

STRATEGY > DEFINITION > DELIVERY > TRANSITION

Hornsby Ku-Ring-Gai Hospital Stage 2 – State Significant Development Project (SSD 8647)



Response to Submissions Report 2
NSW Health Infrastructure
12 April 2018

Response to Submissions Report – SSD 8647 – HKH Stage 2 Redevelopment

In respect of SSD 17_8647

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Site Description: Hornsby Ku-Ring-Gai Hospital Campus
Palmerston Road, Hornsby

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Executive Summary

This report has been prepared to provide a tabulated response to further clarifications and requests for information that were made following issue of our Response to Submissions Report dated 26 February 2018. Additional submissions were made by;

- Department of Planning and Environment (DPE);
- Environment Protection Authority (EPA);
- Government Architect (GA)

This report is supplemented by additional technical reports and plans which have taken into account any concerns raised by the above.

ITEM	LETTER	MATTER RAISED	RESPONSE	REFERENCE
1.0	Environment Protection Authority			
		Site Contamination		
1.1	Environment Protection Authority	Report item 3.1 is intended to address the EPA's submission recommendation concerning the need for further investigation of site contamination, including information about groundwater. The EPA notes that Appendix G referred to in Report item 3.1 is a geotechnical report rather than a contamination assessment report. EPA further notes that the Report proposes additional targeted contamination assessments. Importantly, Report Appendix G compares the assessment results against the National Environment Protection Measure (NEPM) criteria for commercial/industrial land use. However, section 3.2.5.3 to NEPM Schedule B7 guidelines, states that the Health Investigation Levels (HILs) developed for the commercial/industrial land use scenario are not applicable to a site used frequently by more sensitive groups such as children (within childcare centres, hospitals and hotels) and the elderly (within hospitals, aged care facilities and hospices).	A detailed contamination investigation (DCI), to be implemented following building demolition, is included within the Project Commitments and Mitigation Measures. The DCI report will compare new testing data, and previous testing data (presented in the PCI report) against the health and ecological screening levels for a more sensitive land use than commercial / industrial. The DCI will also identify any requirement to report contamination to the EPA under the EPA Guidelines for Duty to Report Contamination. Should the DCI determine that a remediation action plan (RAP) is required, an unexpected finds protocol (UFP) will be included as part of the RAP. If a RAP is not deemed necessary, an UFP will still be recommended to be prepared by an Environmental Consultant, for inclusion in the construction environmental management plan (CEMP) of the appointed civil and construction contractor(s). If the UFP is required under the RAP, then the Environmental Consultant will need to address any UFP (as	

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		The proponent should thus be required to ensure contamination assessments are reported against screening criteria appropriate to the more sensitive hospital land use. Report item 3.3 suggests that in response to the EPA's advice and recommendation about the need for a site contamination 'unexpected finds procedure' that such a procedure would be incorporated into the Construction Environmental Management Plan (CEMP). The EPA recommends that any consent nevertheless includes the following conditions.	informed by the contractor) in the final site validation report. If the UFP is not part of a RAP, then it will be the responsibility of the contractor to inform the Principal of an unexpected find (or any other arrangement under a contract), and an Environmental Consultant would be engaged to assess it. If remediation is required at the site then the site will be validated through a process to be outlined in the RAP. The abovementioned staged process complies with that outlined in SEPP55.	
1.2	Environment Protection Authority	Background Noise Monitoring The EPA's EIS submission emphasised that " ... properly establishing background noise levels in accordance with guidance material in the New South Wales Industrial Noise Policy (INP) is fundamental to a consistent approach to the quantitative assessment of noise impacts of development. And that, any background noise monitoring undertaken must provide at least a ' ... week's worth ... ' of valid data. The NSW Industrial Noise Policy (INP) requires monitoring at the potentially most affected noise sensitive locations, which are usually residences. However, the EIS indicated that unattended background noise monitoring could not be undertaken at residences " ... without compromising the security of the noise monitoring equipment." The EPA is aware from its review of numerous noise impact assessments	The calibration certificates have been attached with the revision 4 Acoustic Assessment, included under Appendix A. Detailed justification of both unattended and attended noise logging was provided in our amended report (ref: 20170560.1/1801A/R3/JL, section 4.2) as submitted under Appendix J of the APP Response to Submissions Report dated 26 February 2018. As previously stated, the site is affected by pre-existing mechanical plant noise. It is not possible to shut down the hospital to take measurements of the area in the absence of this noise. This being the case, the EPA recommended procedure for the adjustment of the Amenity noise criteria	Appendix A – SSD Acoustic Assessment Rev 4

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		that other proponents have obtained owner consent and securely located unattended noise monitoring equipment at most affected residential premises. The Report provides no justification for undertaking a week's worth of unattended background noise monitoring on the development site and section 4.1 to the Report Appendix J (i.e. updated noise impact assessment) merely re-states the equipment security issue raised in the EIS. Similarly, the Report Appendix J presents – • Tables of Assessment Background Levels, which indicate from the similarity of the day, evening and night values for the (Derby Road) monitor 2 that the data are probably affected by a local noise source, such as an air conditioner; and • graphs of noise levels measured at monitor 2, which indicate from the L90, Leq and L10 levels in the early morning hours, particularly for Saturday 27 May 2017, that the data are probably affected by a local noise source, such as an air conditioner. Item 3.15 to the Report suggests that Appendix J includes “... calibration certificates for noise monitoring equipment.” However, the EPA did not find any details (or certificates) as to the laboratory calibration status of the instruments (meters and field calibrators) used to undertake background noise monitoring. The proponent should provide the laboratory calibration certificates for all instruments used including the	was followed as is the EPA Industrial Noise Policy recommended practice. Despite the comments provided by the EPA, their proposed acoustic criteria (presumably for the night time period) are either the same or less stringent than those proposed in the Acoustic Logic report, and it is suitable that they be adopted. The sleep arousal criteria has been amended to be based on a night time background noise level of 35dB(A)L90 at the Burdett Street receivers. In addition, an assessment of sleep arousal from reversing ambulances has been included in the revision 4 acoustic report. Noise from construction plant noted during the attended measurements at the Palmerston Road residents on the 18/01/2018 were inaudible at the Burdett Street and Derby Road residents (noting that the car park site is located on the western boundary of the site along Palmerston Road).	

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		instruments used to undertake the additional attended monitoring so as to confirm that all monitoring results are reliable. Item 3.15 to the Report indicates that additional short-term attended noise monitoring was undertaken in January 2018. The proponent should clarify how Appendix J was completed and signed off on 18 January 2018 particularly given that section 4.2 to Appendix J indicates that the attended monitoring was undertaken at several locations on “... 18th January 2018 from 11pm onwards”. Industrial Noise Policy section 3.1 states that “... for the assessment of modifications to an existing development, the noise from the existing development should be excluded from the background noise measurements”. Section 4.2.2 to the Report Appendix J, with reference to mechanical plant at the loading dock, appears to indicate that background noise monitoring may not have been undertaken in the absence of existing noise sources on the premises. The proponent should clarify whether attended background noise monitoring measurements exclude noise from the existing development. The EPA notes that the measured background noise level for Burdett Street residences is shown in Table 4 as 35 dBA. However, the background noise level for Burdett Street is shown in Table 6 ‘sleep arousal’ as 37 dBA. The proponent should clarify whether a night period RBL of 35 dBA or 37 dBA was used to calculate project specific noise levels, including		

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		likely compliance in respect of noise emissions from reversing ambulances. The EPA accepts that the January 2018 attended noise monitoring results presented in section 4.2 to the Report Appendix J took into account existing noise sources on the development site. However, the EPA is unclear how other background noise measurements undertaken at nearby locations in Derby Road and Burdett Street on the night of 18 January 2018 were not similarly affected by construction noise that interfered with measurements at Palmerston Road residences on the same night. As INP section 2.4 requires the project specific noise levels to reflect the most stringent noise level requirements from the noise levels derived from both the intrusive and amenity criteria for each location, the development consent for compliance purposes should explicitly adopt the following project specific noise levels of: (a) 40 dB LA eq (15 minute) for residences in Burdett Street; (b) 35 dBA LA eq (15 minute) for residences in Derby Road;; and (c) 39 dBA LA eq (15 minute) for residences Palmerston Road.		
		Noise – Standard Construction Hours		
1.3	Environment Protection Authority	The EPA's EIS submission explicitly noted "... the proximity of surrounding residences, child care centres and Waitara Anglican church and thus anticipates significant noise impacts	The proponent agrees to adopt the standard work hours on Saturday being 8am to 1pm in line with Table 1 of the EPA's Interim Construction Noise Guideline.	

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		particularly during demolition, site preparation, bulk earthworks, construction and construction-related activities as well as the operational phase of the project.”. And, recommended that the proponent be required to comply with standard construction hours on Saturdays instead of the extended hours proposed in the EIS. The Report suggests at item 3.8 that the proposed construction hours on Saturdays (i.e. between 7.00 am and 3.30 pm) “... align with the approved hours of operation prescribed for the Multi-Storey Car Park project.” The EPA thus understands that the car park project was approved under a separate assessment process and that the consent obtained is inconsistent with standard construction hours recommended in the Interim Construction Noise Guideline. The EPA notes with concern that section 4.2.3 to the Report Appendix J reveals that an attempt to undertake background noise monitoring at Palmerston Road residences after 11.00 pm on 18 January 2018 was thwarted by “... construction works being undertaken for the Hornsby Hospital multi-storey car park.” The EPA further notes that if the consent authority for car park was the local council, section 4.33 (1) (b) of the Environmental Planning and Assessment Act 1979 prohibits council from imposing a condition on its consent “... except with the approval of the applicant ...”.		

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		The EPA emphasises that any council consent would not preclude the EPA from exercising its powers in the event that construction activities for or on behalf of the proponent (or another public authority) results in the emission of noise that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted. The EPA explicitly noted in its EIS submission that “ ... NSW Health and Northern Sydney Local Health District are each a ‘public authority’ within the meaning of the Protection of the Environment Administration Act 1991. And further, that the Environment Protection Authority has general responsibility under that Act for amongst other things: (a) ensuring that the best practicable measures are taken for environment protection in accordance with the environment protection legislation and other legislation, and (b) coordinating the activities of all public authorities in respect of those measures” Table 1 to the EPA’s Interim Construction Noise Guideline clearly identifies the best practicable measures in respect of the recommended standard hours of construction (absent strong justification for alternative hours in the particular case). The EPA does not accept the premise that the less stringent approach adopted in the consent for the car park		

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		represents adequate justification for a departure from the standard hours for this project. Accordingly, the EPA reaffirms its EIS submission recommendations concerning standard hours of construction. And, re-affirms its recommendation that activities "... likely to be audible at any noise sensitive receivers such as surrounding residences are only undertaken during the standard construction hours, ..."		
		Intra-day Respite Periods		
1.4	Environment Protection Authority	The EPA emphasised in its advice about the need for intra-day respite periods that those periods "...are not proposed to apply to those demolition, site preparation, bulk earthworks, construction and construction-related activities that do not generate noise with particularly annoying or intrusive characteristics." However, item 3.9 to the Report indicates that the proponent's consultant does not "... support the blanket adoption of respite periods ...". The EPA is unclear what bearing the opinion of the proponent's consultant may have in relation to guidance provided to public authorities by the EPA in respect of the best practicable measures to be taken for environment protection (i.e. implementing intra-day respite from certain construction activities). The EPA again notes the proximity of the development site to surrounding residences and other noise sensitive receiver	Adoption of intra-day respite periods in the event of an exceedance of a noise management level (BG+10) is not consistent with the Interim Construction Noise Guidelines. Intra-day respite periods are recommended for exceedances of the 75dB(A) Highly Noise Affected level, not simply the Noise Management Level. Further, the intra-day respite period would be required only for those activities where an exceedance of the Highly Noise Affected level is predicted, and not a blanket restriction. Any request for a blanket adoption of respite periods should not be applied. We note that it is typical acoustic practice that preparation of a Construction Noise and Vibration Management Plan be made mandatory in a condition of consent. The Management Plan should identify activities predicted to	

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		locations and anticipates significant noise impacts on those receiver locations throughout the construction phase. Accordingly, the EPA re-affirms its advice and recommendation concerning intra-day respite periods.	exceed the Highly Noise Affected threshold, and respite periods applied to these activities only.	
		Operational Noise		
1.5	Environment Protection Authority	The EPA emphasises that until the issue of rating background noise levels is satisfactorily resolved, noise impacts are unable to be properly assessed against the relevant Industrial Noise Policy criteria. Section 3.20 to the Report suggests that it is unreasonable for the EPA to recommend that “... comprehensive mechanical design to be conducted prior to it being even possible to commence acoustic assessment of that design.” The EPA notes that – (a) an EIS is required to include an analysis of “... the likely impact on the environment of the development, activity or infrastructure”, (b) item 8 to the project SEARs requires the proponent to amongst other things “Identify and provide a quantitative assessment of the main noise and vibration generating sources during construction and operation ...”, and (c) mechanical plant and equipment, especially ventilation and air conditioning plant and equipment, are likely to be main noise sources during operation of the project.	The noise emission goals proposed in item 1.2 above (presumably for the night time period) are the same, or less stringent than what had been proposed in the ALC report. Given this, there is no reason why the background noise monitoring data presented in the Acoustic report (based on the attended and unattended measurements) cannot be used for setting noise emission criteria as the resultant noise emission criteria (based on the attended and unattended measurements) are equal to or less stringent than the noise emission criteria recommended by the EPA. An indicative assessment of plant items was presented in the Acoustic Assessment prepared by Acoustic Logic and the likely acoustic treatments identified. This is entirely consistent with the level of reporting that is reasonably required for development of this nature. The project commitments and mitigation measures include commitments for compliance noise monitoring after the construction, including verification of compliance with the relevant noise criteria to be provided prior to the occupation of the development.	

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		The EPA is thus unclear how its recommendation to require the proponent to provide a quantitative assessment of the noise impact of operation of mechanical plant and equipment at the development site might be considered unreasonable. The EPA re-affirms its advice and recommendations concerning operational noise.		
2.0	Government Architect NSW			
		Master Plan verse Landscaping Plan		
2.1	Government Architect NSW	We have reviewed the relevant sections of the RtS submitted by Health Infrastructure on February 26, 2018. The proponent responded to our letter dated December 15, 2017 with additional information. We note that the master plan supplied in RtS Appendix C is different to the landscape plan. We assume the landscape plan to be correct.	We confirm that the landscape plan is correct – we note for clarity that the demolition of the Lumby Building does not form part of this application, refer to Appendix B.	Appendix B – L01E Landscape Masterplan
		Request for Public Domain Strategy		
2.2	Government Architect NSW	Revisions to the scheme since the initial application are limited to variations to driveways and some landscaping. While the RtS submission was sufficient to answer most issues raised, and we thank the proponents for their considered responses, we reiterate our concerns for the public domain, specifically the request for a public domain strategy overlay; Provide a public domain strategy overlay to the site planning of the campus as a whole. Show how the public hospital will	A Public Domain Strategy Overlay has not been prepared. The design has been critiqued and we have provided responses to the various specific design issues identified by the GA.	

