monitoring was undertaken in a period of fine weather with light-moderate northerly and easterly breezes. Temperatures generally ranged from 7 to 24 degrees Celsius.

The datalogger used was an Acoustic Research Laboratories noise datalogger, model EL-215, pre-calibrated to 94 dB at 1kHz using a Rion Sound Level Calibrator, model NC-73. At post-calibration, the datalogger exhibited less than ±0.5 dB deviation.

In addition to the long-term noise datalogging, short-term, manned noise measurements were performed to characterise noise levels experienced at various locations surrounding the site.

The results of the short-term noise monitoring conducted on 1 July, 2004 are provided in **Table 2** below, with noise measurement locations shown on **Figure 3**.

Table 2: **Recorded Short-Term Noise Levels**

#	LOCATION	DATE	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)					COMMENTS
				L_1	L_{10}	L_{50}	L_{90}	L_{eq}	
1	Trafalgar Drive	1/07/2004	1230 – 1240	58.0	48.8	45.1	43.3	47.3	Highway traffic, light planes = 63.2, 66.5 dB(A)
2	Nolan Drive	1/07/2004	1245 – 1255	70.1	57.6	54.1	52.1	60.5	Highway traffic, near-field traffic on Nolan Drive, helicopter
3	End of Buckley Road	1/07/2004	1310 - 1320	56.5	48.6	40.1	38.7	45.2	Car on nursery grounds, distant heavy machinery, birds

The predominant influence on the recorded noise levels was the noise of road traffic on the Bruce Highway with less frequent but nearer traffic on Nolan Drive and Trafalgar Drive. Noise levels recorded at the noise datalogger location and at monitoring locations 1 and 2 indicate that the ambient noise environment at the residences to the west and south of the site, on Trafalgar Drive, Nolan Drive and Coach Road are significantly affected by elevated background noise from the Bruce Highway. There is additional noise impact at these residences from vehicular traffic on Trafalgar Drive and Nolan Drive. Ambient noise levels decrease further to the east away from the Bruce Highway, especially at the end of Buckley Drive where there are limited vehicle movements. Noise from vehicles at an adjacent commercial nursery was audible at the end of Buckley Road. All monitoring locations experienced some noise from generally light aircraft movements.

3.0 RELEVANT NOISE CRITERIA

The noise sources considered for the assessment are the following:

- Plant and equipment noise, e.g. air-conditioning, refrigeration, exhaust vents, air compressors;
- Noise of warehousing / distribution activities, e.g. forklifts, loading / unloading noise;
- Noise of typical industrial activities, e.g. power tools, hand tools etc.
- Truck movements and service noise, e.g. noise of heavy vehicle on site, goods delivery vehicles;
- Road traffic noise;
- Site carparking noise.

The range of potential noise sources and the potential for 24-hour per day noise amenity impacts dictates that several noise assessment methodologies are required. The following paragraphs contain assessment methodologies in ***bold and italic*** type that are considered to be appropriate for application to the proposed development.

For plant and equipment noise, an appropriate assessment is using ***background plus excess*** criteria. Thus, the plant and equipment noise criteria will be based upon exceeding the existing ambient background noise levels at sensitive land uses by no more than 5 dB(A) during the daytime and evening periods and by no more than 3 dB(A) during the nighttime period. The criteria are listed in **Table 3** below:

Table 3: Background Plus Excess Noise Criteria (dB(A))

Period	Noise Level at Noise Sensitive Place (Residence)	Noise Level at Commercial Premises
Daytime 7am – 6pm	Background noise level plus 5 dB(A)	Background noise level plus 10 dB(A)
Evening 6pm – 10pm	Background noise level plus 5 dB(A)	Background noise level plus 10 dB(A)
Nighttime 10pm – 7am	Background noise level plus 3 dB(A)	Background noise level plus 8 dB(A)

The noise from trucks and service vehicles on-site, industrial and general warehousing activity noise and noise from site carparking are typically noise events of a short duration and high level and are best assessed using a ***comparison of like parameters or descriptors***, with the aim being not to exceed the existing ambient noise environment by more than 3 dB(A) for the appropriate noise parameter used. Such an assessment applies for the periods 7am to 6pm (Daytime) and 6pm to 10pm (Evening). As there is the potential for noise generating activities to occur in the period 10pm to 7am (Nighttime) the appropriate noise criteria in this period is the ***Sleep Disturbance*** noise approach, which considers the resultant internal noise level at the nearest habitable dwellings from the intrusive source.

4.0 NOISE ASSESSMENT

4.1 Noise from Plant and Equipment

The appropriate selection, siting and installation of any external mechanical plant associated with the future commercial, industrial and warehousing uses at the proposed development is required to take account of potential noise impacts at existing surrounding residences and the potential future residential uses to the southeast of the subject site. The installation of external mechanical plant for any future development at the site shall include the provision of noise control measures and suitable location of the plant such that noise from plant will not adversely impact at sensitive land uses. Plant and equipment associated with the proposed commercial, industrial and warehousing uses are generally limited to refrigeration and air-conditioning equipment associated with the site building(s). The industrial uses may also require the use of other major plant items specific to the industry.

The noise monitoring undertaken demonstrates a minimum background noise level of 32.5 dB(A) at a location representative of the noise environment at the residences to the south and west of the subject site. As there is the potential for plant and equipment noise from the proposed development during the nighttime period, the appropriate maximum design plant noise level is 3 dB(A) above the minimum background noise level. This relates to a design ***maximum permissible plant and equipment noise level of 35 dB(A)*** at surrounding residences for all plant items installed at the proposed development.

As such, any refrigeration and/or air-conditioning units and other mechanical plant and equipment associated with future uses of proposed development should be located and acoustically treated and/or shielded to achieve the 35 dB(A) limit external to existing surrounding and potential future residential dwellings. This design standard is readily achievable considering the separation distance available to surrounding residences.

The above noise limit does not necessarily apply to a single item of plant, but rather should constitute the additional noise component levels of all plant and equipment, measured at the nearest receptor(s).

Given the relatively quiet minimum background noise levels at the site and the potential for 24 hour per day operation, it is recommended that any major refrigeration and air-conditioning plant and equipment adjacent to a residential area be selected to be low noise emitting with the main condenser units having either variable speed fan drives or switchable high and low speed fan settings. This permits lower noise emissions during the nighttime period when loads are lower.

As a worst-case, the section below considers the noise of plant and equipment that would be required for a cold-storage facility at the General Industry Precinct or the Warehousing / Logistics Precinct. The shortest distance from a proposed General Industry Precinct or the Warehousing / Logistics Precinct to a residential dwelling is approximately 120 metres from the northwestern corner of the General Industry Precinct to the nearest dwelling on Nolan Drive.

For a typical refrigeration condenser (operating on low-noise setting during the nighttime period), the following is a typical octave band source noise level (sound power level - SWL).

Table 4: **Typical Refrigeration Condenser – dB SWL**

Source	Sound Power Level - dB(A) [Hz]							AP - dB
	125	250	500	1k	2k	4k	8k	
Typical Refrigeration Condenser - Low Speed Fan (Nighttime Operation)	87	87	86	83	81	80	75	**93**

The above condenser can be considered as having a source noise level of 89 dB(A) Sound Power Level. Experience suggests that a maximum of four (4) plant items of similar noise level in the plant area will be required for a cold store facility. Considered as single sources each of these four items would combine to produce a single source noise level of 95 dB(A) SWL, or a single source sound pressure level of approximately 87 dB(A) at 1 metre.

The likely minimum distance from major plant (assumed to be located 10 metres within the General Industry Precinct boundary) to a residential facade is approximately 130 metres as discussed above. As such, the likely maximum noise level from the above major plant items at the nearest residence with no noise control measures is 45 dB(A), calculated as follows:

$$L_{p2} = L_{p1} - 20*\log_{10}(r_2/r_1) \qquad L_{p1} = 87 \text{ dB(A)}, \; r_1 = 3 \text{ m}, \; r_2 = 130 \text{ m}$$

$$= 87 - 20*\log_{10}(130/3)$$

$$L_{p2} = 45 \text{ dB(A)}$$

The above calculation demonstrates that in order to achieve the 35 dB(A) nighttime noise criterion at the nearest surrounding residences, major plant and equipment associated with a worst-case future cold store use may require up to 10 dB(A) of noise attenuation. This level of noise attenuation is readily achievable using appropriate plant location, purpose designed acoustic enclosures, solid walled condenser decks, and/or barriers shielding the transmission of plant and equipment noise towards residential areas. The ultimate acoustic solution for major plant items nearest to residential areas would likely form a combination of the above measures.

The required level of plant noise reduction for the worst-case cold-store facility as detailed above is significantly higher than would be necessary for the bulk of likely commercial, industrial and warehousing uses at the site. As such, the plant installations at the bulk of the proposed commercial, industrial and warehousing use areas may not require any dedicated noise control measures to achieve the 35 dB(A) nighttime noise criterion.