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		provide public amenity and community support that aligns with and supports the primary function of health care.		
		Quality of Public Domain		
2.3	Government Architect NSW	In our submission, we identified that the existing car park has a significant impact on the proposed café located less than 8 metres away. The landscape drawing L03-D in Appendix G of the EIS showed that the Lumby Building was to be retained – limiting the scope for moving the car park away from the café. We note that the revised landscape drawing L03-D in Appendix F of the RtS Shows that the Lumby Building is to be demolished and turf is shown in its place. We acknowledge that this is an improvement to the quality of the public domain. We suggest that the designers consider enlarging the landscaped area adjacent to the café by reconfiguring or reducing car parking as part of the work to demolish the Lumby Building. This would provide patients, visitors and staff access to much needed greenspace and winter sun directly from the café.	The present submission has outlined the interfaces of the proposed development and the public. The benefits to the public largely focused on the primary function of health care. Amendments were requested for consideration by the GA around the location of the existing car park (formally known as the “Bull Ring” car park), separation of the café space and access to Winter sun. We note that the 8m is the minimum separation in the proposed design and larger portion of this area is separated by more than 8m. The on-grade car park shown on the application is largely unchanged, save for a few minor changes proposed in the NE and SE corners to better connect to the proposed site covered link and the external space connection to the café and outdoor public area. We also note that the level of the existing car park on grade is some 1.2m-1.5m below the external public usable area. The external public area outside the café is therefore higher and the users of this outdoor space will be able to look over and beyond the cars in the parking area. The edge of the two spaces (car park and public space) have been softened also by planting and landscape features to help screen the view of the car park.	

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			The external public space outside the café area faces north and has a significant roof canopy overhang designed as part of the entry canopy and roof structure. This roof feature will provide shade from the summer sun and allow winter sun to penetrate through this zone. The design as proposed does provide much needed greenspace and winter sun; it is accessed directly from the café and it is provided for the use of patients, visitors and staff. This has been provided for in the design without incurring the significant expense of moving an existing car park area. A sun analysis study was done as part of the design development and is attached here for reference to show the shading impacts of the roof design on the café and public spaces. In the context of the site and available space to be given to parking provisions, the proposed design has provided some 600m² (200m² internally and 400m² externally) directly related with the café. A further 1500m² of public open space has been provided between the main entry and Palmerston Road. This 1500m² area connects the Palmerston Road frontage and the transport modes to the site with the Main Entry. The pedestrian entry into the site and the pedestrian connection between the main parking structure and the Main Entry to the building both connect via this large landscaped zone. All these spaces offer public amenity and opportunities for recreation and recuperation; much needed space within such a hospital site. Further opportunities for public recreation and recuperation are provided in addition to the above mentioned spaces	

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			such as the lower landscaped area, courtyards and other open spaces already existing on the campus.	
		Master Planning		
2.4	Government Architect NSW	In our submission, we also requested that the master plan that was referred to in the EIS be submitted. The external flow diagram and zonal masterplan provided in RtS Appendix C do not satisfy this requirement. All future work to this campus should be accompanied by a master plan which can demonstrate the relationship between new, existing and proposed work and the proposed approach to public domain, integration with context and transport networks and zones and usage through the campus. We would appreciate the opportunity to meet with the proponent to discuss the public domain and masterplan for this project.	We provided a master plan report which reviewed and update the zonal master plan as part of the Preliminary Business Case in 2014. This work was reviewed and critiqued by Health Infrastructure Expert Reference Group, the Executive of the Hospital and passed through the NSW Government review process (formerly known as Gateway). The master plan review at that time addresses the Clinical Services Plan and also future capacity on the site for further stages. It demonstrates in a master plan context how new and existing development integrate and how future development are also possible without the disruption of services on a live hospital site that has to remain fully functioning 24 hours a day.	
3.0	Department of Planning and Environment			
		Planning Contributions		
3.1	Department of Planning and Environment	The EIS provided justification for exemption from the Hornsby Shire Council Section 94 Development Contributions Plan 2014, however this document does not apply. The application is actually subject to the Hornsby Shire Council Section 94A Development Contributions Plan 2014 which	The proponent has never been required to provide contributions to infrastructure on the basis that the infrastructure provides a social benefit to the community. No projects have paid S94A contributions to date.	

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		specifically identifies hospitals as being subject to contributions. It is also important to note that the Circular D6 relates to Section 94 contributions (now Section 7.11 contributions under the new Act) and not Section 94A (now Section 7.12 contributions) contributions when drafting the justification.								
		Car Parking								
3.2	Department of Planning and Environment	There are inconsistencies in the Transport and Accessibility Assessment prepared by TTW which makes it unclear how pre and post development car parking availability on the site has been calculated. Can you please clarify the number of parking spaces available on the site prior to the multi storey car park and stage 2 works, and then the number of parking spaces available on the site post multi storey car park and Stage 2 completion, ensuring the figures also take into account the loss of the existing car parking within the Stage 2 footprint.	<table><tr><td></td><td>Pre MSCP and Stage 2</td><td>Post MSCP and Stage 2</td></tr><tr><td>Total Carparking Spaces</td><td>442</td><td>788</td></tr></table> Note that the total carparking spaces include line-marked and accessible spaces. The count excludes police, ambulance, fleet, environmental, engineering and informal spaces. The count differs from that reported within the SSD Traffic Report due to design development of the project (both Stage 2 and the MSCP). The increase in supplied carparking spaces is therefore 346 which is sufficient to cater to the 284 increase in demand for parking spaces. The diagrams under Appendix C show the parking inventory for both pre and post completion of MSCP and Stage 2.		Pre MSCP and Stage 2	Post MSCP and Stage 2	Total Carparking Spaces	442	788	Appendix C – Pre / Post MSCP and Stage 2 Car Parking
	Pre MSCP and Stage 2	Post MSCP and Stage 2								
Total Carparking Spaces	442	788								
		Demolition								

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3.3	Department of Planning and Environment	The EIS differs from the demolition plan in that there is no reference to the George Lumby Unit, Overnight Room, Palmerston. Please clarify the buildings for demolition.	The buildings for demolition include; - Building 1 – Pharmacy ECG Computer Services - Building 2 – Medical Imaging and ICU - Building 3 – ROFE and Northern Clinical Library - Building 93 – Cottage - Shop - OT - Emergency Department HOPE (internal demolition as part of refurbishment) - Palmerston Building – optional demolition as not yet confirmed Lumby Building and Building 31 are not included under this application.	
		Landscape Plan		
3.4	Department of Planning and Environment	The 'Landscape Masterplan' (drawing no. L01 E) is inconsistent with the detailed Area 2 Landscape Plan (drawing no. L03 D). Please correct.	Please refer to Appendix D – updated Landscape Plan L03 E.	Appendix D – L03E Area 2 Landscape Plan
		Gross Floor Area (GFA)		Appendix E – GFA Calculation

ITEM	LETTER	MATTER RAISED	RESPONSE	REFERENCE																
3.5	Department of Planning and Environment	Please provide the GFA of the proposed works.	<table><thead><tr><th>LEVEL</th><th>GROSS FLOOR AREA (m²)</th></tr></thead><tbody><tr><td>LEVEL 0</td><td>1851.100</td></tr><tr><td>LEVEL 1</td><td>6347.784</td></tr><tr><td>LEVEL 2</td><td>4067.751</td></tr><tr><td>LEVEL 3</td><td>3341.447</td></tr><tr><td>LEVEL 4</td><td>3399.544</td></tr><tr><td>LEVEL 5</td><td>3379.772</td></tr><tr><td>TOTAL</td><td>22,387.398</td></tr></tbody></table> Note 1: Level 6 contains plant and is therefore excluded from the total GFA Note 2: GFA for each level excludes : • Vertical circulation • Plant & services risers • Terraces & balconies (outdoor spaces & courtyards) • Voids above a floor Please refer to Appendix E.	LEVEL	GROSS FLOOR AREA (m ²)	LEVEL 0	1851.100	LEVEL 1	6347.784	LEVEL 2	4067.751	LEVEL 3	3341.447	LEVEL 4	3399.544	LEVEL 5	3379.772	TOTAL	22,387.398	
LEVEL	GROSS FLOOR AREA (m ²)																			
LEVEL 0	1851.100																			
LEVEL 1	6347.784																			
LEVEL 2	4067.751																			
LEVEL 3	3341.447																			
LEVEL 4	3399.544																			
LEVEL 5	3379.772																			
TOTAL	22,387.398																			
		Job Creation																		
3.6	Department of Planning and Environment	Please confirm the number of operational jobs that will be created by the proposal.	The FTE will be increased at the completion of Stage 2 by 56 positions.																	
		Signage																		
3.7	Department of Planning and Environment	The EIS refers to pylon signage that requires approval and provides an assessment against SEPP 64. However no details of the proposed signage are provided on plan other than	There is a pylon sign shown at the main driveway entry. Please refer to Appendix F Sign Type P1 - Pylon. The pylon content matches existing pylon signage on site – note that	Appendix F – Typical Sign Types Sheet 2																

ITEM	LETTER	MATTER RAISED	RESPONSE	REFERENCE
		signage locations. Elevations of the proposed signage are required.	the content has not gone through any review process by the hospital.	
		Architectural Plans		
3.8	Department of Planning and Environment	The 'Level 2 – Overall Plan' (drawing no. NET-AR-S2-1021 Rev 4) includes the 'paediatric IPU' and 'paediatric outpatient unit' which is partially located above the approved medical imaging building. It is understood from the EIS that the paediatric unit was approved under Part 5 along with the medical imaging building. Please clearly indicate on plan which elements of the paediatric unit are subject of this application.	Please refer to Appendix 7 showing mark up of area subject to the separate approval.	Appendix G – Separate Approval Mark-up
		Architectural Plans		
3.9	Department of Planning and Environment	The detailed drawings for each unit identified in brackets on each of the overall plans have not been provided. Please provide these plans or advise if this was a purposeful omission.	This was a purposeful omission as the level of detail provided is sufficient for planning approval.	
		Contamination		
3.10	Department of Planning and Environment	The contamination reports provided do not state that the site is suitable for the hospital use in accordance with SEPP 55 – Remediation of Land. It is also noted that sampling undertaken for the 'Preliminary Contamination Investigation' dated 2014 and submitted with the EIS did not meet the Sampling Design Guidelines. It is understood that at the time this was due to a number of buildings being located on the site, however since a number of these have now being demolished and replaced by car parking or landscaped areas,	A detailed contamination investigation (DCI), to be implemented following building demolition, is included within the Project Commitments and Mitigation Measures. The proposed DCI address all sampling data gaps that were previously present due to existing structures. The DCI report will conclude either that the site is suitable for hospital use or can be made suitable through implementation of a Remediation Action Plan.	

MATTER RAISED				RESPONSE	REFERENCE
ITEM	LETTER	MATTER RAISED		RESPONSE	REFERENCE
		further sampling should be undertaken and the report updated accordingly.			

Appendix A. Acoustic Assessment Revision 4

MANAGING DIRECTORS

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Hornsby Ku-ring-gai Hospital Stage 2 Redevelopment

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DOCUMENT CONTROL REGISTER

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Issue Type	Email
Attention To	Health Infrastructure Amanda Lardner

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	11/07/2017	20170560.1/1107A/R0/JL	JL		TT
1	16/08/2017	20170560.1/1608A/R1/JL	JL		
2	15/09/2017	20170560.1/1509A/R2/JL	JL		
3	18/01/2018	20170560.1/1801A/R3/JL	JL		
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1 INTRODUCTION

Acoustic Logic Consultancy (ALC) have been engaged by Health Infrastructure NSW (HI) to undertake an assessment of potential noise and vibration impacts resulting from the proposed Stage 2 redevelopment of the Hornsby Ku-ring-gai Hospital.

This report will:

- Conduct an external noise intrusion assessment (primarily of traffic noise to determine the building façade construction required to meet the internal noise requirements.
- Address the relevant Council and Environmental Protection Authority (EPA) noise emission criteria applicable to the development.
- Identify nearby noise sensitive receivers and anticipated operational noise sources with the potential to adversely impact surrounding sensitive receivers.
- Predict operational noise emissions and assess them against acoustic criteria.
- Where required, determine building and/or management controls necessary to ensure ongoing compliance with noise emission goals.

In addition, this report will also include a preliminary review of potential noise and vibration impacts resulting from the proposed demolition, excavation and constructions works associated with the Stage 2 redevelopment.

2 SITE DESCRIPTION AND PROPOSED WORKS

The Hornsby Ku-ring-gai Hospital is bound to the north by Lowe Road, to the west by Palmerston Road, to the east by Derby Road and to the south by Burdett Street. These local roads carry low to medium volumes of traffic.

The proposed Stage 2 redevelopment of the Hornsby Ku-ring-gai Hospital involves,

- Demolition and Enabling works;
- Construction of a new six storey building located towards the southern half of the hospital precinct. The development will include the following:
 - Ambulatory Care Centre;
 - Medical Assessment Unit;
 - Emergency Department;
 - Cardiology and Intensive Care Unit;
 - Rehabilitation facilities;
 - In-patient units;
 - Education and research facilities;
 - A new ambulance bay will be located towards the south-western boundary of the site along Burdett Street. Ambulances will enter from Palmerston Road and exit onto Burdett Street (see figure 2);
 - Café on the ground floor of the proposed development with outdoor seating areas.
- Construction of new roadways within the hospital precinct, primarily near the south-western boundary.

The proposed Stage 2 redevelopment is proposed to operate 24 hours a day, seven days a week.

We note that a new multi-storey car park has been approved and will be constructed prior to the completion of the Stage 2 redevelopment (see aerial photo). This multi-storey car park will cater for the additional parking demand generated by the Stage 2 redevelopment. Noise impacts from the proposed multi-storey car park have been addressed previously in the *Noise Impact Assessment* prepared by this office (re: 20161182.1/1008A/R1/BW, dated 12/09/2016).

In addition, we note that there is an existing emergency generator located near the south-western boundary of the site which will be retained as part of the Stage 2 works.

There are currently hospital buildings along the south-western boundary of the hospital precinct providing screening between the residents to the south across Burdett Street (see aerial photo) and an existing generator and the existing ambulance dock located on the hospital precinct. These hospital buildings will be demolished as part of the Stage 2 redevelopment which will result in the residents to the south along Burdett Street having direct line of sight to the generator and the proposed ambulance bay. The change in noise generation from the generator as a result has been addressed in section 6.1.2. Noise from the proposed ambulance bay has been addressed in section 6.1.1.