No detailed design is available at this stage on the precise type or manufacturer of any plant and equipment required for future uses at the proposed development, and as this becomes available, more detailed assessment of the attenuation required should be undertaken. Experience with many other similar commercial, industrial and warehousing developments in proximity to residential areas dictates that appropriate noise controls are feasible to ensure that plant and equipment can achieve the noise limits required and the plant selection and acoustic design will form an integral part of the detailed design process for future development on the subject site.

4.2 Noise from Commercial / Industrial / Warehousing Activities

The potential for noise impacts from the proposed commercial, industrial and warehousing uses relates to the noise of on-site service and passenger vehicles, carparking, loading / unloading activities and noise from industrial activities.

Without any specific knowledge of the ultimate usage of the proposed commercial, industrial and warehousing precincts, it is considered appropriate to conduct a noise impact assessment based upon typical commercial, industrial and warehousing activities being conducted at the site.

The noise from future commercial, industrial and warehousing activities is best considered by comparison of likely noise peaks with existing peak noise levels in the locality and applying a maximum excess of 3 dB(A) above existing ambient levels. Consideration of the frequency of occurrence of the noise source is also important in determining potential noise impacts.

Utilising the L_1 parameter as appropriate for assessment of carparking noise and the L_{10} parameter as appropriate for assessment of service vehicle and industrial activity noise, the following noise criteria are adopted.

Table 5: Noise Monitoring Recorded Average L_1 & L_{10} Noise Levels and Adopted Criteria Noise Limits – dB(A)

Time Period	Carparking Noise Criteria		Service Vehicle and Industrial Activity Noise Criteria	
	Average L_1 Noise Level – dB(A)	Criteria Noise Limit dB(A) L_1 + 3	Average L_{10} Noise Level – dB(A)	Criteria Noise Limit dB(A) L_{10} + 3
Daytime (7am to 6pm)	63	**66**	57	**60**
Evening (6pm to 10pm)	62	**65**	57	**60**

The average recorded intrusive (L_{10}) noise levels were applied to this assessment because the locality is currently developing and the lower minimum L_{10} noise levels were not considered appropriate for the consideration of future noise levels. Additionally, the noise criteria are within the existing recorded L_{10} noise levels (see **Table 1**) and should not result in a significant impact on the existing noise environment.

As there is potential for industrial, service vehicle and carparking activities 24 hours per day, it is considered appropriate to adopt a sleep disturbance criterion for the nighttime period (10pm to 7am). Commonly it is recognised that a short-term noise event of 45 dB(A) resulting within a bedroom has potential to cause sleep disturbance. This equates to a level external of approximately 55 dB(A) allowing for 10 dB(A) noise reduction through an open window. Hence a nighttime noise criterion of 55 dB(A) external to a sensitive receptor is considered appropriate for the assessment of noise from future industrial, service vehicle and carparking activities at the proposed development.

As such, the appropriate design criterion for the assessment of industrial and on-site vehicle and loading related noise and noise from carparking is ***55 dB(A)*** external to residential dwellings.

Source noise levels for typical industrial sources that may occur at the proposed development have been previously recorded by Max Winders and Associates and others and can be summarised as follows:

Idling Truck:	85 dB(A) at 1 metre
Slow Moving Truck:	85 dB(A) at 1 metre
Unloading Truck:	90 dB(A) at 1 metre
Forklift:	83 dB(A) at 1 metre (with tonality correction)
Reversing Beeper:	80 dB(A) at 1 metre
Angle Grinder:	95 dB(A) at 1 metre
Bench Grinder:	86 dB(A) at 1 metre
Hammering:	90 dB(A) at 1 metre
Large Air Compressor:	95 dB(A) at 1 metre
Metal Lathe on Metal:	92 dB(A) at 1 metre
Car Start / Door Slam:	85 dB(A) at 1 metre

The resultant noise levels of the above typical commercial and industrial noise sources affecting the nearest existing residences to the west on Trafalgar Drive and Nolan Drive, are detailed in **Table 6** below. This residential area is nearest to the proposed Business Park / High Tech Precinct, the Commercial Industry / Showroom Precinct and the General Industry Precinct. The **Table 6** calculations consider noise sources located 10 metres within the precinct boundaries and residential dwellings located 30 metres within the residential allotment, with no intervening buildings or barriers. These setbacks are conservatively small and based upon inspection of the residential area and analysis of aerial photography.

Table 6: Resultant Noise Levels from On-Site Activities– dB(A)
Residential Area A – Nolan Drive and Trafalgar Drive

Source (Location)	Source SPL dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL – dB(A)
Idling truck (Business Park / High Tech Precinct)	85 at 1m	32 (40)	**53**
Slow Moving Truck (Business Park / High Tech Precinct)	85 at 1m	32 (40)	**53**
Unloading Truck (Business Park / High Tech Precinct)	90 at 1m	32 (40)	**58**
Forklift (Business Park / High Tech Precinct)	85 at 1m	32 (40)	**53**
Reversing Beeper (Business Park / High Tech Precinct)	83 at 1m (with tonality correction)	32 (40)	**51**
Angle Grinder (General Industry Precinct)	95 at 1m	42 (130)	**53**
Bench Grinder (General Industry Precinct)	86 at 1m	42 (130)	**44**
Hammering (General Industry Precinct)	90 at 1m	42 (130)	**48**
Large Air Compressor (General Industry Precinct)	95 at 1m	42 (130)	**53**
Metal Lathe on Metal (General Industry Precinct)	92 at 1m	42 (130)	**50**
Car Start / Door Slam (Business Park / High Tech Precinct)	85 at 1m	32 (40)	**53**
	Criterion Noise Level 55 dB(A)		

Thus, the resultant noise levels of typical commercial and industrial precinct activities that may be conducted adjacent to the residences along Nolan Drive and Trafalgar Drive are predicted to generally satisfy the criterion noise level, with the exception of loud unloading noise external to a building with no intervening building or barrier. As such, it may be necessary to provide acoustic barriers for Business Park / High Tech Precinct and the Commercial Industry / Showroom Precinct uses nearest to the existing residences to mitigate noise impacts from servicing and loading activities. Such acoustic barriers would generally be 2 to 4 metres in height. Alternatively, the design of future development to locate buildings between noisy loading activities and surrounding residences would readily provide the required noise attenuation.

The resultant noise levels of the above typical commercial and industrial noise sources affecting the nearest existing residences to the south on Coach Road, are detailed in **Table 7** below. This residential area is nearest to the proposed Commercial Industry / Showroom Precinct, the Warehouse / Logistics Precinct and the General Industry Precinct. The **Table 7** calculations consider noise sources located 10 metres within the precinct boundaries and residential dwellings located 30 metres within the residential allotment, with no intervening buildings or barriers. These setbacks are conservatively small and based upon inspection of the residential area and analysis of aerial photography.

Table 7: Resultant Noise Levels from On-Site Activities– dB(A) Residential Area B – Coach Road

Source	Source SPL dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL – dB(A)
Idling truck (Commercial Industry / Showroom Precinct)	85 at 1m	40 (100)	**45**
Slow Moving Truck (Commercial Industry / Showroom Precinct)	85 at 1m	40 (100)	**45**
Unloading Truck (Commercial Industry / Showroom Precinct)	90 at 1m	40 (100)	**50**
Forklift (Commercial Industry / Showroom Precinct)	85 at 1m	40 (100)	**45**
Reversing Beeper (Commercial Industry / Showroom Precinct)	83 at 1m (with tonality correction)	40 (100)	**43**
Angle Grinder (General Industry Precinct)	95 at 1m	50 (320)	**45**
Bench Grinder (General Industry Precinct)	86 at 1m	50 (320)	**36**
Hammering (General Industry Precinct)	90 at 1m	50 (320)	**40**
Large Air Compressor (General Industry Precinct)	95 at 1m	50 (320)	**45**
Metal Lathe on Metal (General Industry Precinct)	92 at 1m	50 (320)	**42**
Car Start / Door Slam (Commercial Industry / Showroom Precinct)	85 at 1m	40 (100)	**45**
		Criterion Noise Level 55 dB(A)	

Thus, the resultant noise levels of typical commercial and industrial precinct activities that may be conducted adjacent to the residences to the south along Coach Road satisfy the criterion noise level for all noise sources considered. As such, it is unlikely that any dedicated noise control measures will be required in order to achieve the criterion noise level the residences to the south, especially considering the additional noise shielding that will be provided by future intervening commercial and industrial building structures.

The resultant noise levels of the above typical commercial and industrial noise sources affecting the nearest potential future residences to the southeast of the subject site, are detailed in **Table 8** below. This potential residential area is nearest to the proposed Warehouse / Logistics Precinct, the Commercial Industry / Showroom Precinct and the General Industry Precinct. The **Table 8** calculations consider noise sources located 10 metres within the precinct boundaries and residential dwellings located 10 metres within the potential Low Density Home Business Precinct boundary, with no intervening buildings or barriers. These setbacks are conservatively small and based upon experience with low density residential development.