2.1 SURROUNDING DEVELOPMENT

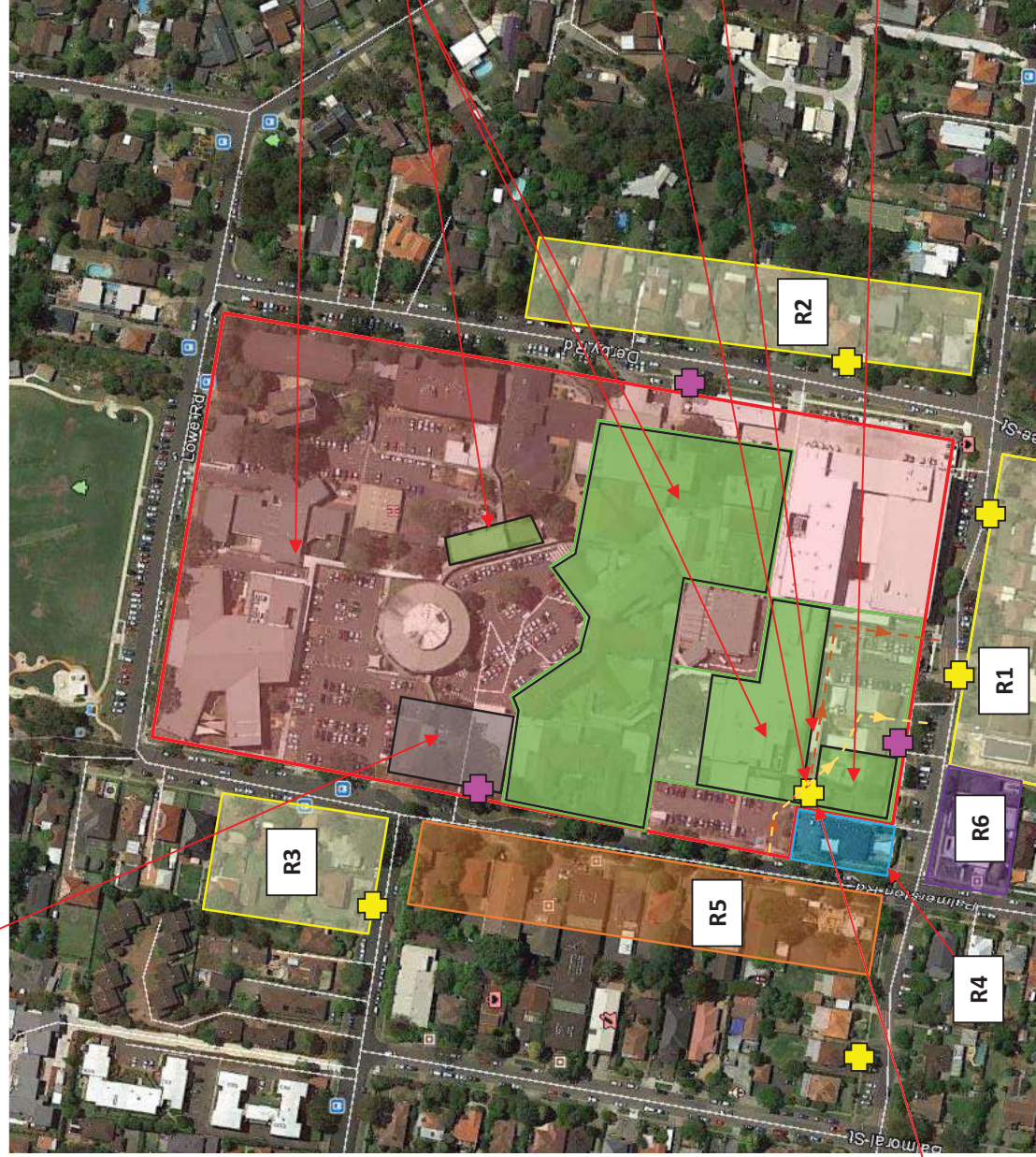
The hospital precinct is generally surrounded by residential properties with local road networks carrying low to medium volumes of traffic.

The surrounding potentially affected receivers as a result of the proposed Stage 2 redevelopment project are as follows:

- Receiver 1: Residential development located to the south of the site across Burdett Street;
- Receiver 2: Residential development located to the east of the site across Derby Street;
- Receiver 3: Residential development located to the north-west of the site across Palmerston Road;
- Receiver 4: Childcare centre located to the immediate south-west of the site;
- Receiver 5: Commercial development located to the west of the site across Palmerston Road;
- Receiver 6: Waitara Anglican Church located to the south of the site across Burdett Street.

Figure 2 below illustrates location of surrounding sensitive land uses.

Proposed Multi-storey Car Park
(not part of Stage 2 works)



Existing Ambulance
Driving Path

Proposed
Ambulance Driving
Path (Approximate)

Hospital
Precinct

Buildings being Demolished as
part of Stage 2

Location of Existing Generator

Location of Existing Ambulance
Dock

Hospital Buildings being
Demolished as part of Stage 2
located Near Existing Generator.
This is where the proposed
ambulance bay will be located.

Stage 2 Redevelopment	Residential Receivers	Childcare Centre	Commercial Receivers	Place of Worship	Unattended Noise Monitor Locations	Attended Measurement Locations



**Attended
Measurement of
Existing Generator**

Figure 1 – Site Photo (Google Earth)

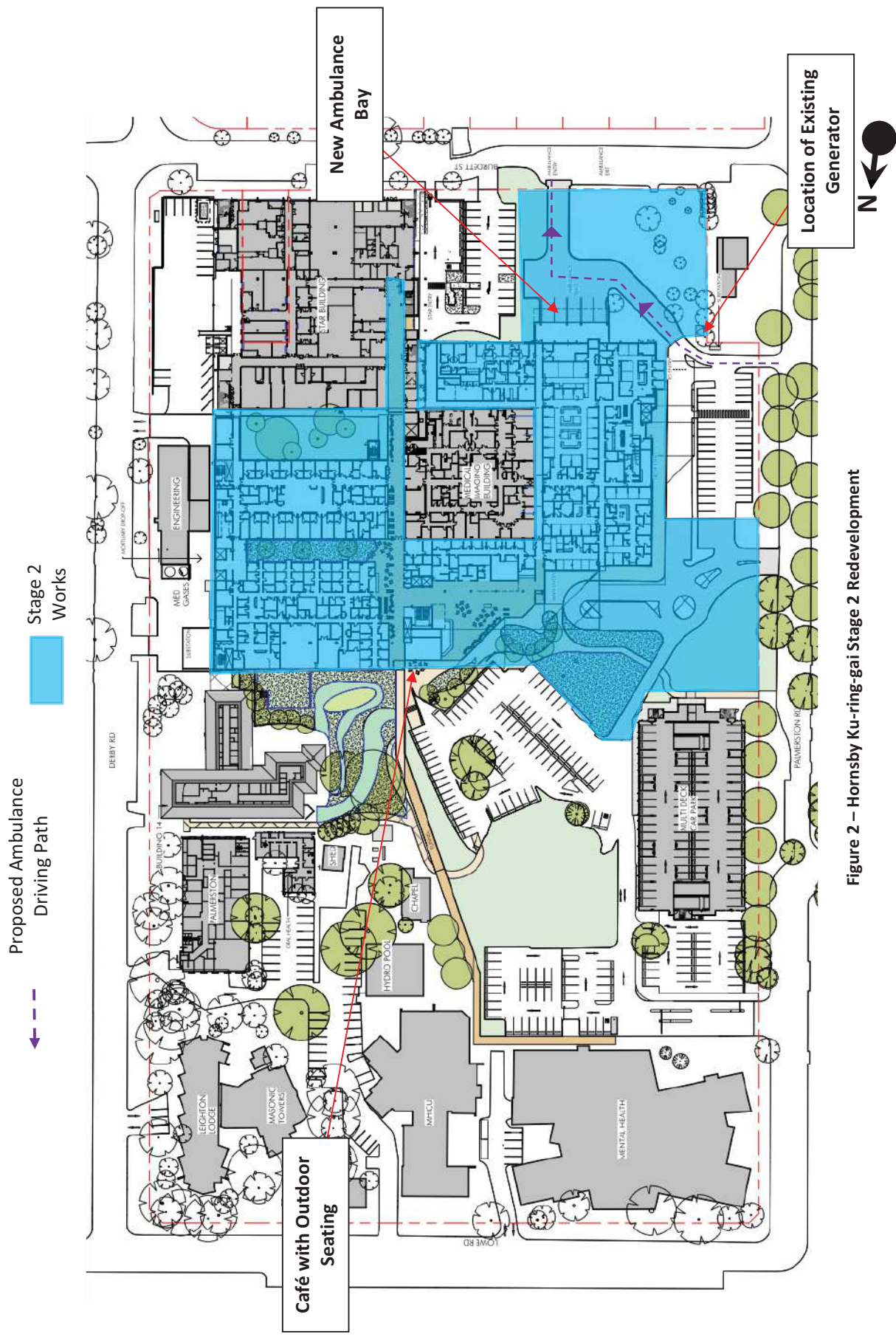


Figure 2 – Hornsby Ku-ring-gai Stage 2 Redevelopment

3 NOISE DESCRIPTORS

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

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10} , L_{90} and L_{eq} .

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

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

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

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

L_1 levels represent is the loudest 1% noise event during a measurement period.

4 EXISTING ACOUSTIC ENVIRONMENT

Unattended long term monitoring and attended short term measurements were conducted at the hospital precinct, to quantify the existing acoustic environment.

4.1 UNATTENDED NOISE MEASUREMENTS

Unattended noise monitoring was conducted using three Acoustic Research Laboratories noise monitors. The monitors were set to an A-weighted fast response mode, recording continuously at 15 minute intervals. Both monitors were calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted.

The locations of the noise monitors were as follows:

- **Monitor 1:** Installed along Burdett Street on the southern boundary of the hospital precinct. Background noise levels measured by this logger are representative of existing levels at the residential properties along Burdett Street. The noise monitor was on site between the 31st May and the 7th June 2017. Refer to Appendix 1 for this logging data.
- **Monitor 2:** Installed along Derby Street on the eastern boundary of the hospital precinct. Background noise levels measured by this logger are representative of existing levels at the residential properties along Derby Street. The noise monitor was on site between the 24th and the 31st May 2017. Refer to Appendix 2 for this logging data.
- **Monitor 3:** Installed along Palmerston Road on the western boundary of the site. The noise monitor was on site between the 24th and the 31st May 2017. Refer to Appendix 3 for this logging data.

The noise monitor locations were located as close as possible to the nearby residential receivers (R1-R3). It was not possible to locate the noise monitors any closer to the residential receivers (i.e. on the same side of the road as the residents) without compromising the security of the noise monitoring equipment.

4.1.1 Unattended Noise Measurement Results

The measured ambient and background noise levels are presented in the tables below and have been based on the unattended measurements.

Table 1 – Measured Ambient and Background Noise Levels along Burdett Street (Monitor 1)

Date	Measured Rating Background Noise Level dB(A) $L_{90}(\text{period})$			Measured Ambient Noise Level dB(A) $L_{eq}(\text{period})$		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
31/05/2017	-	44	40	-	52	50
01/06/2017	45	46	40	55	52	48
02/06/2017	43	44	37	53	53	48
03/06/2017	44	41	37	54	49	46
04/06/2017	41	41	37	52	54	49
05/06/2017	39	38	37	53	50	48
06/06/2017	45	47*	44*	54	57*	55*
07/06/2017	48*	-	-	58*	-	-
	MEDIAN			AVERAGE		
	44	43	35** (37)	53	52	48

*Noise data not used as it is affected by adverse weather conditions.

** Measured background noise level from the noise monitor was 37dB(A) L_{90} . However in order to be conservative, a background noise level of 35dB(A) L_{90} for the night time period has been adopted based on attended background noise measurements. Refer to section 4.2.1.

Table 2 – Measured Ambient and Background Noise Levels along Derby Street (Monitor 2)

Date	Measured Rating Background Noise Level dB(A) _{L₉₀(period)}			Measured Ambient Noise Level dB(A) _{L_{eq}(period)}		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
24/05/2017	-	41	41	-	49	55
25/05/2017	41	44	41	56	51	51
26/05/2017	42	44	42	55	52	48
27/05/2017	41	43	42	52	52	48
28/05/2017	43	42	41	54	48	56
29/05/2017	42	45	41	56	51	49
30/05/2017	41	43	42	53	51	53
	MEDIAN			AVERAGE		
	42	43	41	54	51	51

Table 3 – Measured Ambient and Background Noise Levels along Palmerston Road (Monitor 3)

Date	Measured Rating Background Noise Level dB(A) _{L₉₀(period)}			Measured Ambient Noise Level dB(A) _{L_{eq}(period)}		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
24/05/2017	-	44	40	-	50	49
25/05/2017	43	45	39	55	50	48
26/05/2017	44	41	37	54	50	44
27/05/2017	40	41	38	53	48	45
28/05/2017	43	42	37	55	49	47
29/05/2017	45	42	42	62	49	49
30/05/2017	43	43	41	52	49	47
31/05/2017	45	-	-	54	-	-
	MEDIAN			AVERAGE		
	43	42	39	55	49	47

4.2 ATTENDED NOISE MEASUREMENTS

Attended noise measurements were conducted at the nearest residential receivers to supplement the unattended noise measurements on the 18th January 2018 from 11pm onwards.

Attended measurements were obtained using a Norsonics Type 140 Sound Level Analyser. The Sound Level Analyser was calibrated at the beginning and the end of the measurement using a Norsonics Type 1251 Sound Level Calibrator. No significant drift was noted. All measurements were conducted on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period.

The calibration certificate for the sound level meter is attached in Appendix 2.

The results of the attended night time measurements are as follows:

4.2.1 Burdett Street Residents (Receiver 1)

- Our attended survey of existing night time ambient conditions on 18/1/2017 showed that ambient conditions on Burdett Street residential receivers varied depending on the resident's location.
- Burdett Street residents further west (towards Palmerston Road such as 76A Burdett Street) were affected by noise from rooftop mechanical plant serving the hospital, with measured noise levels from mechanical plant of 42dB(A) L_{eq} .
- However, Burdett Street residents further east (towards Derby Street such as 88 Burdett Street) are screened such that plant noise is not audible and background noise levels as low as 37dB(A) L_{90} were measured.
- An additional background noise measurement was conducted further west along Burdett Street, past Palmerston Road (at 79 Burdett Street), where noise from the hospital was inaudible and dominated by distant traffic noise (from the Pacific Highway). The measured background noise level was 35dB(A) L_{90} .
- Based on these measurement results it can be concluded that the existing background noise level at the Burnett Street residents, in the absence of any noise from the existing hospital, is between 35dB(A) L_{90} and 37dB(A) L_{90} .
- While in our opinion, 37dB(A) L_{90} is in fact the correct background noise level, a background noise level of 35dB(A) L_{90} will be adopted for the Burdett Street residents for the purposes of the setting noise emission criteria.