Table 8: Resultant Noise Levels from On-Site Activities– dB(A)
Residential Area C – Potential Low Density Home Business Precinct

Source	Source SPL dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL – dB(A)
Idling truck (Warehouse / Logistics Precinct)	85 at 1m	49 (300)	**36**
Slow Moving Truck (Warehouse / Logistics Precinct)	85 at 1m	49 (300)	**36**
Unloading Truck (Warehouse / Logistics Precinct)	90 at 1m	49 (300)	**41**
Forklift (Warehouse / Logistics Precinct)	85 at 1m	49 (300)	**36**
Reversing Beeper (Warehouse / Logistics Precinct)	83 at 1m (with tonality correction)	49 (300)	**34**
Angle Grinder (General Industry Precinct)	95 at 1m	54 (510)	**41**
Bench Grinder (General Industry Precinct)	86 at 1m	54 (510)	**32**
Hammering (General Industry Precinct)	90 at 1m	54 (510)	**36**
Large Air Compressor (General Industry Precinct)	95 at 1m	54 (510)	**41**
Metal Lathe on Metal (General Industry Precinct)	92 at 1m	54 (510)	**38**
Car Start / Door Slam (Commercial Industry / Showroom Precinct)	85 at 1m	49 (300)	**36**
	Criterion Noise Level 55 dB(A)		

Thus, the resultant noise levels of typical commercial and industrial precinct activities that may be conducted adjacent to the potential Low Density Home Business Precinct satisfy the criterion noise level for all noise sources considered. As such, it is unlikely that any dedicated noise control measures will be required in order to achieve the criterion noise level the proposed residential area, especially considering the additional noise shielding that will be provided by future intervening commercial and industrial building structures.

With the provision of appropriate noise control measures and design strategies, the noise of commercial and industrial activities and on-site vehicles is not predicted to adversely impact on amenity at the existing and potential future residential areas. Any future industrial development at the proposed Caboolture River Business Park that generates significant noise emissions should be individually assessed to determine appropriate noise control strategies for the particular use.

4.3 Noise from Conference Centre Activities

The Accommodation / Conference Precinct is proposed to be located at the northwestern corner of the subject site, adjacent to residential allotments along Trafalgar Drive. As such, it is necessary to consider the potential noise impact of the accommodation and conference activities on residential amenity.

Noise emissions from an Accommodation / Conference Precinct include the following:

- Noise from vehicles including buses;
- Noise from carparking activities;
- Noise from amplified entertainment and presentations;
- Noise from patrons at external areas;

The noise of amplified entertainment, presentations and patrons at internal areas is typically well contained by the building structure. The requirement to provide a suitable level of amenity at the on-site accommodation rooms dictates that neighbouring residences that are further away are not adversely affected by these internal noise sources associated with the conference rooms.

Noise emissions from patrons at external areas are generally minimal as it is unusual for large groups to congregate at external areas for any period of time. Noise calculations demonstrate that patron noise emissions from a busy hotel beer garden, as recorded by Max Winders and Associates, would be well within the ambient road traffic noise levels at the nearest residences to the Accommodation / Conference Precinct. As such, the noise of accommodation / conference centre patrons at external areas is not predicted adversely impact on the surrounding residences.

The noise of passenger vehicles and buses manoeuvring on the Accommodation / Conference Precinct and noise from carparking areas may occur 24 hours. As such, the appropriate assessment criterion is the sleep disturbance criteria, which relates to a design vehicle and carparking noise level of 55 dB(A) external to residential facades (refer ***Section 4.2***).

The resultant noise levels of vehicle and carparking noise affecting the nearest existing residences to the west of the Accommodation / Conference Precinct on Trafalgar Drive, are detailed in **Table 9** below. The **Table 9** calculations consider noise sources located 10 metres within the precinct boundary and residential dwellings located 30 metres within the residential allotment, with no intervening buildings or barriers. These setbacks are conservatively small and based upon inspection of the residential area and analysis of aerial photography.

Table 9: Resultant Noise Levels from Vehicle and Carparking Activities– dB(A) Nearest Residences on Trafalgar Drive

Source (Location)	Source SPL dB(A)	Distance Attenuation dB(A) (m)	Resultant SPL – dB(A)
Idling Bus (Accommodation / Conference Precinct)	80 at 1m	32 (40)	**48**
Slow Moving Bus (Accommodation / Conference Precinct)	85 at 1m	32 (40)	**53**
Slow Passenger Car (Accommodation / Conference Precinct)	80 at 1m	32 (40)	**48**
Car Start / Door Slam (Accommodation / Conference Precinct)	85 at 1m	32 (40)	**53**
	Criterion Noise Level 55 dB(A)		

Thus, the resultant noise levels of typical conference and accommodation precinct vehicles and carparking that may be conducted adjacent to the residences along Trafalgar Drive are predicted to satisfy the criterion noise level for activities occurring 24 hours. Thus, for normal carparking activities at the Accommodation / Conference Precinct it may not be necessary to construct an acoustic barrier to shield the adjacent residences along Trafalgar Drive. However, if a high intensity carparking activity such as a heavily trafficked driveway or a bus drop-off area were located at a residential boundary it would be prudent to provide an acoustic barrier 2 to 3 metres in height to mitigate noise impacts at the affected residential allotments. However, design to avoid locating noise generating areas adjacent to residential properties is the preferred noise control strategy wherever practicable.

The ultimate requirements for noise controls within the Accommodation / Conference Precinct are dependant upon the form of the development and will require acoustic assessment at the development application stage to determine any impacts and amelioration measures. However, preliminary assessment indicates that design measures can be used to address any potential noise impacts.

4.4 Effect of Development on Traffic Noise Levels

Future commercial and industrial uses at the proposed development have the potential to generate additional traffic movements on the roadways surrounding the site. Commercial and industrial traffic will enter and leave the site via the proposed entry / exit to Nolan Drive. Almost all vehicle movements associated with the proposed development will travel directly to / from the Bruce Highway via Nolan Drive, travelling past several allotments that currently contain residential dwellings.

The ambient road traffic noise levels are currently elevated along the relevant section of Nolan Drive due to high background traffic noise from the Bruce Highway and vehicle movements along Nolan Drive to access Trafalgar Drive and Coach Road. Analysis of the ambient noise levels recorded at the locality suggests that the residences under consideration on Nolan Drive are best described as R4 to R5 as per AS1055.2-1997, with the classifications described as follows:

R4 *Areas with dense transportation or some commerce or industry*

R5 *Areas with very dense transportation or in commercial districts or bordering industrial districts*

Thus, the amenity of existing residences on the section of Nolan Road between the proposed site entry and the Highway interchange is currently significantly affected by road traffic noise. The elevated existing traffic noise levels experienced at these dwellings significantly reduces the potential for noise amenity impacts to result from additional vehicle movements generated by the proposed development.

5.0 CONCLUSION

This report is a revised Noise Impact Assessment for the proposed Caboolture River Business Park development at Morayfield. The purpose of this report is to demonstrate that the proposed commercial and industrial development can operate on a 24 hour, 7 day basis without causing adverse noise amenity impacts at the existing and potential future surrounding residential areas. Without any specific knowledge of future site uses, the report has considered a range of typical commercial, industrial, warehousing and accommodation activities occurring at the proposed precincts.

The report has been prepared to address the requirements of a Queensland Department of Local Government and Planning Coordinated Information Request (Reference RCU875, dated 16 August, 2002).