4.2.2 Derby Road Residents (Receiver 2)

- A site investigation on the 18/01/2018 revealed that the residents along Derby Street were affected by plant noise from fans serving the hospital loading dock.
- This measured noise level (on the 18/01/2017) from the hospital plant at the property boundary of the resident at 8 Derby Road was 42dB(A) L_{eq} .
- An attempt was made to conduct background noise measurements further north along Derby Road that were not affected by plant noise from the hospital, however background noise levels further north were measured to be over 44dB(A) L_{90} as they were affected by distant traffic noise from the Pacific Highway.
- We also note that the existing mechanical plant servicing the loading dock will not be altered as part of the Stage 2 redevelopment works at the hospital.
- The measured hospital plant noise levels at the Derby Road residents will be used in setting the Amenity noise emission criteria for the Stage 2 development (refer to section 5.2.2).

4.2.3 Palmerston Road Residents (Receiver 3)

- During our late night attended noise measurements on 18/1/2018, it was not possible to take background noise measurements at the residences on Palmerston Road, as there was noise from temporary construction plant associated with the Hornsby Hospital multi-storey car park. We note that this plant noise was not audible at the Burdett Street or Derby Road residents.
- This being the case, the 18/1/2018 background noise measurements were conducted at the property boundary 2 Northcote Road, which is further away from the hospital site than the Palmerston Road residents. No hospital generated noise was audible at this location.
- The measured background noise level was 39dB(A) L_{90} , which is consistent with the 39dB(A) L_{90} night time noise level measured by the Palmerston Road noise monitor. The long term logging data along Palmerston Road is therefore appropriate for use in setting noise emission goals.

4.3 METEOROLOGICAL CONDITIONS DURING MONITORING PERIOD

Section 3.4 of the NSW Environment Protection Authority (EPA) Industrial Noise Policy document outlines the following with regards to meteorological impacts on noise monitoring:

“Noise monitoring should not be conducted (or the data should be excluded) when average wind speeds (over 15-minute periods or shorter) at microphone height are greater than 5 m/s, or when rainfall occurs.”

However, the same section of this policy also outlines that;

“Exceptions to this rule are allowed, provided the proponent is able to show that the wind-induced noise on the microphone, and sound levels due to rain, are at least 10 dB below the noise levels (that is, background and/or ambient) under investigation.”

Weather conditions during the monitoring period have been assessed and the periods of inclement weather are highlighted in the logging data in Appendices 1-3.

On review of the monitoring data, the measured L_{90} noise levels during high wind speed days generally do not increase background noise levels significantly as periods with little to no wind. This demonstrates that even though wind speeds measured at Terrey Hills exceed EPA guidelines, either:

- The wind speed on site at this time was significantly lower than at Terrey Hills (which is likely given Terrey Hills weather station is located in a very exposed area) and/or
- The wind on site was not sufficiently consistent to increase background noise levels compared to calm periods.

Nevertheless, periods where it appears that adverse weather have affected the noise monitoring data have been eliminated when determining the rating background noise level at the site, which is presented in the section above.

For example, the monitoring data along Burdett Street (refer to Appendix 1) on the 6th June from 6pm onwards and all of the data on the 7th June have not been used in formulating rating background noise levels, as it is evident that the noise measurements have been adversely impacted by wind and rain.

5 NOISE & VIBRATION EMISSION CRITERIA

The following noise controls and guidelines are applicable to the site:

- NSW Department of Planning & Environment SEARs Requirements.
- Hornsby Shire Council's *Policy and Guidelines for Noise and Vibration Generating Development*.
- NSW EPA Industrial Noise Policy.
- NSW EPA Road Noise Policy.
- NSW EPA Guidelines for Sleep Arousal (Application Notes to the Industrial Noise Policy).
- NSW EPA Noise Control Manual

In addition, the following guidelines will be referenced with respect to construction noise and vibration impacts:

- NSW EPA Interim Construction Noise Guidelines.
- German Standard DIN 4150-3 (1999-02).
- EPA "Assessing Vibration: A Technical Guideline" 2006

5.1 HORNSBY SHIRE COUNCIL'S POLICY AND GUIDELINES FOR NOISE AND VIBRATION GENERATING DEVELOPMENT

The Hornsby Shire Council's *Policy and Guidelines for Noise and Vibration Generating Development* does not present any noise emission requirements relating specifically to hospital development. It does however reference the NSW EPA Industrial Noise Policy.

5.2 EPA INDUSTRIAL NOISE POLICY

Noise sources covered by this code will include vehicle noise (generated on the site), patron noise from the café and mechanical services noise. Both the Intrusiveness and the Amenity criteria (as set out below) must be complied with.

5.2.1 INP - Intrusiveness Assessment

Intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels. The criteria are as follow:

Table 4 – EPA Intrusiveness Criteria

Location	Time of Day	Measured Background noise Level dB(A) _{L₉₀}	Intrusiveness Noise Objective dB(A) _{L_{eq}(15min)} (Background + 5dB)
Residences located to the south of the site along Burdett Street (R1)	Day Time (7am - 6pm)	44	49
	Evening (6pm - 10pm)	43	48
	Night (10pm - 7am)	35	40
Residences located to the east of the site along Derby Street (R2)	Day Time (7am - 6pm)	42	47
	Evening (6pm - 10pm)	43	48
	Night (10pm - 7am)	41	46
Residences located to the north-west of the site along Palmerston Road (R3)	Day Time (7am - 6pm)	43	48
	Evening (6pm - 10pm)	42	47
	Night (10pm - 7am)	39	44

5.2.2 INP - Amenity Assessment

The Amenity criteria set additional criteria based on the land use of the noise sensitive receivers.

Amenity criteria are as follows:

Table 5 – EPA Amenity Criteria

Receiver Location	Land Type	Time of Day	Amenity Noise Objective dB(A) _{Leq(Period)}
Residential properties along Burdett Street (R1)	Suburban	Day Time (7am – 6pm)	55
		Evening (6pm – 10pm)	45
		Night (10pm-7am)	40
Residential properties along Derby Road (R2)	Suburban	Day Time (7am – 6pm)	55*
		Evening (6pm – 10pm)	42*
		Night (10pm-7am)	32*
Residential properties along Palmerston Road (R3)	Suburban	Day Time (7am – 6pm)	50**
		Evening (6pm – 10pm)	40**
		Night (10pm-7am)	35**
Active Recreation Area (e.g. school playground, gold course) – to be used for Childcare Centre (R4)	All	When in use	55
Commercial	All	When in use	65
Place of Worship – Internal	All	When in use	40

*Residents along Derby Road are affected by existing plant noise from the hospital. Given this, the Amenity criteria for these residents have been set based on Table 2.2 of the Industrial Noise Policy (*Modification to acceptable noise level to account for existing level of industrial noise*).

**The amenity criteria for mechanical plant for the residents along Palmerston Road (R3) have been adjusted to factor in the cumulative noise impact from the proposed multi-storey car park and proposed mechanical plant.

Provided that noise emissions from any proposed mechanical plant comply with the criteria outlined above, the cumulative noise impacts from the proposed multi-storey car park (as detailed in *Noise Impact Assessment* prepared by this office (re: 20161182.1/1008A/R1/BW, dated 12/09/2016)) and Stage 2 mechanical plant will comply with the noise emission goals.

There will be no adverse noise impacts on the residents along Burdett Street or Derby Street (R1 and R2) from the operation of the proposed multi-storey car park.

5.3 SLEEP AROUSAL CRITERIA

Potential sleep arousal impacts should be considered for noise generated before 7am or after 10pm.

Short duration, intermittent noise events (such as vehicle engine starts) are typically assessed for potential sleep disturbance.

Potential impacts are assessed using the recommended procedure in the Application Notes to the EPA Industrial Noise Policy. As recommended in the Application Notes, when assessing potential sleep arousal impacts, a two stage test is carried out:

- Step 1 - An “emergence” test is first carried out. That is, the L_1 noise level of any specific noise source should not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident’s bedroom window between the hours of 10pm and 7am. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The guideline level is set out below.

Table 6 – Sleep Arousal (Emergence Criteria)

Location	Background Noise Level (10pm-7am) dB(A) $_{L90}$	Emergence Level dB(A) $L_{1(1min)}$
Residences located to the south of the site along Burdett Street (R1)	35	50
Residences located to the east of the site along Derby Street (R2)	41	56
Residences located to the north-west of the site along Palmerston Road (R3)	39	54

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

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

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

5.4 CONSTRUCTION NOISE AND VIBRATION IMPACTS

5.4.1 EPA Interim Construction Noise Guideline (ICNG)

5.4.1.1 Residential Receivers (R1, R2 & R3)

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *“Noise affected” level.* Where construction noise is predicted to exceed the “noise affected” level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the “noise affected level”. For residential properties, the “noise effected” level occurs when construction noise exceeds ambient levels by more than:
 - 10dB(A)_{Leq(15min)} for work during standard construction hours (7am-6pm Monday to Friday and 8am to 1pm on Saturdays) and
 - 5dB(A)_{Leq(15min)} for work outside of standard construction hours.
- *“Highly noise affected level”.* Where noise emissions are such that nearby properties are “highly noise effected”, noise controls such as respite periods should be considered. For residential properties, the “highly noise effected” level occurs when construction noise exceeds 75dB(A)_{Leq(15min)} at nearby residences.

5.4.1.2 Childcare Centre (R4)

Noise management levels for construction noise impacts on the outdoor play area of the childcare centre receiver to the south-west of the site will be formulated with reference to table 3 of the ICGN for Active Recreation Areas, which is 65dB(A)_{Leq(15min)}.

5.4.1.3 Commercial Receivers (R5)

Section 4.1.3 of the ICGN recommends a noise management level of 70dB(A)_{Leq(15min)} for construction noise impacts on the external areas of offices/retail outlets.

5.4.1.4 Places of Worship (R6)

Section 4.1.2 of the ICGN recommends a noise management level of 45dB(A)_{Leq(15min)} for construction noise impacts on the internal areas of places of worship.

5.4.2 Summary of Construction Noise Management Levels

A summary of construction noise management levels for both standard hours of construction and outside standard hours are presented in the table below. We note that after-hours construction is not proposed as part of this application, however noise emission goals have been included for completeness.

Table 7 – Construction Noise Emission Goals

Location	“Noise Affected” Level - $\text{dB(A)}_{\text{Leq}(15\text{min})}$	“Highly Noise Affected” Level - $\text{dB(A)}_{\text{Leq}(15\text{min})}$
Residences to the south along Burdett Street (R1)	54 (Normal Construction Hours) 49 (Outside Normal Hours - 6pm-10pm) 42 (Outside Normal Hours - 10pm-7am)	75
Residences to the east along Derby Street (R2)	52 (Normal Construction Hours) 48 (Outside Normal Hours - 6pm-10pm) 46 (Outside Normal Hours - 10pm-7am)	75
Residences to the north-west along Palmerston Road (R3)	53 (Normal Construction Hours) 47 (Outside Normal Hours - 6pm-10pm) 44 (Outside Normal Hours - 10pm-7am)	75
Childcare Centre Outdoor Play Areas (R4)	65 (based on management level for Active Recreation Areas of ICGN)	N/A
Commercial Receivers (R5)	70	N/A
Place of Worship (R6)	45 (internal)	N/A

5.4.3 Construction Vibration

The construction vibration criteria applicable to the site are presented below.

5.4.3.1 German Standard DIN 4150-3 (Building Damage Limit)

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

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

Table 8 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

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

5.4.3.2 Amenity Criteria (Human Comfort)

Table 2.2 of EPA “Assessing Vibration: A technical guideline” specifies the following vibration criteria for the protection of human comfort:

Table 9 – Construction Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences (R1-R3)	Daytime	0.28	0.56
Offices (to be used for R4 & R5)	When in use	0.56	1.1
Critical Working Areas (e.g. Hospital Operating Theatres)	Day or Night Time	0.14	0.28
Impulsive Vibration			
Residences	Daytime	8.6	17
Offices (to be used for R4 & R5)	When in use	18	36
Critical Working Areas (e.g. Hospital Operating Theatres)	Day or Night Time	0.14	0.28

6 NOISE EMISSION ASSESSMENT

This section addresses potential noise impacts resulting from the future operation of the proposed hospital development, and also noise and vibration impacts associated with the construction works.

6.1 OPERATIONAL NOISE

Operational noise sources with the potential to impact on the amenity of surrounding sensitive land include:

- Vehicular noise on site from the new ambulance bay.
- Noise from the existing generator towards to the south-western boundary of the site.
- Patron noise from the café.
- A preliminary assessment of noise from any new external mechanical plant and equipment.

6.1.1 Vehicular Noise from the Ambulance Bay

6.1.1.1 Average L_{eq} Noise Emissions

Noise generated from the new ambulance bay is assessed with reference to the EPA Industrial Noise Policy.

Noise emission predictions are based on the following data/assumptions:

- In typical use, an ambulance would not be expected to use its siren when travelling within hospital grounds.
- Primary noise source will be from ambulances manoeuvring in the ambulance bay. Ambulances will enter the bay via Palmerston Road and exit onto Burdett Street as indicated in Appendix A of the Traffic Impact Assessment prepared by TTW (re: TTW-TF-S2-RP01, dated 15/12/2016).
- Sound power level (SWL) of 90dB(A) for an ambulance travelling at 10km/hr.
- Sound power level (SWL) of 95dB(A) for an ambulance reversing at 10km/hr (based on measurements conducted by this office). This noise level applies a 5dB(A) penalty (i.e. increase) to account for tonality from the reverse beacon
- For the purposes of this assessment, we have assumed that the following:
 - Up to 4 ambulances entering and exiting the ambulance bay in a 15 minute period during the day and evening period (7am-10pm);
 - Up to 2 ambulances entering and exiting the ambulance bay in a 15 minute period during the night time period (10pm-7am).

These are likely to be conservatively high levels of vehicle movements.

Noise at the residents emissions will be assessed against the Intrusiveness criteria of the Industrial Noise Policy as detailed in section 5.2.1.

Noise at the Waitara Anglican Church will be assessed against the Amenity criteria presented in section 5.2.2.

The nearest receivers to be impacted by the ambulance bay are the residents to the south along Burdett Street (R1) and the Waitara Anglican Church to the south across Burdett Street (R6). If noise impacts are compliant at these receivers, then they will be compliant at all receivers in the vicinity of the development. Predicted noise levels are presented in the table below.

Predicted noise levels to the internal spaces of the Waitara Anglican Church are based on the assumption that windows to the church are open.

Table 10 – Predicted Noise Levels from Ambulance Bay

Noise Receiver Location	Time Period	Predicted Noise Level dB(A) $L_{eq(15min)}$	Noise Emission Criteria dB(A) $L_{eq(15min)}$	Complies
Northern Boundary of Residents along Burdett Street (R1)	Day & Evening (7am-10pm)	43	Day – 49* Evening – 48*	Yes
	Night (10pm-7am)	40	42*	Yes
Waitara Anglican Church (R6)	Day & Evening (7am-10pm)	32 (internal)	40 (internal)	Yes

*For intermittent, peak periods of use it is the INP Intrusiveness criteria (which utilises a $L_{eq(15min)}$ noise descriptor which is most appropriate. Long term average noise levels (4-11 hours, depending on the period being considered) used in the Amenity Criteria are not appropriate when assessing peak periods of ambulance bay use.

Noise from ambulances manoeuvring within the proposed ambulance bay will comply with the noise emission requirements.

We note that ambulance sirens are only used in emergencies and are not subject to the noise emission requirements of the INP. Sirens to ambulances are not typically used within the site as ambulances will have their own dedicated access road to the ambulance bay and would not run into conflict with other vehicles.

6.1.1.2 Transient Noise Events (Sleep Arousal)

Given that the ambulance bay will potentially be in use during the night time period (10pm and 7am), noise impacts should be assessed for sleep disturbance impacts on nearby residents.

Primary noise sources which have been considered are:

- Noise from a door closing or an engine starting, both with an approximate sound power level of approximately 95dB(A) $L_{1(1min)}$.
- Noise created by the ambulance pass-by as it leaves the site (the peak noise level as the ambulance travels past the closest point to the residences).

The nearest receiver to be impacted by the ambulance bay are the residents to the south along Burdett Street (R1). If noise impacts are compliant at these receivers, then they will be compliant at all receivers in the vicinity of the development. Predicted noise levels are presented in the table below.

Analysis will be conducted as follows:

- Firstly, the noise event will be assessed with reference to the “background+15dB(A)” criteria (this is the first step of the sleep arousal test outlined in section 5.3).
- Secondly, in the event that compliance with the “background+15” test is not satisfied, a more detailed assessment will be undertaken, in which the noise level is predicted inside the bedroom itself.

Step 1 - Predicted noise levels and assessment against “background+15dB(A)” criteria are as follows.

Table 11 – Sleep Arousal Assessment

Receiver Location	Noise Source	Predicted Noise Level dB(A) $L_{1(1min)}$	Emergence Criteria dB(A) $L_{1(1min)}$	Complies
Northern Façade Windows of Residents along Burdett Street (R1)	Engine Start-Up/Door Slamming in Ambulance Bay	51	50	Marginal Exceedance
	Engine Noise When Ambulance Leaving the Site.	53	50	No
	Ambulance Reversing in Ambulance Bay	53	50	No

As shown in the table above, noise emissions from engine start-ups or closing doors marginally exceeds the “background+15dB(A)” acoustic criteria. Noise from ambulances leaving the site and ambulances reversing in the ambulance bay is predicted to exceed the sleep arousal criteria by 3dB(A). Given this, a more detailed assessment has been conducted. This involves predicting the noise level in the bedroom itself, and comparing to the EPA recommended criteria as presented in section 5.3, and is outlined below.

Step 2 - The predicted noise levels *inside* the bedroom (assuming the bedroom window is left open) is presented below.

Table 12 – Sleep Arousal Assessment (Internal Noise Level Test)

Receiver Location	Noise Source	Predicted Noise Level dB(A) $L_{1(1min)}$	Acoustic Criteria* dB(A) $L_{1(1min)}$	Complies
Within Bedrooms of Residents along Burdett Street (R1) (assuming windows are open)	Engine Start-Up/Door Slamming in Ambulance Bay	41	50-55	Yes
	Engine Noise When Ambulance Leaving the Site.	43	50-55	Yes
	Ambulance Reversing in Ambulance Bay	43	50-55	Yes

*As noted in section 5.3 of this report, where emergence test is not satisfied, EPA guidelines note that L_{Max} noise levels of 50-55dB(A) *inside a habitable area*, maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep.

Predicted noise levels inside the bedrooms are less 50dB(A) $L_{1(1min)}$, which is compliant with the more stringent end of the range specified in the EPA guidelines.

6.1.2 Noise from Existing Generator (near South-Western Boundary of Hospital Precinct)

This section of the report presents our assessment of future noise impacts from the existing emergency generator located near the south-western boundary of the site.

There are currently hospital buildings along the south-west boundary of the hospital precinct along Burdett Street providing screening between this generator and the residents to the south across Burdett Street (R1). We note that these hospital buildings will be demolished as part of the Stage 2 works (and be replaced with an ambulance bay and associated roadways) which will result in the Burdett Street residents having direct line of sight to the generator. This will result in an increased noise impact on the Burdett Street residents from the generator.

Acoustic treatments should be implemented such that noise emissions from the generator at the Burdett Street residents (R1) are compliant with the intrusiveness criteria of the INP (see section 5.2.1) after the demolition of the hospital buildings on along the south-western boundary hospital precinct.

As part of this assessment, noise measurements have been conducted of the existing generator during operation. Attended noise measurements of the generator were conducted on the 3rd June 2017 between 7am and 8am. Measurements were undertaken using a Norsonics Type 140 precision sound level analyser, set to A-weighted fast response. The precision sound level analyser was calibrated before and after the measurements using a Norsonics 1251 sound level calibrator. No significant drift was recorded.

Measured noise levels indicate that the generator has a noise level of 77dB(A)_{Leq} at a distance of 4m.

Recommended treatments are presented in section 6.3.

6.1.3 Patron Noise from Café

The main source of noise from the proposed café will be patron speech in the outdoor seating area of the café. The café will be located towards the middle of the hospital precinct.

The nearest receivers to be impacted are:

- Residents along Derby Street to the east (R2) which have a partial view of the café;
- Commercial receivers along Palmerston Road to the west (R5).

If noise emissions from the café are compliant at these receivers, then noise emissions will be compliant at all receivers in the vicinity of the site.

Patron noise impacts on the residential receivers will be assessed against the intrusiveness criteria (see section 5.2.1) for residential receivers and the amenity criteria for commercial receivers (see section 5.2.2).

Noise emission predictions are based on the following data/assumptions:

- A sound power level of 75dB(A) L_{eq} was used for patron voice levels (raised speech) for this assessment.
- 1 in 3 patrons are speaking at any given time.
- 32 patrons using the outdoor seating area.
- No music in the outdoor dining area.

The predicted noise levels are presented in the table below. The predicted noise levels factor in distance attenuation and barrier effects.

Table 13 - Predicted Patron Noise Levels from Cafe

Receiver Location	Predicted Noise Level dB(A) $L_{eq}(15min)$	Noise Emission Criteria dB(A) $L_{eq}(15min)$	Complies
Residents along Derby Street (R2)	35	Day – 47 Evening – 48 Night – 46	Yes
Commercial along Palmerston Road (R5)	38	65	Yes

Noise emissions from proposed café are compliant with the nominated acoustic criteria.

6.1.4 Noise from Mechanical Plant

Detailed acoustic design of mechanical plant cannot be undertaken at approval stage, as plant selections have not been finalised.

Preliminary mechanical drawings provided to this office indicate that the majority of the Stage 2 mechanical plant will be located on level 6 of the development. An indicative assessment of primary plant items is presented below.

Primary plant items will include:

- Cooling towers.
- Air handling plant (air handling units, supply/exhaust/outside air fans).
- Chillers.
- Emergency diesel generator.

With respect to the above, we note:

- Cooling towers
 - Two cooling towers are proposed to be located in an external area on level 6 of the development.
 - Preliminary plant selections indicate that the cooling towers will have a sound power level of 86dB(A) when operating at full speed.
 - Given the distance between the cooling towers and the surroundings residents and shielding provided by the hospital building structure, the proposed cooling towers will comply with the noise emission requirements.
 - Despite this, it recommended that cooling towers are fitted with variable speed drives, to allow for reduced fan speed during periods of low load. Typically, a fan speed of no more than 50% would be expected at night time.
- Chillers (assumed sound power of 102dB(A)).
 - Three chillers are proposed to be located within an enclosed plant room on level 6 of the development.
 - The plant rooms housing the chillers should not have any external ventilation opening/louvre.
 - Light weight cladding to plant room walls and ceiling will potentially require internal plasterboard sheeting to ensure noise breakout through wall/roof to nearby receivers are compliant with INP requirements. Final plant room building shell design to be conducted following final chiller selection.
 - Typical vibration isolation would consist of 25mm static deflection springs sitting on a concrete plinth isolated from the structural slab using 10mm rubber matting.

- Fans and air-handling units.
 - Air handling units are proposed to be located within a plant room on level 6 of the development.
 - Air handling units do not typically require extensive acoustic treatment to ensure compliant noise emissions at nearby properties.
 - Air handling unit exhaust and outside air ducting (both of which are typically ducted to outside) are to be acoustically reviewed following layout design by mechanical engineer/contractor to determine whether internal lining to this ductwork is required.
 - It is recommended that the outside air intakes of the air handling units are ducted to a dedicated louvre rather than having a naturally ventilated plant room housing the air handling units.
 - Major fans (typically with a sound power over 90(A) – such as kitchen exhaust, major toilet exhaust and major relief air fans) will require acoustic treatment if located externally. This treatment would include internal lining to any external ductwork. Acoustic treatment of fan casing may also be required. Review of all external fans (including fans ducted to external locations) must be conducted once selected to ensure compliant noise emissions to external areas.
- New emergency power backup generator.
 - Two new emergency generators are proposed to be located in an external area on level 6 of the development.
 - It is likely that the generators will need to be located in a proprietary acoustic enclosure if not being located in a plant room.
 - Acoustic attenuators will be required to the plant room/acoustic enclosure air inlet and air discharge (indicatively 1.8m long, 40% open area attenuators). Additionally, the exhaust gas discharge will require a muffler such that it creates a noise level of no more than 85dB(A) at 1m distance.
 - Detailed acoustic performance of plant room (or any acoustic enclosure) to be finalised following final generator selection/location.

Compliance with INP acoustic criteria as set out in Section 5.2 will be achievable, provided that detailed acoustic review of plant items is undertaken once plant is selected.

6.2 CONSTRUCTION IMPACTS

6.2.1 Construction Noise

With respect to general construction noise, the impacts on nearby development will be dependent on the activity in question and where on the site the activity is undertaken. Excavation and piling works tend to be the loudest typical construction activity. Work close to the boundaries will have greatest potential impact on the residents surrounding the site and the childcare centre to the south-west and the commercial development to the west. Detailed acoustic assessment of individual activities cannot be undertaken prior to knowing the activities/construction methods proposed, their duration and location. This office has been advised that the total construction period (demolition, excavation, piling and construction) will be approximately between the beginning of 2018 until the last quarter of 2020.

Based on initial analysis we make the following comments:

Demolition/Excavation Phase

Primary noise emissions occur during demolition, excavation and earth retention (piling), with equipment items typically having sound power levels of approximately 115dB(A)_{Leq(15min)}. Some exceedance of the EPA “Noise Affected” target levels may occur at the boundary of existing residences along Derby Street, Burdett Street and Palmerston Road. Noise levels exceeding the “Highly Noise Affected” level of 75dB(A) at the residences are unlikely to occur for extended periods.

For the childcare centre and Waitara Anglican Church, some exceedances of the noise management levels (presented in section 5.4.1) are predicted when activities are taking place near the south-western boundary of the site.

Construction Phase

During erection of structure, it is the use of hand tools (angle grinders etc) and concrete pumps which are the loudest typical activity (sound power levels of approximately 105dB(A)_{Leq(15min)}). Intermittent exceedances of the EPA “Noise Affected” levels may occur, at the boundary of existing residences along Derby Street, Burdett Street and Palmerston Road, however there may be some screening provided by the existing buildings on site depending on the location of the equipment. Noise levels exceeding the “Highly Noise Affected” level of 75dB(A) at the residences are unlikely to occur for extended periods. Intermittent exceedances of the noise management levels (presented in section 5.4.1) are predicted for the childcare centre and Waitara Anglican Church when activities are taking place near the south-western boundary of the site.

Once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building façade will provide considerable noise attenuation. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to exceed EPA recommended levels. Vehicle noise and crane noise will create the greatest possibility of noise disturbance during this phase.

Noise impacts can be minimised using the following:

- Careful planning/scheduling of noisy works, particularly when located near the property boundaries.
- Location of static plant (concrete pumps, cranes) as far as practicable away from the boundaries is recommended.
- Use of augured rather than driven or vibratory piling should be considered if feasible.
- Locate cranes as close to the middle of the site as practicable.
- Letter box drops or similar to advise residents on activities with the potential to result in noise levels reaching the “Highly Noise Affected” noise level. Leaflet should advise of the likely duration of the activity.

In light of the above, we recommend:

- On completion of the construction program, an acoustic review of proposed construction activities and plant/methods/selections should be undertaken to identify the extent and duration of potential exceedances of EPA construction noise management levels;
- Community consultation to inform adjacent property owners of potential noise sensitive activities;
- Identify feasible acoustic controls or management techniques (for example, selection of plant, use of screens around static plant, scheduling of noisy works, notification of adjoining land users, respite periods) when exceedance of management noise levels may occur;
- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby residences are made aware of the time and duration of noise intensive construction processes; and
- Implementation of a noise monitoring program during construction to provide feedback to the Builder to ascertain whether construction noise goals are being exceeded and determine additional management strategies.

Through adoption of the above, noise impacts on nearby residences can be suitably managed to prevent unreasonable impact.

6.2.2 Construction Vibration

Excavation and earth retention works (piling) are the primary vibration generating activities.

Given the distance between the site and the nearest residential buildings (R1-R3) and the commercial buildings (R5), it is unlikely that construction vibration will exceed EPA guidelines at these receivers.

The childcare centre (R4) is in close proximity to the proposed development. In order to manage/minimise vibration impacts on the childcare centre we recommend:

- That attended vibration measurements are conducted at the commencement of the excavation stages to ensure that vibration impacts on this receivers are compliant with criteria presented in section 5.4.3.

In addition, consultation with hospital users should be undertaken to identify any highly vibration sensitive spaces in close proximity to the excavation area. Potentially it will be necessary to conduct vibration monitoring with SMS notification system to protect highly vibration sensitive spaces such as operating theatres or laboratories.

6.3 RECOMMENDATIONS

We recommend the following acoustic treatments/management controls to ensure compliance with EPA noise emission guidelines.

6.3.1 Existing Generator (near South-Western Boundary of Hospital Precinct)

- Install a solid, imperforate (i.e. no holes) screen around the south, east and western sides of the generator as shown in Figure 3 below.
- The screen is to extend a minimum 500mm above the top of the generator and is to be located no more than 1.2 metres from the generator.
- Suitable materials for the screen include 6mm fibre cement, lapped and capped timber or Colorbond metal.