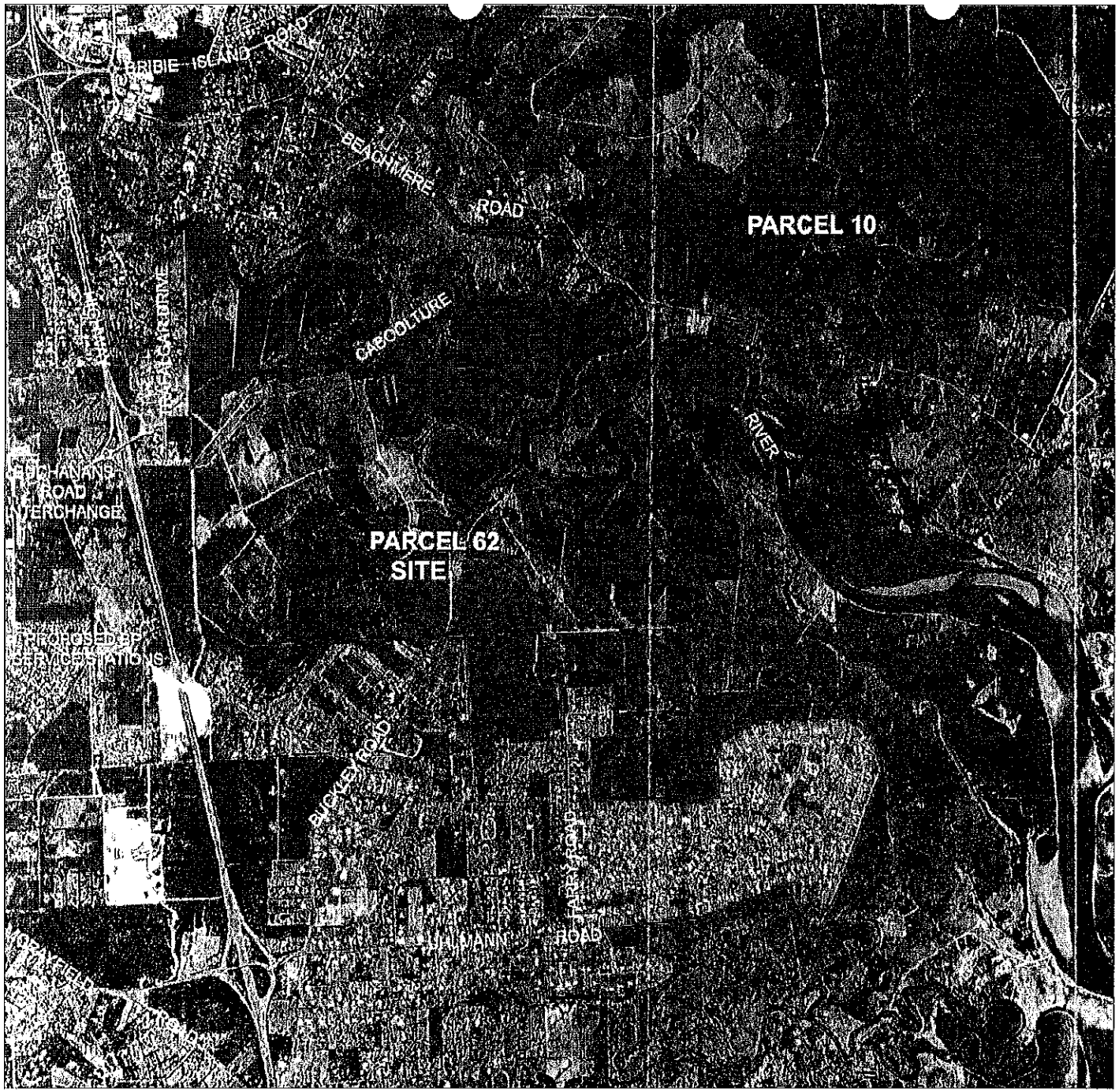
The assessment has provided design advice and maximum permissible noise level guidelines for any fixed plant and equipment (e.g. airconditioning and refrigeration equipment) associated with future commercial and industrial uses at the proposed development. The assessment has demonstrated that the design noise limit is achievable at the surrounding residences considering a worst-case cold store usage of the site using modern plant and equipment with appropriate noise control measures. The required level of plant noise attenuation is achievable using appropriate plant location, purpose designed acoustic enclosures, solid walled condenser decks, and/or barriers shielding the transmission of plant and equipment noise towards residential areas for major plant items adjacent to residential areas.

The noise of industrial activities, on-site trucks and loading activities, conference centre activities and carparking likely to be conducted at the proposed commercial, industrial and accommodation precincts has been assessed with the conclusion that acoustic amenity at existing and potential future surrounding residences will not be adversely affected by the proposed development. Indicative calculations have been conducted demonstrating that the available separation distances from the precincts to surrounding residences are generally sufficient. The use of acoustic barriers and/or additional separation distance may be necessary for high intensity servicing, loading and carparking activities adjacent to residences. The ultimate requirements for noise control measures shall be determined at the application stage for future uses at the proposed development.

The proposed development will generate additional traffic movements on Nolan Drive between the site entry and the Bruce Highway interchange. The elevated ambient traffic noise environment at these residences significantly reduces the potential for noise amenity impacts to result from additional vehicle movements generated by the proposed development.

In summary, our experience dictates that, with appropriate noise control measures, the proposed development can be constructed to readily comply with acoustic design standards operating on a 24 hour, 7 day basis.

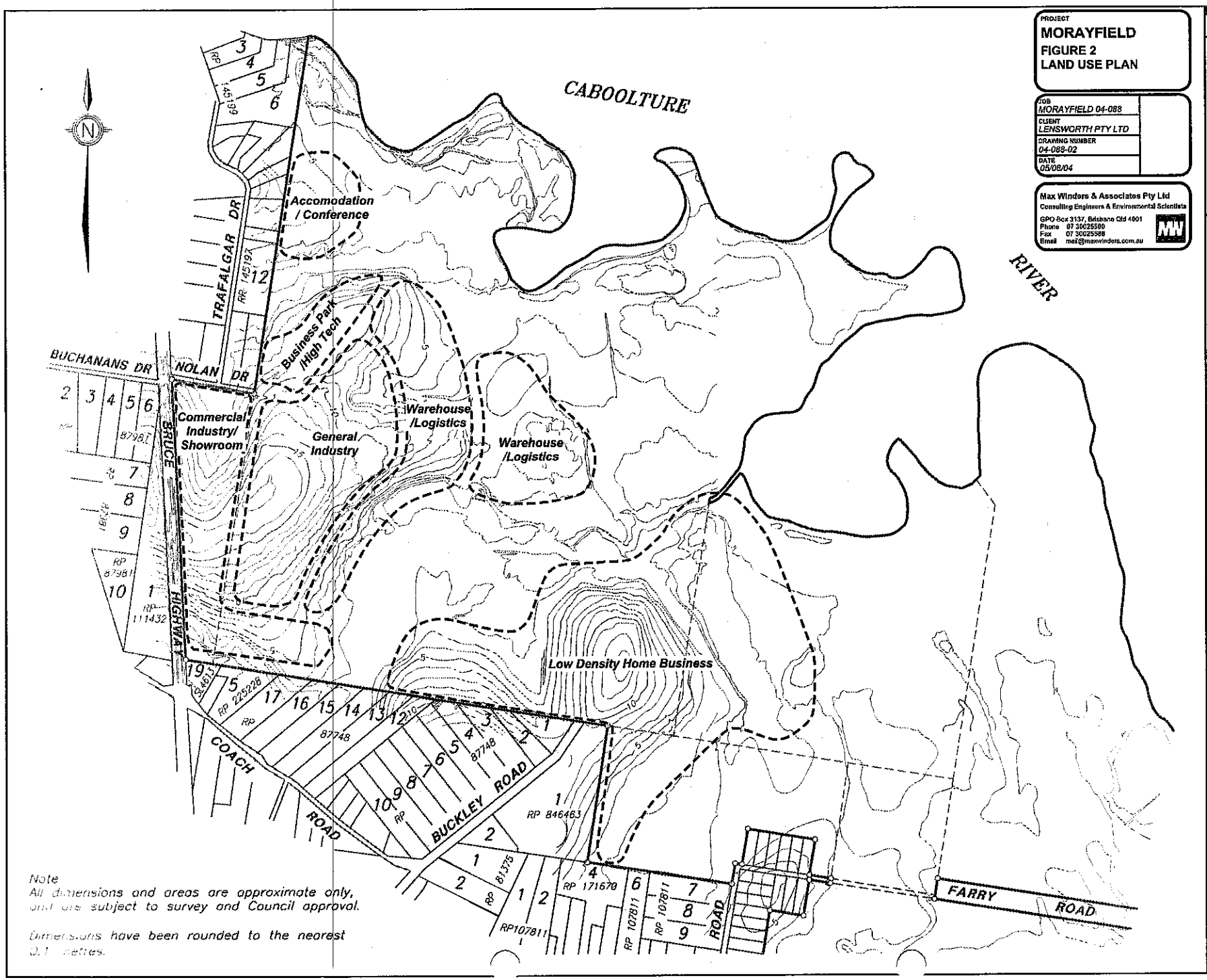
Max Winders and Associates
6 August 2004



PROJECT
MORAYFIELD
FIGURE 1
SITE LOCATION

JOB	*MORAYFIELD 04-088*
CLIENT	*LENSWORTH PTY LTD*
DRAWING NUMBER	*04-088-01*
DATE	*05/08/04*

Max Winders & Associates Pty Ltd
Consulting Engineers & Environmental Scientists
GPO Box 3137, Brisbane Qld 4001
Phone 07 30025500
Fax 07 30025588
Email mail@maxwinders.com.au



Note
All dimensions and areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

PROJECT
MORAYFIELD
FIGURE 2
LAND USE PLAN

JOB: MORAYFIELD 04-088
CLIENT: LENSWORTH PTY LTD
DRAWING NUMBER: 04-088-02
DATE: 05/08/04

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Consulting Engineers & Environmental Scientists
GPO Box 3137, Brisbane Qld 4001
Phone 07 30025500
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AMENDMENTS

ASSOCIATED CONSULTANTS

CLIENT
LENSWORTH GROUP LTD

PROJECT
PROPOSED SUBDIVISION

PARISH: CANNING/TOORBUL
LEGAL AUTHORITY: CABOOLTURE SHIRE COUNCIL
LEVEL DATUM
ORIGIN
SCALE: 1 : 15000@A3
DATE: JUNE 8 2004
SURVEYED
DRAWN: GDC
DESIGNED
DWG NAME 4057-CAB_LUP1
DRAWN
NORTH

pmm GROUP
urban designers
townplanners
land surveyors
PMM GROUP PTY LTD
A.C.N. 010370445
743 Ann Street, Fortitude Valley.
PO BOX 1599,
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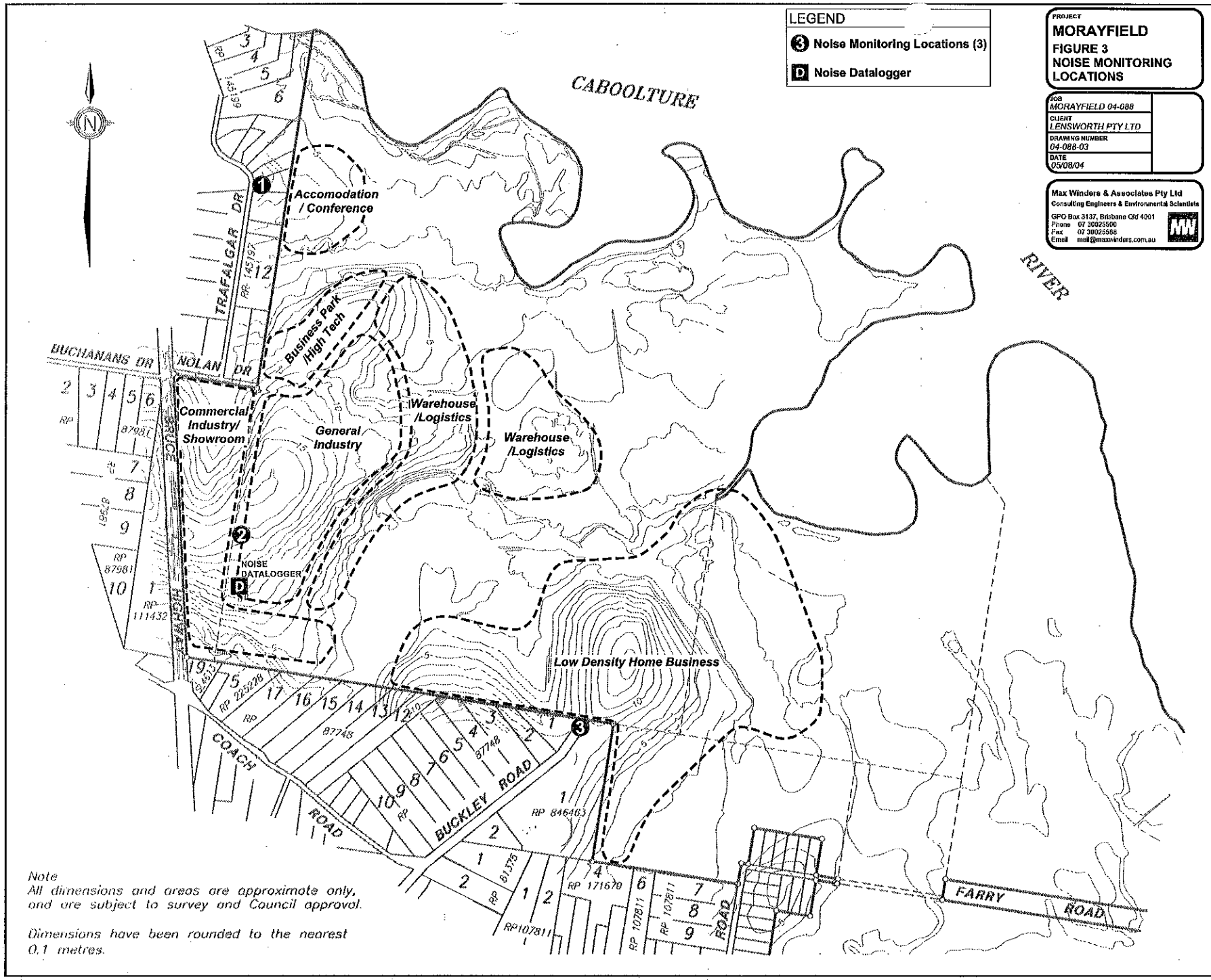
REFERENCE No
4057-218



PROJECT
MORAYFIELD
FIGURE 3
NOISE MONITORING LOCATIONS

JOB: MORAYFIELD 04-088
CLIENT: LENSWORTH PTY LTD