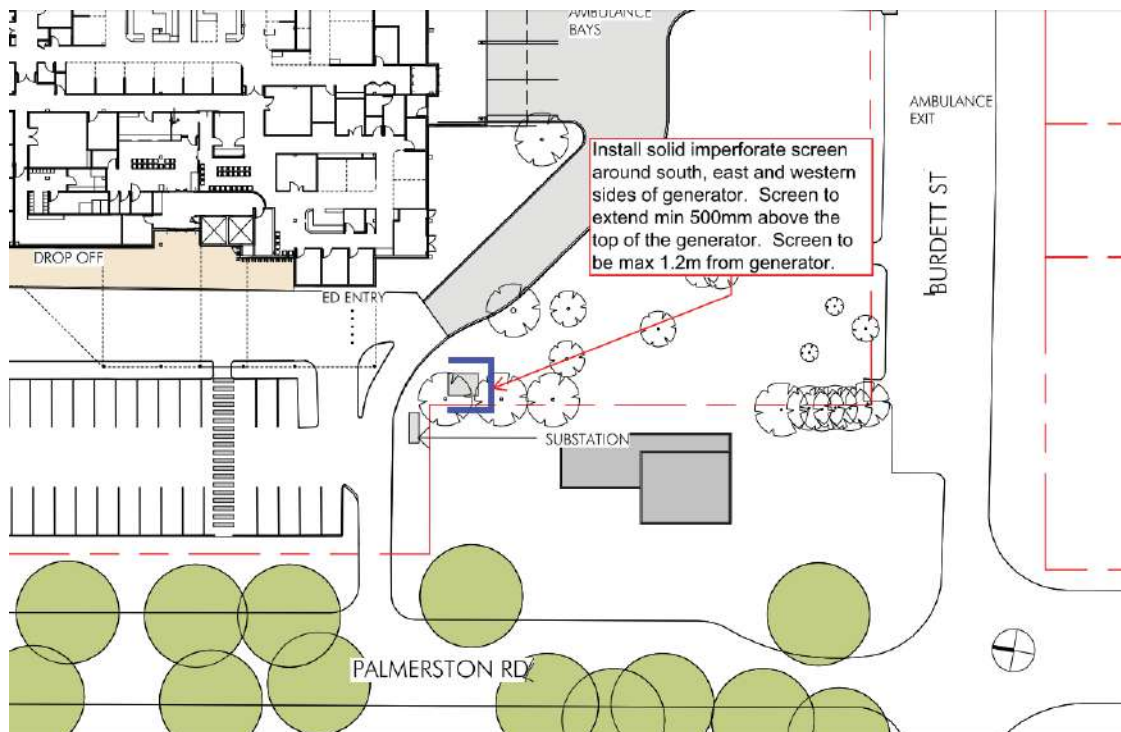


Figure 3 – Recommended Screen Around Existing Generator

6.3.2 Construction Noise and Vibration

- A detailed construction noise and vibration management plan should be implemented. Review of the mitigation techniques outlined in this report should be carried once the construction methods have been determined.

6.3.3 Mechanical Plant

- Detailed acoustic review of all external plant items should be undertaken following equipment selection and duct layout design. Initial analysis indicates that with acoustic treatment, all plant items will be capable of meeting noise emission requirements. However this is likely to require:
 - Noise screening (using either a dedicated noise screen or the building shell) for roof top cooling towers.
 - An acoustic enclosure for any externally located back-up generator.
 - Acoustic treatment to fan casing and lining of external ducting for major external fans.
 - Plant room wall/roof construction for any plant room housing chiller plant.
 - Detailed acoustic review of external louvres for any plant rooms to determine whether acoustic louvres/attenuators are required.

7 EXTERNAL NOISE IMPACT ASSESSMENT

Significant noise sources in the vicinity of the site are as follows:

- Traffic noise from surrounding roadways.

Noise impacts should comply with the requirements of the Hornsby Shire Council DCP, NSW Health Infrastructure Engineering Services Guidelines and Australian Standard AS2107:2016.

7.1 ACOUSTIC OBJECTIVES

The determination of an acceptable level of traffic noise within the health spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities

Internal traffic noise level criteria are to comply with the requirements of the

- NSW Health Infrastructure Engineering Services Guidelines
- AS2107-2000 “Recommended Design Sound Levels and Reverberation Times for Building Interiors”
- NSW Department of Planning’s *Development Near Rail Corridors and Busy Roads – Interim Guideline 2008*

7.1.1 Hornsby Shire Council’s Policy and Guidelines for Noise and Vibration Generating Development

Table 5.1.3 of the Hornsby Shire Council’s *Policy and Guidelines for Noise and Vibration Generating Development* references the NSW Environmental Criteria for Road Traffic Noise for traffic noise criteria for hospital wards. This is presented in the table below.

Table 14 – Traffic Noise Criteria from NSW Environmental Criteria for Road Traffic Noise

Sensitive Land Use	Criteria	
	Day (7am-10pm) dB(A)	Night (10pm-7am) dB(A)
Hospital Wards	L _{Aeq} (1hour) 35 (internal)	L _{Aeq} (1hour) 35 (internal)

7.1.2 NSW Health Infrastructure Engineering Services Guidelines

7.1.2.1 Continuous Noise Sources

Table 12 of the NSW Health Infrastructure Engineering Services Guidelines (July 2017) presents internal noise criteria for hospitals with respect to continuous/steady-state noise sources (such as traffic noise impacts). The criteria is presented in the table below:

Table 15 – Health Infrastructure Engineering Services Guidelines Internal Noise Criteria

Area Designation	Continuous Internal Noise Levels dB(A) _{L_{eq}}	
	Satisfactory	Maximum
Corridors and Lobby Spaces	40	45
Intensive Care	40	45
Patient Wards	35	40
Consultation/Interview Rooms	40	45
Treatment/Medication/Examination Room	40	45
Waiting Rooms, Reception Areas	45	50
Cafeterias/Dining	45	50
Meeting Room	35	40
Board/Conference Room	30	35
Open Plan Offices	40	45
Private Offices	35	40
Laboratories	45	50
Toilet/Ensuite	50	55

7.1.3 Australian Standard AS2107:2016

The Australian Standards recommends internal design sound levels for different areas of health buildings depending on the use of the space.

The recommended internal noise criteria are presented in the table below and will also be used to develop internal noise criteria for traffic noise impacts:

Table 16 – AS2107:2016 Internal Noise Criteria

Space/Activity Type	Design Sound Level Range dB(A) L_{eq}
Emergency Areas	40-45
Cafeterias	40-50
Corridors and Lobby Spaces	< 50
Consulting Rooms	40-45
Dining Areas	40-45
Intensive Care Wards	40-45
Laboratories	40-50
Office areas	35-45
Surgeries/Treatment/Procedure Rooms	40-45
Wards	35-40
Waiting Rooms, Reception Areas	40-50

7.1.4 NSW Department of Planning's Development Near Rail Corridors and Busy Roads – Interim Guideline 2008

Table 3.1 of the NSW Department of Planning's *Development Near Rail Corridors and Busy Roads – Interim Guideline 2008* outlines the following internal noise criteria for hospitals.

Table 17 – NSW Department of Planning's Development Near Rail Corridors and Busy Roads (Interim Guideline) Internal Noise Criteria

Space	Recommended Max Level dB(A)
Wards	35
Other Noise Sensitive Areas	45

7.1.5 Summarised Internal Noise Criteria

Based on the criteria listed above, the summarised internal noise criteria to be adopted for the development from external noise impacts is presented in the table below.

Table 18 – Project Internal Noise Criteria from External Noise Impacts

Space/Activity Type	Internal Noise Goal dB(A)_{Leq(1 hour)}
Emergency Areas	40
Cafeterias	45
Corridors and Lobby Spaces	45
Consulting/Interview Rooms	40
Dining Areas	45
Intensive Care Wards	40
Laboratories	45
Meeting Room	40
Board/Conference Room	35
Open Plan Offices	45
Private Offices	40
Surgeries/Treatment/Procedure Rooms	40
Wards	35
Waiting Rooms, Reception Areas	45
Toilet/Ensuite	50

7.2 TRAFFIC NOISE MEASUREMENTS

Traffic noise impacts on the site have been determined by means of attended noise measurements conducted around the site as detailed in Figure 1 above.

Attended measurements were obtained using a Norsonics Type 140 Sound Level Analyser. The Sound Level Analyser was calibrated at the beginning and the end of the measurement using a Norsonics Type 1251 Sound Level Calibrator. No significant drift was noted. All measurements were conducted on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period.

Traffic noise measurements were conducted on 31st May 2017 between 4pm and 6pm (afternoon peak hour) and are presented in the table below.

Table 19 - Measured Traffic Noise Levels

Location	Time Period	Measured Noise Level dB(A)_{Leq(1 hour)}
Along Burdett Street – 4m from kerb	4pm – 6pm	60
Along Palmerston Road – 4m from kerb	4pm – 6pm	59
Along Derby Street – 4m from kerb	4pm – 6pm	52

7.3 RECOMMENDATIONS

External noise intrusion into the proposed development (primarily traffic noise) is assessed using the measured external noise levels reported in section 7.1 as a basis. Internal noise levels will primarily be as a result of noise transfer through the windows as these are relatively light building elements that offer less resistance to the transmission of sound. Noise transfer through masonry elements will not be significant and need not be considered further.

The following constructions are recommended to comply with the noise objectives outlined in section 7.1.

7.3.1 Glazed Windows and Doors

The recommended glazing constructions for this project are listed in the table below. Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

Table 20 - Recommended Glazing Constructions

Facade	Level	Space	Glazing Thickness	Acoustic seals
North	0	All	6.38mm laminated	Yes
	1	Patient Bays, Occupational Therapy Rooms, Gymnasium Group Treatment, Consult Rooms	10.38mm laminated	
		Remaining	6.38mm laminated	
	2	Bedroom Wards and Consult Rooms	10.38mm laminated	
		Remaining	6.38mm laminated	
	3	Bedrooms Wards and OT Therapy Room	10.38mm laminated	
		Remaining	6.38mm laminated	
	4	Bedroom Wards and Lounges	10.38mm laminated	
		Remaining	6.38mm laminated	
	5	All	10.38mm laminated	
West	1-4	All	6.38mm laminated	
	5	All	10.38mm laminated	
East	1	All	6.38mm laminated	
	2	Bedroom Wards	10.38mm laminated	
		Ensuites, Meeting Rooms and Offices	6.38mm laminated	
	3	Independent Assessment Rooms	10.38mm laminated	
		Remaining	6.38mm laminated	
	4	Bedroom Wards, Allied Health Assessment Area	10.38mm laminated	
		Remaining	6.38mm laminated	
	5	All	10.38mm laminated	

*If double glazed units are to be used, the corresponding double glazed units are as follows:

- 12.38mm laminated/12mm air gap/6mm float = 12.38mm laminated
- 10.38mm laminated/12mm air gap/6mm float = 10.38mm laminated
- 6.38mm laminated/12mm air gap/6mm float = 6.38mm laminated

Table 20 - Recommended Glazing Constructions (continued)

Facade	Level	Space	Glazing Thickness	Acoustic seals
South	1	Bedroom Wards	10.38mm laminated	Yes
		Ensuites and Staff Rooms	6.38mm laminated	
	2	Bedroom Wards and Patient Bays	10.38mm laminated	
		Remaining	6.38mm laminated	
	3	Bedroom Wards	10.38mm laminated	
		Remaining	6.38mm laminated	
	4	Bedroom Wards	10.38mm laminated	
		Remaining	6.38mm laminated	
	5	All	10.38mm laminated	
Central Courtyard	1	Consult Rooms	12.38mm laminated	
		Bedroom Wards	10.38mm laminated	
		Bedroom Ward Ensuites	6.38mm laminated	
		Corridors	6.38mm laminated	
	2	Patient Bays, ECG Room, ECG Stress Testing Room, Echo Room	12.38mm laminated	
		Remaining	10.38mm laminated	
	3	Bedroom Wards	12.38mm laminated	
		Ensuites	10.38mm laminated	
		Remaining	6.38mm laminated	
	4	Bedroom Wards and Consult Room	12.38mm laminated	
		Lounge	10.38mm laminated	
		Interview Room	12.38mm laminated	
		Remaining	6.38mm laminated	
	5	All	10.38mm laminated	

*If double glazed units are to be used, the corresponding double glazed units are as follows:

- 12.38mm laminated/12mm air gap/6mm float = 12.38mm laminated
- 10.38mm laminated/12mm air gap/6mm float = 10.38mm laminated
- 6.38mm laminated/12mm air gap/6mm float = 6.38mm laminated

In addition to complying with the minimum scheduled glazing thickness, the STC/R_w rating of the glazing fitted into operable frames and fixed into the building opening should not be lower than the values listed in the table below in all areas. Where nominated, this will require the use of acoustic seals around the full perimeter of operable frames and the frame will need to be sealed into the building opening using a flexible sealant. **Note that mohair seals in windows and doors are not acceptable where acoustic seals are required.** The proposed suppliers should provide evidence that the window systems proposed have been tested in a registered laboratory with the recommended glass thicknesses and comply with the minimum STC/R_w requirements listed in table below, and that they will be constructed and installed in a manner equal to the test samples.

Table 21 – Minimum STC/R_w of Glazing

Glazing Assembly	Acoustic Seals	Minimum STC/R _w of Installed Window
12.38mm laminated OR 12.38mm laminated/12mm air gap/6mm float	Yes	37
10.38mm laminated OR 10.38mm laminated/12mm air gap/6mm float	Yes	35
6.38mm laminated OR 6.38mm laminated/12mm air gap/6mm float	Yes	31

7.3.2 Roof / Ceiling Construction

The proposed concrete roof for the development will be acoustically acceptable and will not require any additional treatment.

7.3.3 External Walls

There should not be vents on the internal skin of external walls. All penetrations in the internal skin of external walls should be acoustically sealed with a flexible sealant.

7.3.3.1 Masonry External Walls

Any proposed masonry external wall construction will be acoustically acceptable and will not require any additional treatment.

7.3.3.2 Lightweight External Walls

The recommended constructions for lightweight external walls are presented below:

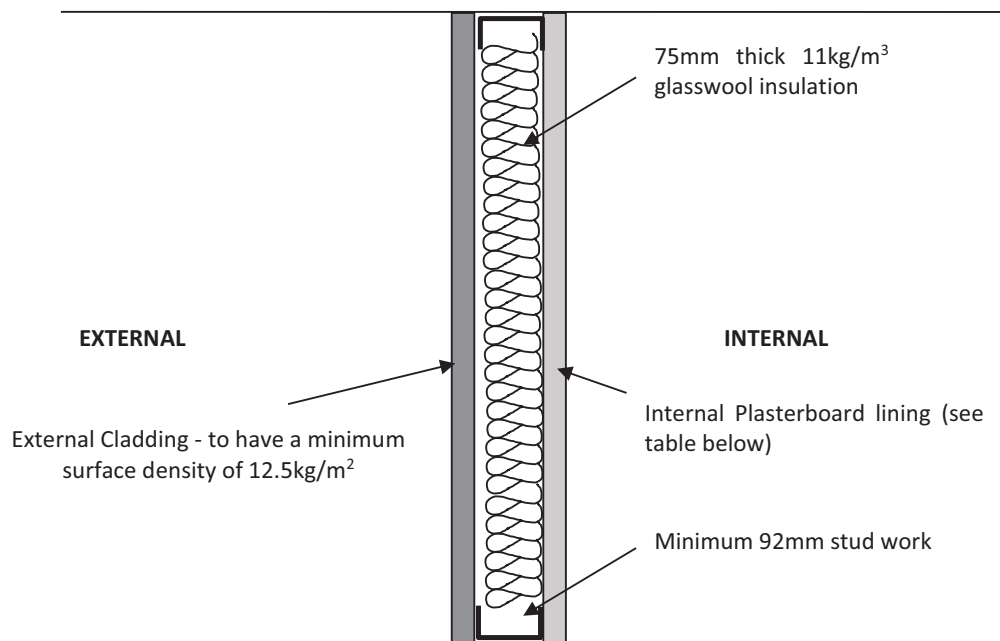


Table 22 – Lightweight External Wall Construction

Facade	Level	Space	Internal Plasterboard Lining Requirement
North	0	All	1 x 13mm plasterboard
	1	All	1 x 13mm plasterboard
	2	Consult Rooms	2 x 13mm plasterboard
		Remaining	1 x 13mm plasterboard
	3-5	All	1 x 13mm plasterboard
West	1-5	All	1 x 13mm plasterboard
East	1-5	All	1 x 13mm plasterboard
South	1	All	1 x 13mm plasterboard
	2	Patient Bays	2 x 13mm plasterboard
		Remaining	1 x 13mm plasterboard
	3	All	1 x 13mm plasterboard
	4	Bedrooms Wards	2 x 13mm plasterboard
		Remaining	1 x 13mm plasterboard
	5	All	1 x 13mm plasterboard
Central Courtyard	1	All	1 x 13mm plasterboard
	2	Patient Bays, ECG Room, ECG Stress Testing Room, Echo Room	2 x 13mm plasterboard
		Remaining	1 x 13mm plasterboard
	3	Bedroom Wards	2 x 13mm plasterboard
		Remaining	1 x 13mm plasterboard
	4	Bedrooms, Interview and Consult Room	2 x 13mm plasterboard
		Remaining	1 x 13mm plasterboard
	5	All	1 x 13mm plasterboard

8 CONCLUSION

Potential noise and vibration impacts associated with the Stage 2 redevelopment at the Hornsby Ku-ring-gai Hospital have been assessed in this report.

An analysis of typical operational noise (new ambulance bay, café, noise from existing generator, new proposed mechanical equipment) associated with the proposed hospital redevelopment indicates that the site is capable of complying with relevant noise emission criteria. Relevant acoustic treatments and management controls have been presented in Section 6.3 of this report.

Detailed acoustic review of mechanical plant should be undertaken once design is further progressed (plant selections finalised etc.). In-principal review indicates that acoustic treatment to any major plant items located externally is likely to be required (screens, in-duct attenuation and enclosures), however through appropriate treatment, noise emissions are capable of complying with EPA Industrial Noise Policy requirements.

Similarly, detailed noise management practices should be implemented for the control of construction noise and vibration. In principal acoustic review indicates that demolition, excavation and piling works have the potential to exceed EPA Interim Construction Noise Policy guidelines, particularly when working in areas near the property boundaries. Noise mitigation through work scheduling and equipment selection should be considered. This should be implemented via a Noise/Vibration Management Plan, which should be determined once a construction program is complete.

An assessment of external noise intrusion into the development (primarily traffic noise) has been carried out and recommended constructions for the building façade have been presented in section 7.3 in order to ensure compliance with the internal noise criteria outlined in section 7.1.

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

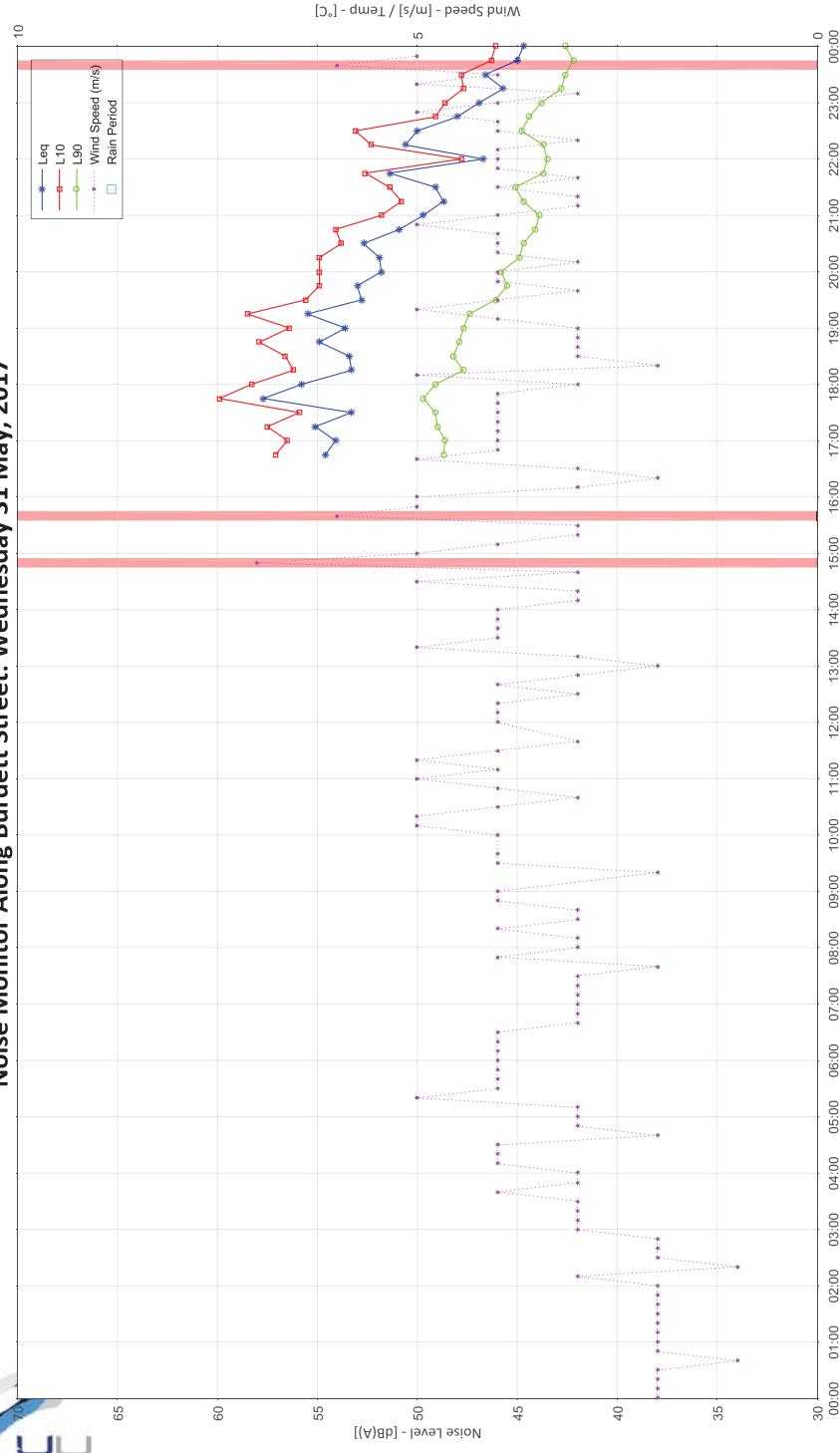
Yours faithfully,

A handwritten signature in black ink, appearing to read 'Justin Leong', with a stylized flourish underneath.

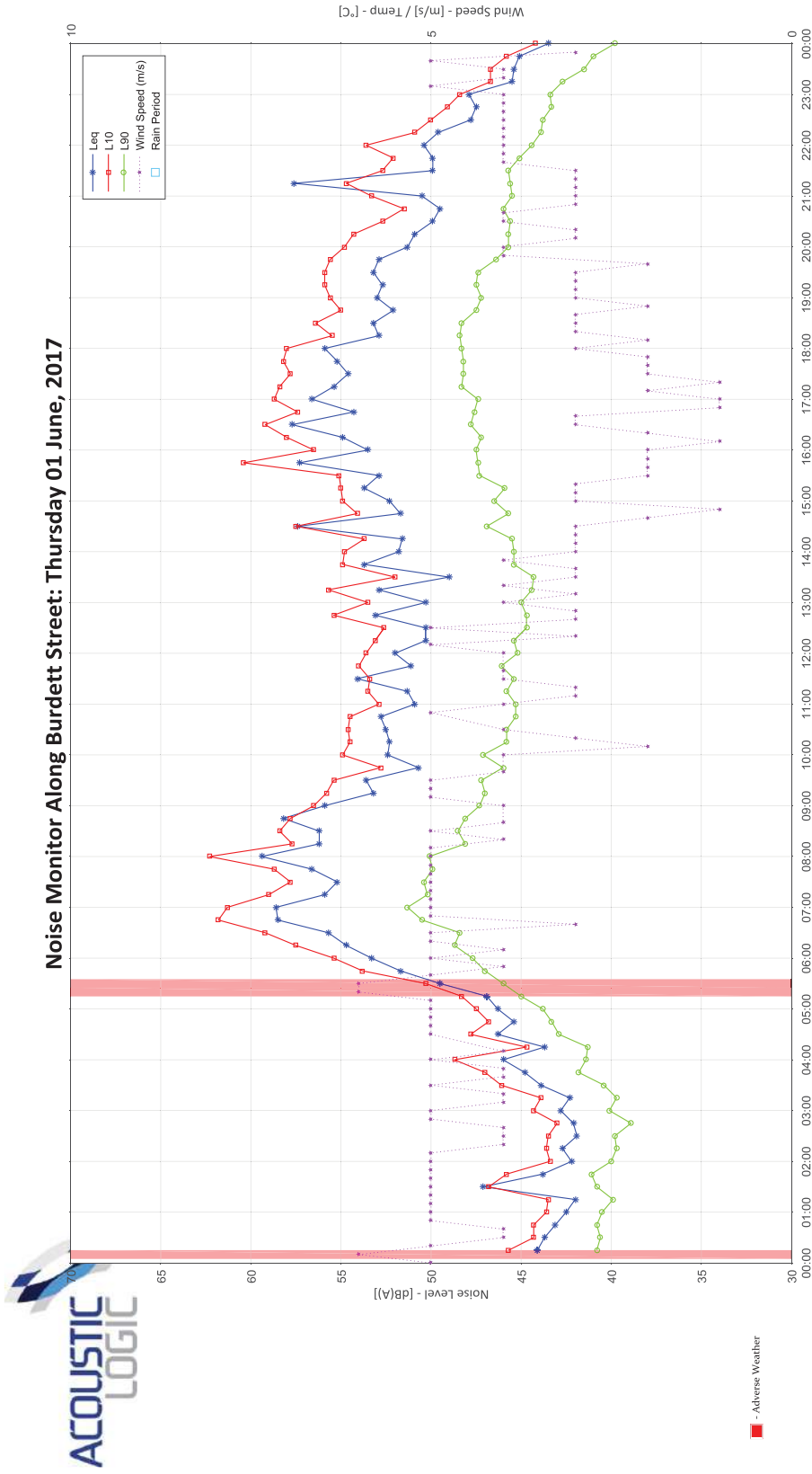
Acoustic Logic Consultancy Pty Ltd
Justin Leong

APPENDIX 1 – NOISE MONITORING ALONG BURDETT STREET

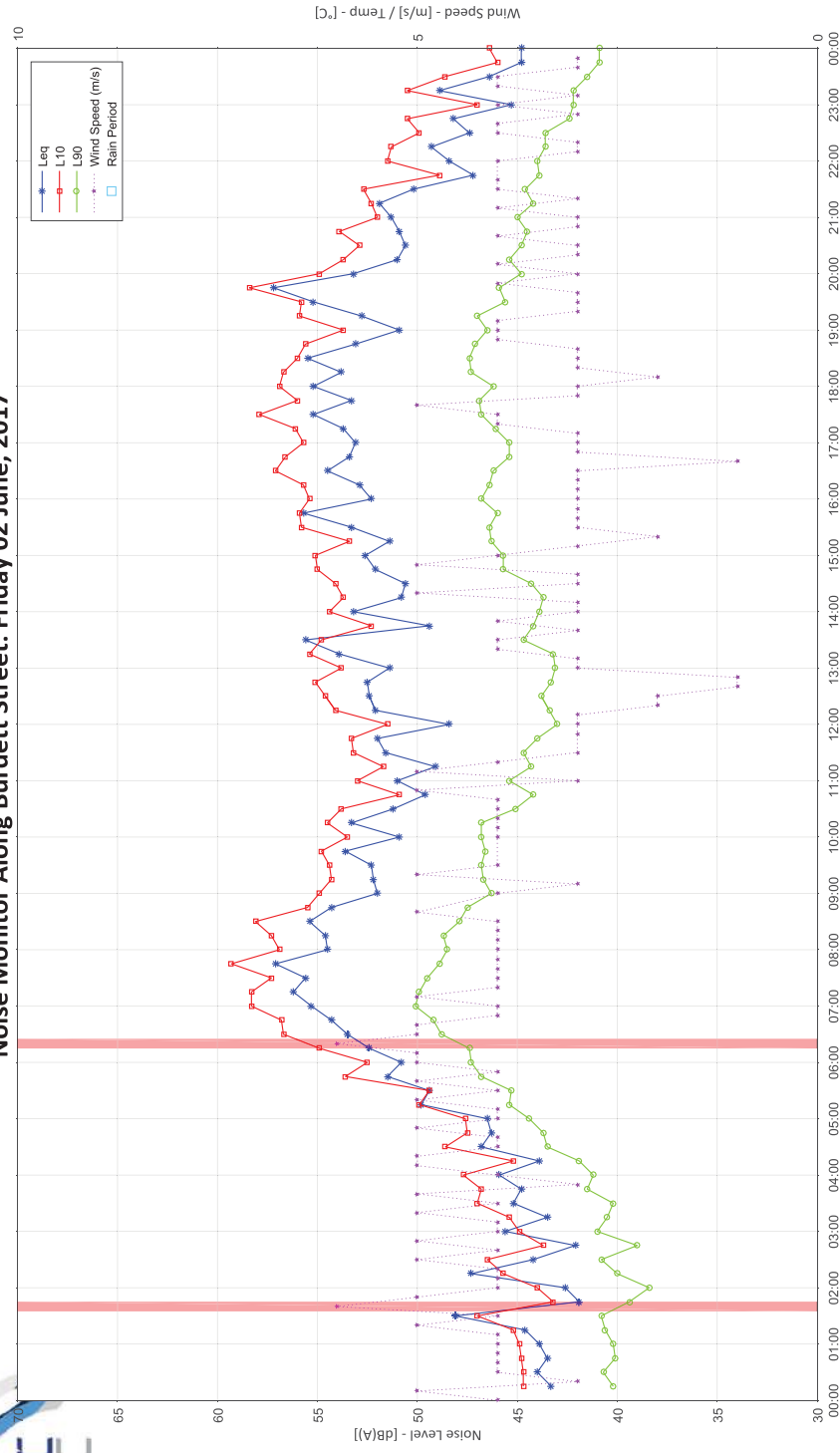
Noise Monitor Along Burdett Street: Wednesday 31 May, 2017