DRAWING NUMBER: 04-088-03
DATE: 05/08/04

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AMENDMENTS

ASSOCIATED CONSULTANTS

CLIENT
LENSWORTH GROUP LTD

PROJECT
PROPOSED SUBDIVISION

PARISH: CANINDI/TOORBUL
LOCAL AUTHORITY: CABOOLTURE SHIRE COUNCIL
LEVEL DATUM
ORIGIN
SCALE: 1 : 18000@A3
DATE: JUNE 8 2004
SURVEYED
DRAWN: GDC
DESIGNED
DWG NAME: 4057-CAB_LUP2
DRAWN

NORTH

pmm GROUP
urban designers
town planners
land surveyors
PMM GROUP PTY LTD
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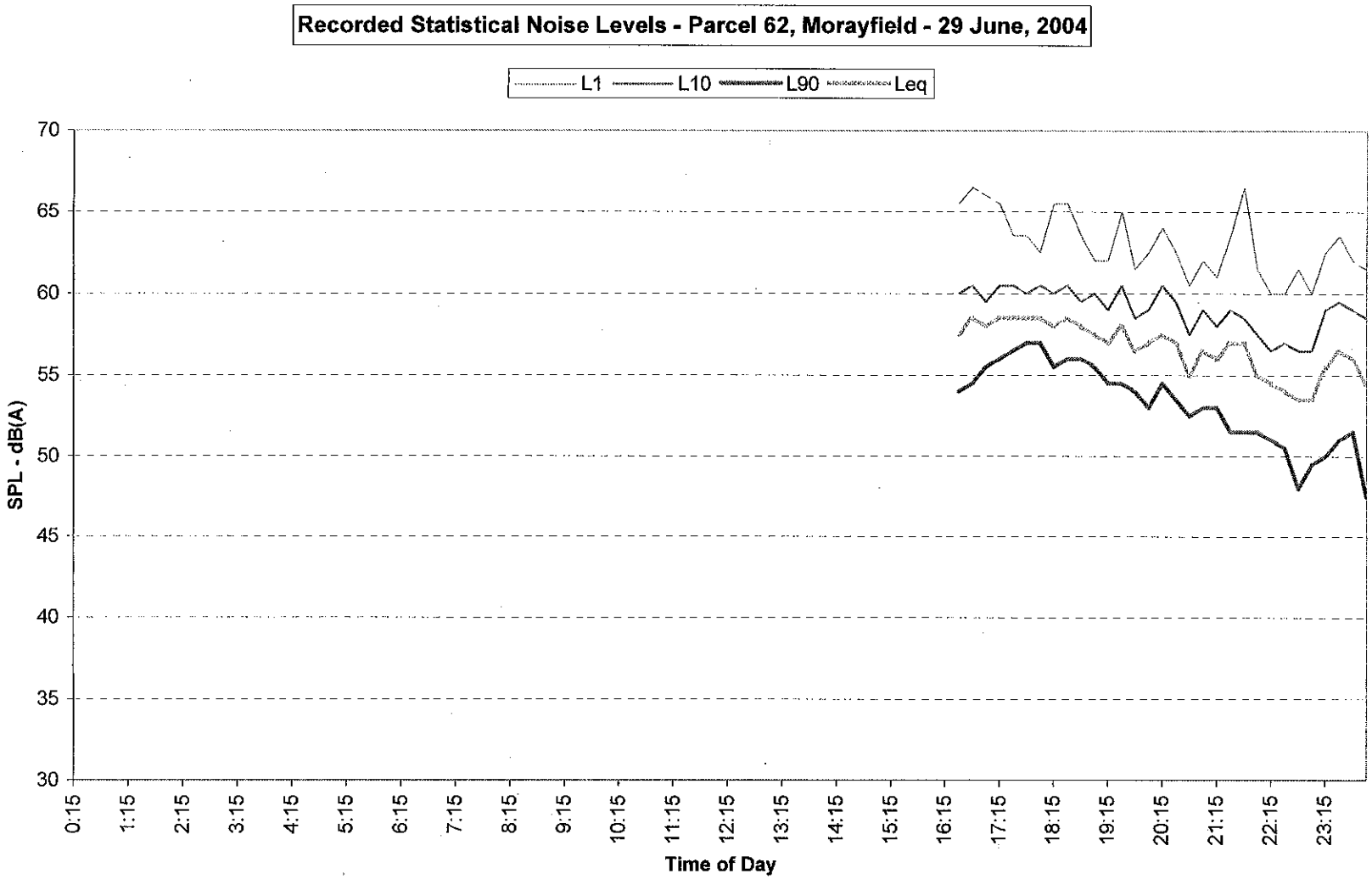
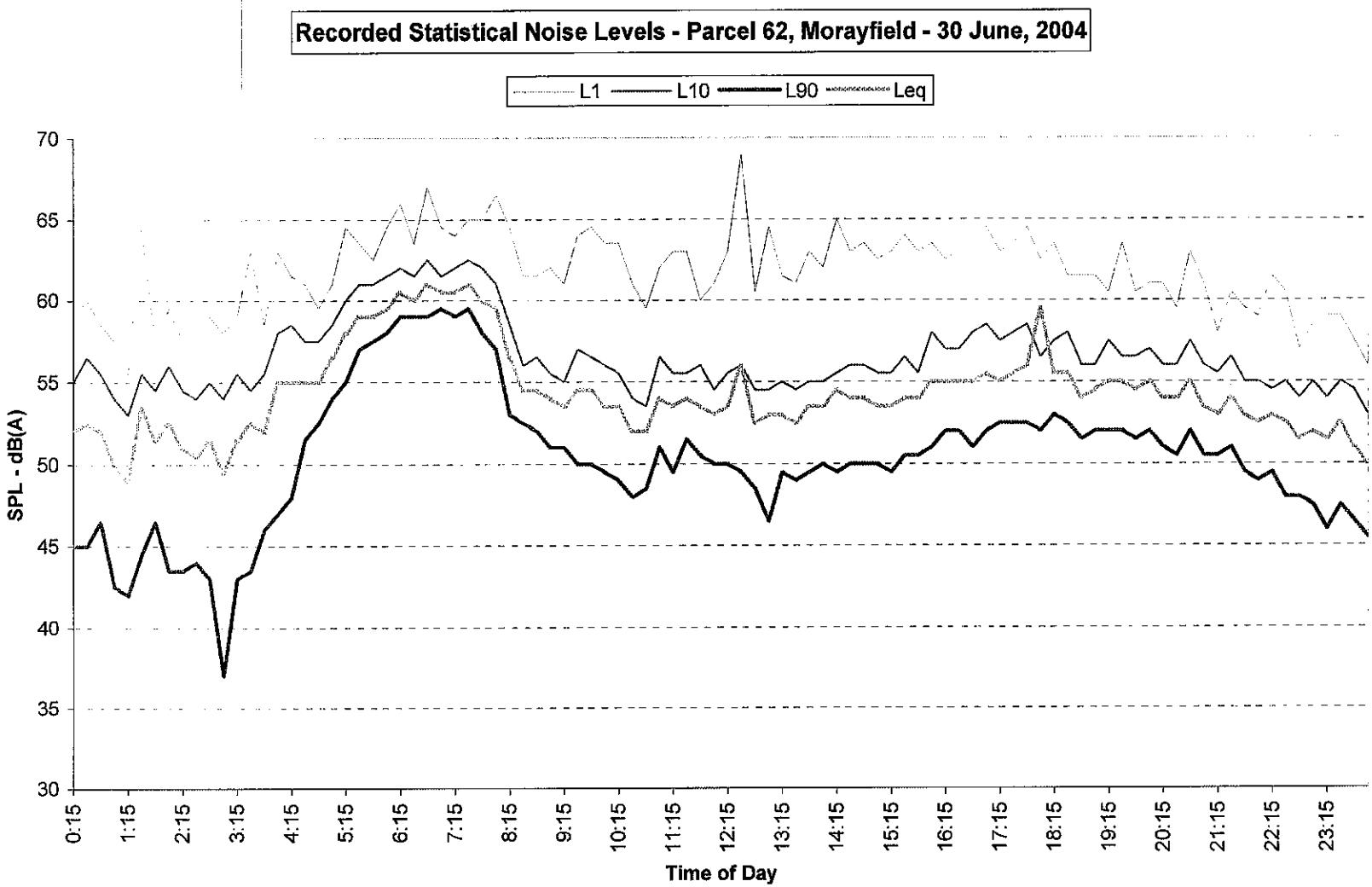
REFERENCE No: 4057-21B

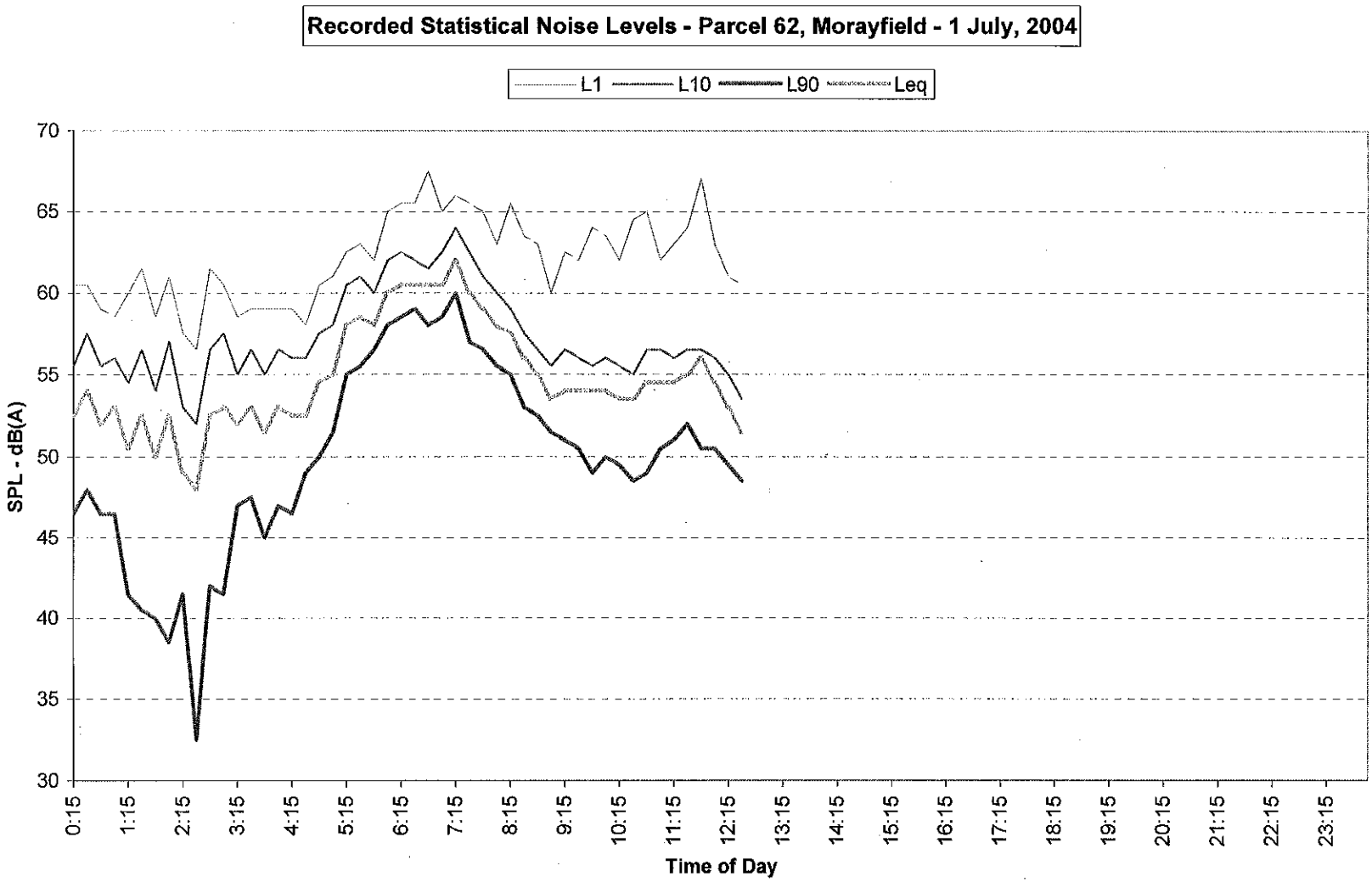
Attachment 1

Recorded Noise Levels

29 June to 1 July, 2004

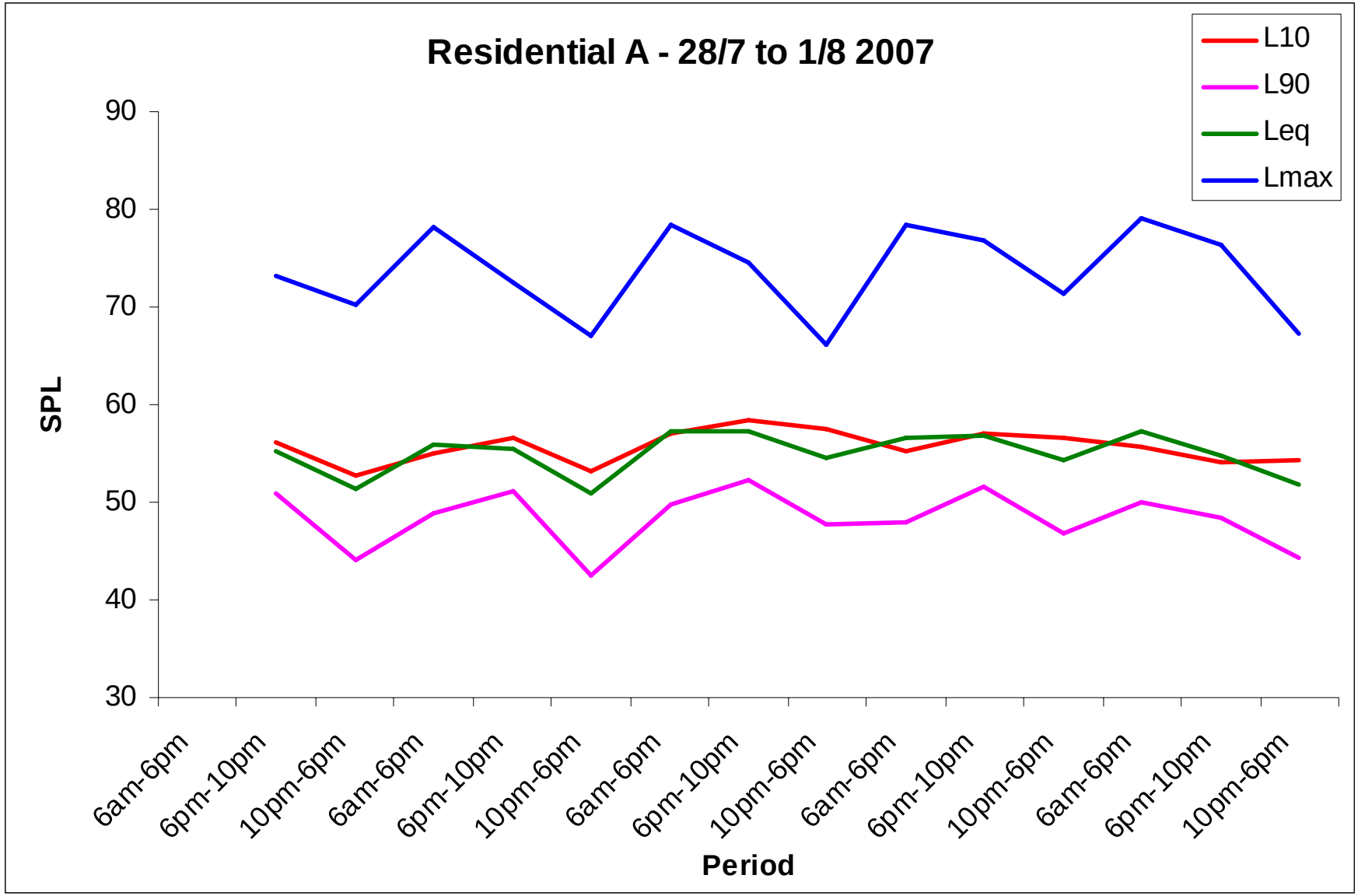

Recorded Statistical Noise Levels - Parcel 62, Morayfield - 29 June, 2004
L1
L10
L90
Leq
SPL - dB(A)
70
65
60
55
50
45
40
35
30
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

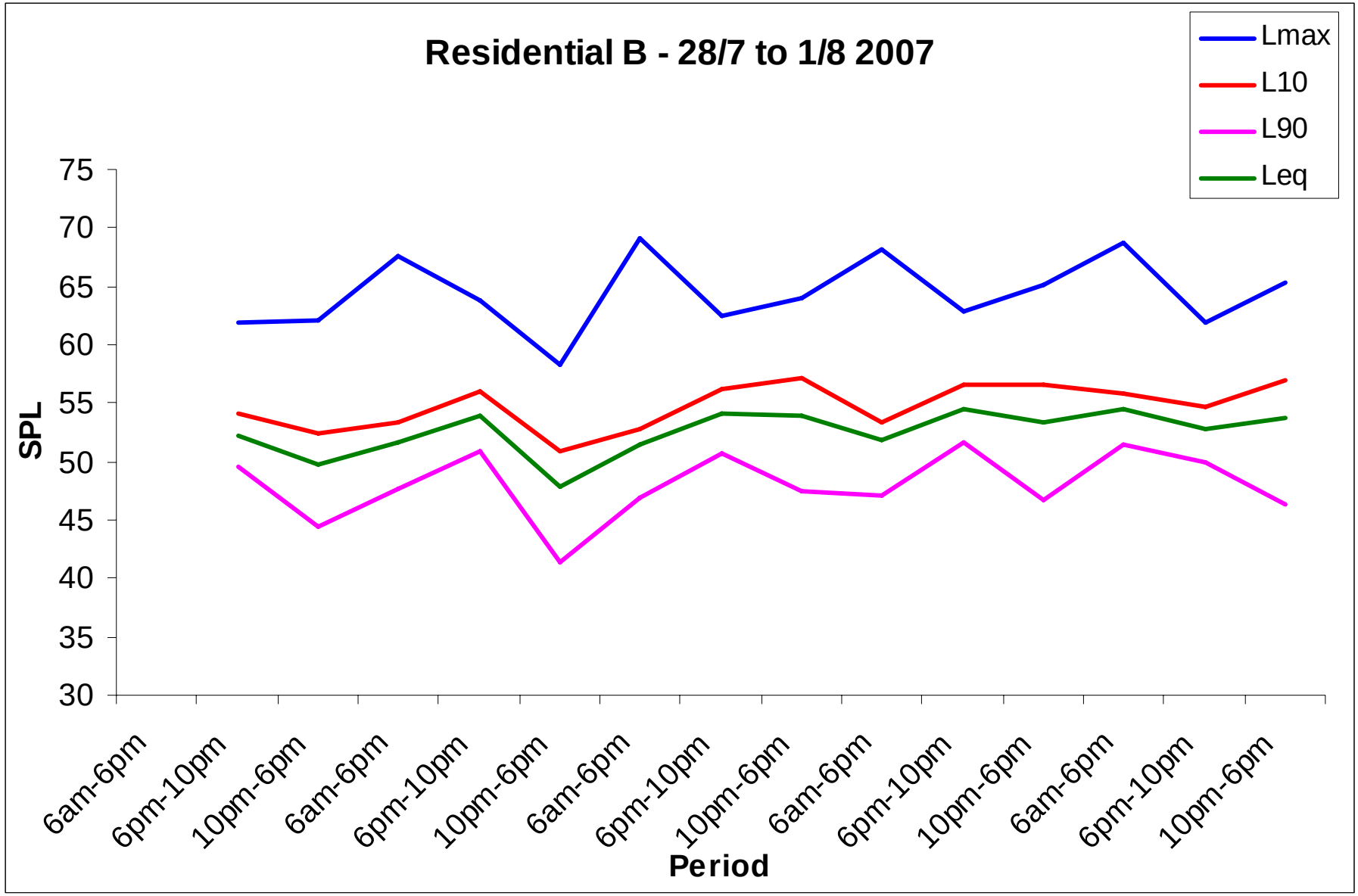

Recorded Statistical Noise Levels - Parcel 62, Morayfield - 30 June, 2004
L1
L10
L90
Leq
SPL - dB(A)
70
65
60
55
50
45
40
35
30
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

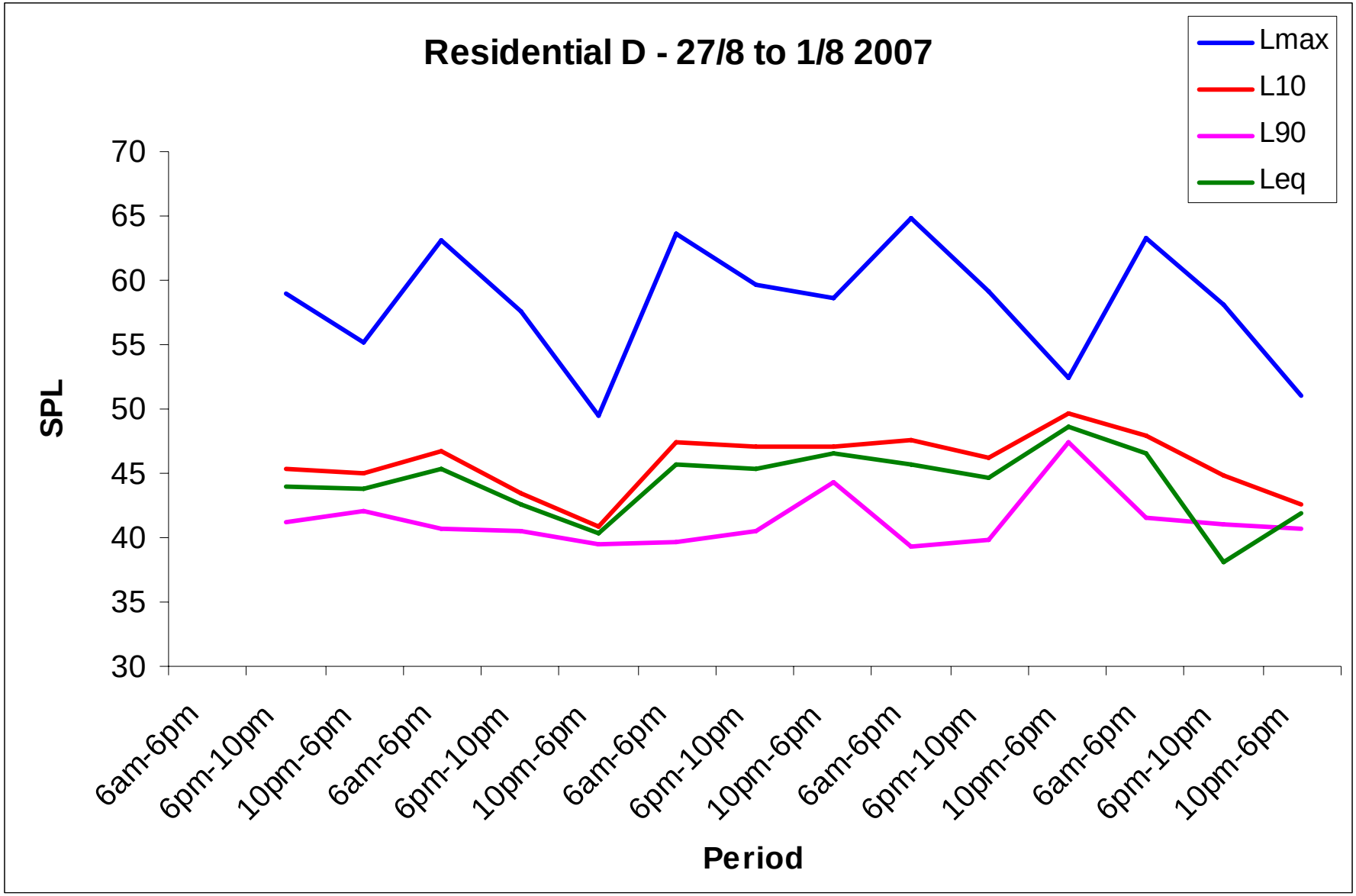

Recorded Statistical Noise Levels - Parcel 62, Morayfield - 1 July, 2004
L1
L10
L90
Leq
SPL - dB(A)
70
65
60
55
50
45
40
35
30
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

APPENDIX B

Graphical Presentation of Raw Data at Sensitive Places


Residential A - 28/7 to 1/8 2007
L10
L90
Leq
Lmax
SPL
90
80
70
60
50
40
30
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
Period


Residential B - 28/7 to 1/8 2007
Lmax
L10
L90
Leq
SPL
75
70
65
60
55
50
45
40
35
30
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
Period


Residential D - 27/8 to 1/8 2007
Lmax
L10
L90
Leq
SPL
70
65
60
55
50
45
40
35
30
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
6am-6pm
6pm-10pm
10pm-6pm
Period

APPENDIX C

Raw Calculations for Planning Noise Levels

		La901hr							
		29/07/2007	ordered	30/07/2007	ordered	31/07/2007	ordered	1/08/2007	ordered
	7.00am	51.625	44.7	56.125	41.5	58.525	41.8	56.75	46.2
	8.00am	50.575	46.2	55.825	44.2	53.6	42	52.55	46.5
	9.00am	50.225	47.6	53.125	44.7	49.425	42.3	49.675	46.5
	10.00am	47.675	47.8	51.25	45.5	46.6	42.8	49.425	46.5
	11.00am	47.8	49.4	46	46	45.05	42.9	49.05	47.7
	12.00am	49.425	49.7	44.275	48.9	42.075	15	46.5	49
	1.00pm	49.725	50.2	52.4	51.2	42.375	16.6	46.55	49.4
	2.00pm	50.65	50.5	45.5	52.1	41.825	48.5	46.5	49.6
	3.00pm	46.2	50.65	41.5	52.4	42.875	49.4	46.275	50.7
	4.00pm	44.75	50.8	44.7	53.1	42.925	51.1	47.775	52.55
	5.00pm	50.8	51.6	48.975	55.8	48.5	53.6	50.725	56.7
4.8 = 5	ABL		49.4		46		42.9		47.7
	RBL	46.5							
	6.00pm	53.3	47.6	52.175	50.7	51.175	51.1	50.55	47.2
	7.00pm	52.8	51.2	53.8	52.1	51.7	51.7	48.525	47.3
	8.00pm	51.275	52.8	52.6	52.6	51.9	51.8	47.35	48.5
	9.00pm	47.6	53.3	50.7	53.8	51.85	51.9	47.25	50.5
1.6 = 2	ABL		51.2		52.1		51.7		47.3
	RBL	50.575							
	10.00pm	43.7	33.7	50.125	41.2	46.625	36.7	46.525	39.1
	11.00pm	40.15	38.3	47.575	42.3	42.5	37.8	44.325	40.8
	12.00am	33.775	38.6	45.1	45.1	38.825	38.8	41.025	41
	1.00am	38.675	40.15	42.375	46.1	37.85	41.9	39.15	43
	2.00am	38.325	42	41.275	47.5	36.7	42.5	40.825	44.3
	3.00am	42.025	43.7	46.125	50.1	41.95	46.6	43.025	45.2
	4.00am	48.675	48.6	50.925	50.9	48.35	48.3	45.25	46.5
	5.00am	54.825	54.8	58.025	58	56.225	56.2	54.625	54.6
	6.00am	56.7	56.7	60.4	60.1	57.875	57.8	59.525	59.5
3.6 = 4	ABL		40.15		46.1		41.9		43
	RBL	42.7875							
	Laeq1hr = minLaeq1hr + 3								
	7.00am - 6.00pm		49.5						
	6.00 - 10.00pm		53.575						
	10.00pm - 7.00am		45.788						
	PNL				project fits category Z3			55	
	7.00am - 6.00pm		45.5					50	
	6.00 - 10.00pm		49.575					45	
	10.00pm - 7.00am		41.788						

APPENDIX D

Construction Materials (Resource and Timing) Spreadsheet

NORTH EAST BUSINESS PARK

CIVIL CONSTRUCTION RESOURCE FRAMEWORK

ACTIVITY	Machinery & Personel TYPICAL
SITE ESTABLISHMENT	D7 Dozer 30t Exc 20m3 Dump Truck Grader Operators - 4No
BULK EARTHWORKS including marina excavation	D10 Dozer - 2No 40t Exc - 4No 20m3 Dump Truck - 10No 16G Grader - 2No 825 Compactor - 3No Water Cart - 3No Grade Checkers - 4 No Operators - 24 No
DREDGING	Dredge 300mm Pilot Boat Pipe Handler Operators - 4No Cons Workers - 6No
SUBDIVISION WORKS	3xGraders 3xRollers 3x30tonne excavators 2xD7 Dozers 1x Loader 2x615 Scrapers 1x Compactor 10x Cons Workers Operators - 14No
INFRASTRUCTURE including major roads, entry & interchange	16G Graders - 4No 20t Rollers - 3No Water Carts - 2No Loaders - 2No 615 Scrapers - 2No Grade Checkers 4No Cons Workers - 10 No Operators 13 No
GOLF COURSE	3xGraders 3x30tonne excavators 2xD7 Dozers 1x Loader 2x615 Scrapers 1x Compactor 6x Cons Workers Operators - 12No
BOULEVARD BRIDGE	Pile Driving Rigs - 2No 80t Hydr Cranes - 3No 20t All Terr Crane - 1 No 30t Exc - 2No Loader - 1No Cons Workers - 15No Operators - 9No
MARINA CONSTRUCTION	3x30tonne excavators 3x 20t All Terrain cranes 20x Cons Workers Operators - 6No
MINOR BRIDGES	Pile Driving Rig 1x80tonne hydraulic crane 1xAll Terrain Crane 2x30tonne excavator 1xLoader 10x Cons Workers Operators - 6No
SITE MANAGEMENT	10No Staff

Year	2008		2009				2010				2011				2012				2013				2014				2015				2016				2017				2018				2019				2020			
number of quarters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Quarter	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ANTICIPATED COMPLETION					STAGE 1				STAGE 2				STAGE 3				STAGE 4					STAGE 5		STAGE 6				STAGE 7				STAGE 8				STAGE 9				STAGE 10									STAGE 11
TOTAL NUMBER MACHINES (per month for quarter)	28	39	42	42	70	70	70	70	88	85	85	61	15	15	15	15	34	34	37	37	37	37	15	15	24	24	24	24	12	12	12	12	18	18	18	18	12	12	12	12	12	12	12	12	12	12	12	12	12	12
TOTAL NUMBER SITE STAFFING (per month for quarter)	42	62	72	72	149	149	149	149	188	178	178	150	34	34	34	34	81	81	85	85	85	85	34	34	48	48	48	48	30	30	30	30	46	46	46	46	30	30	30	30	28	28	28	28	28	28	28	28	28	28

APPENDIX E

Concept Plans of Staged Development

PHASE 3 Snapshot Dec 2019