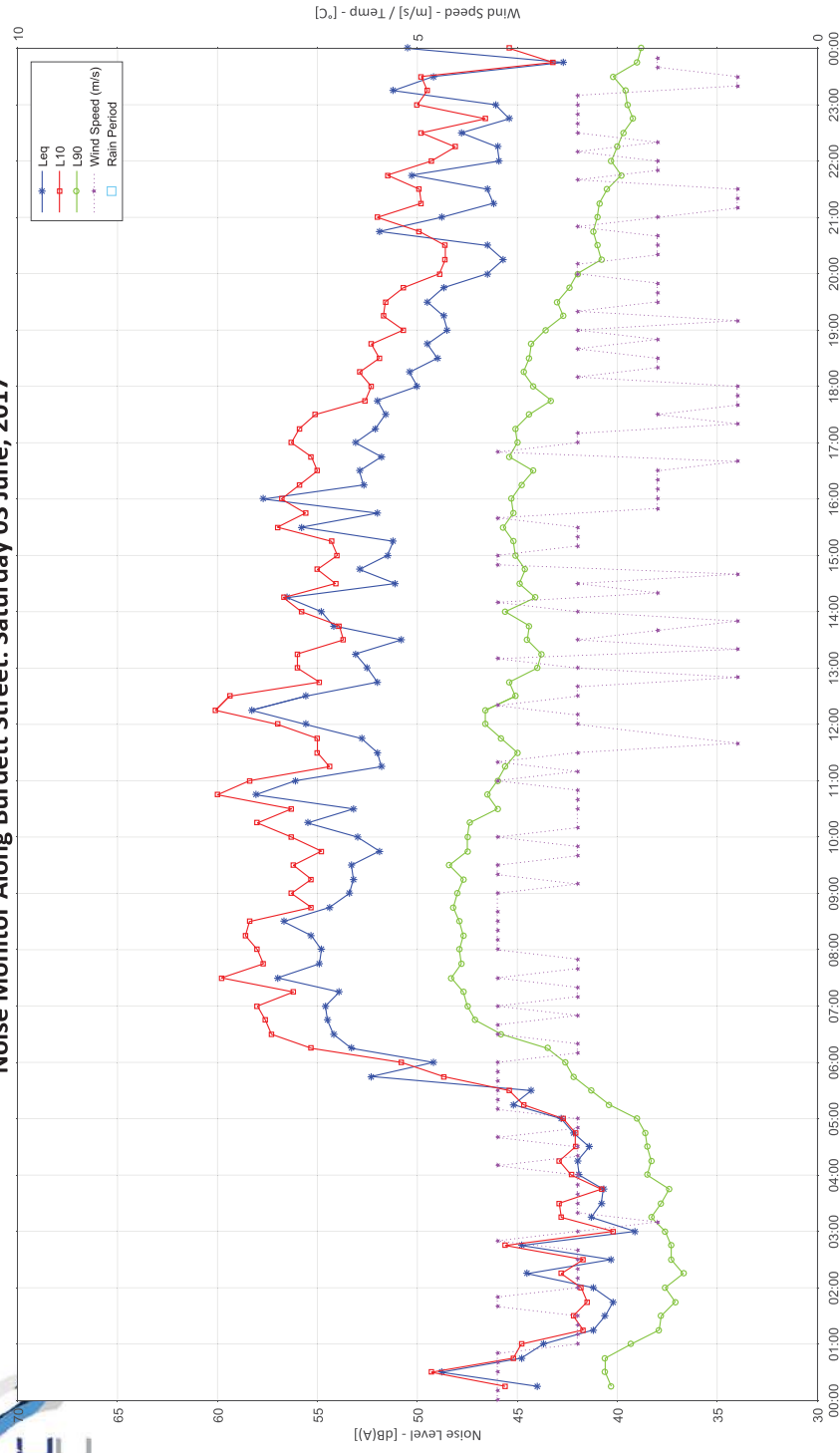
■ - Adverse Weather

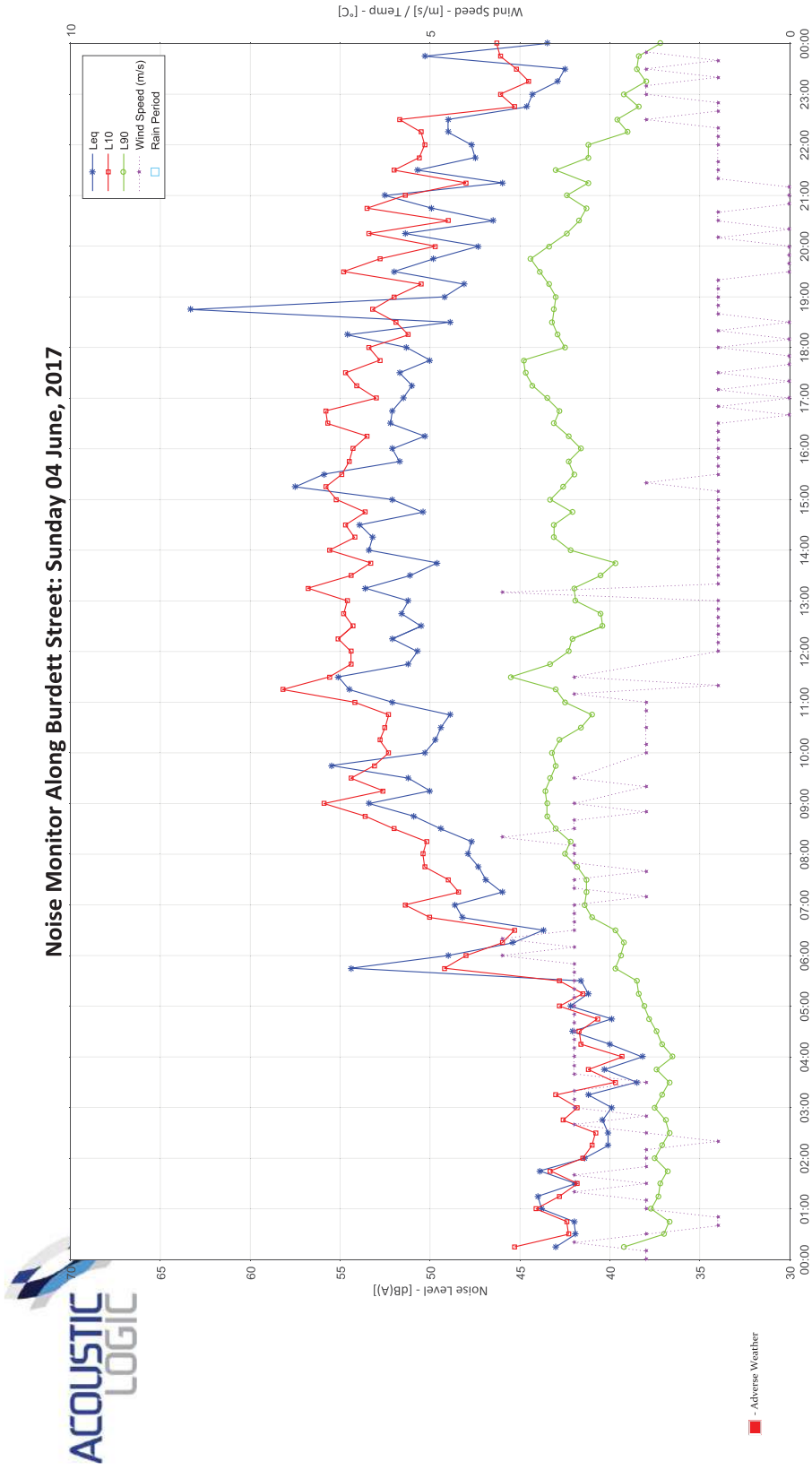


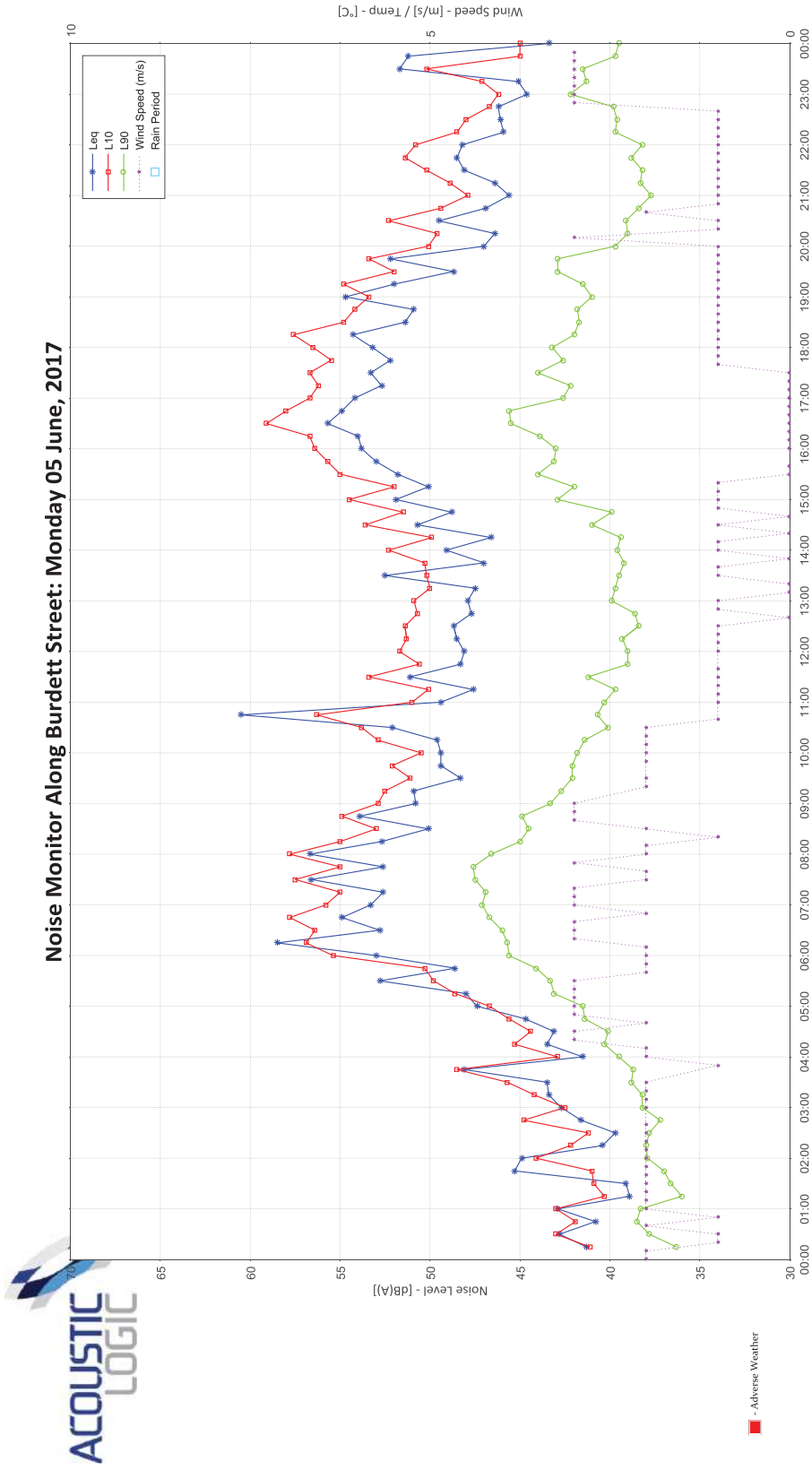
Noise Monitor Along Burdett Street: Friday 02 June, 2017



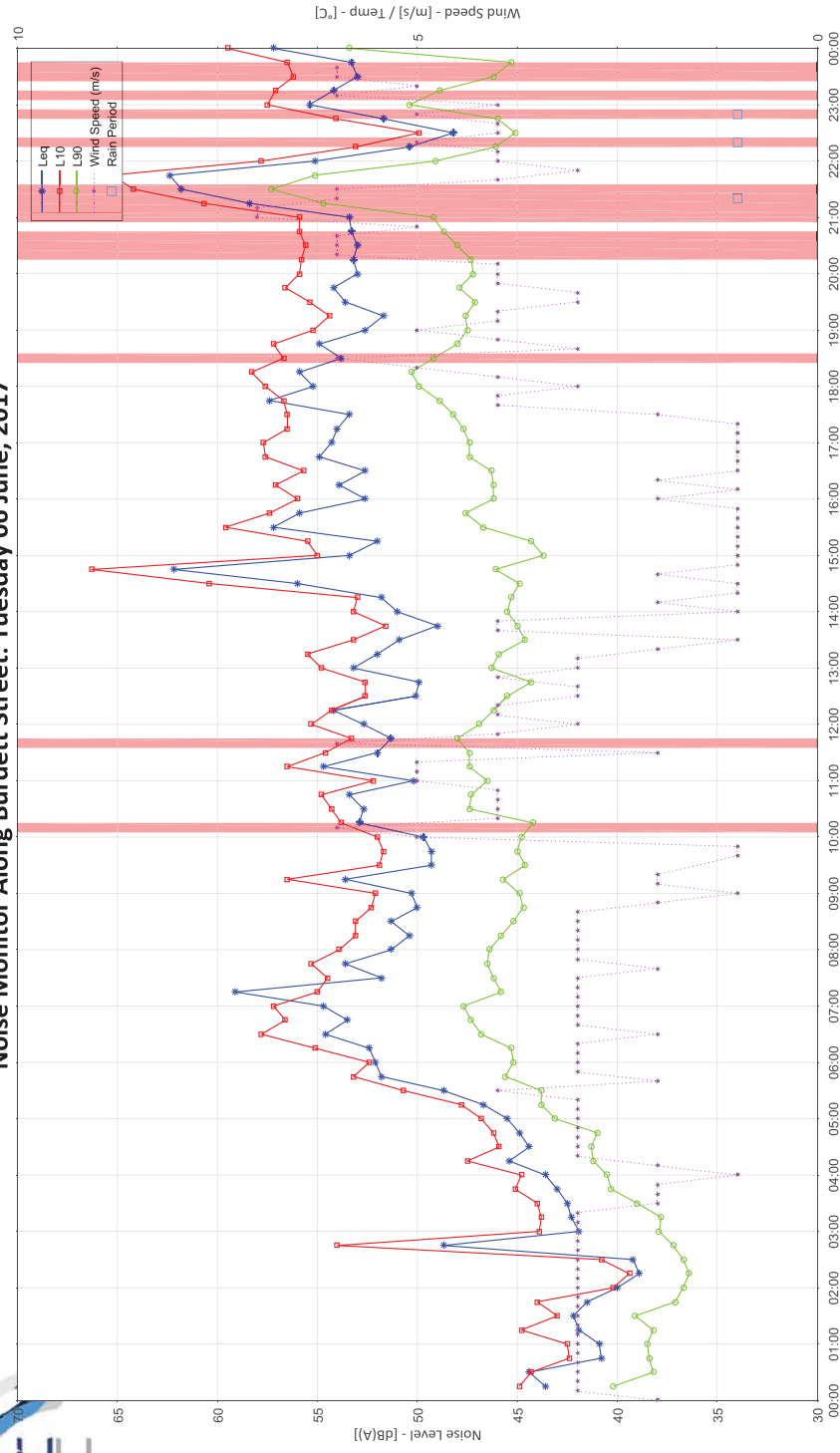
Noise Monitor Along Burdett Street: Saturday 03 June, 2017

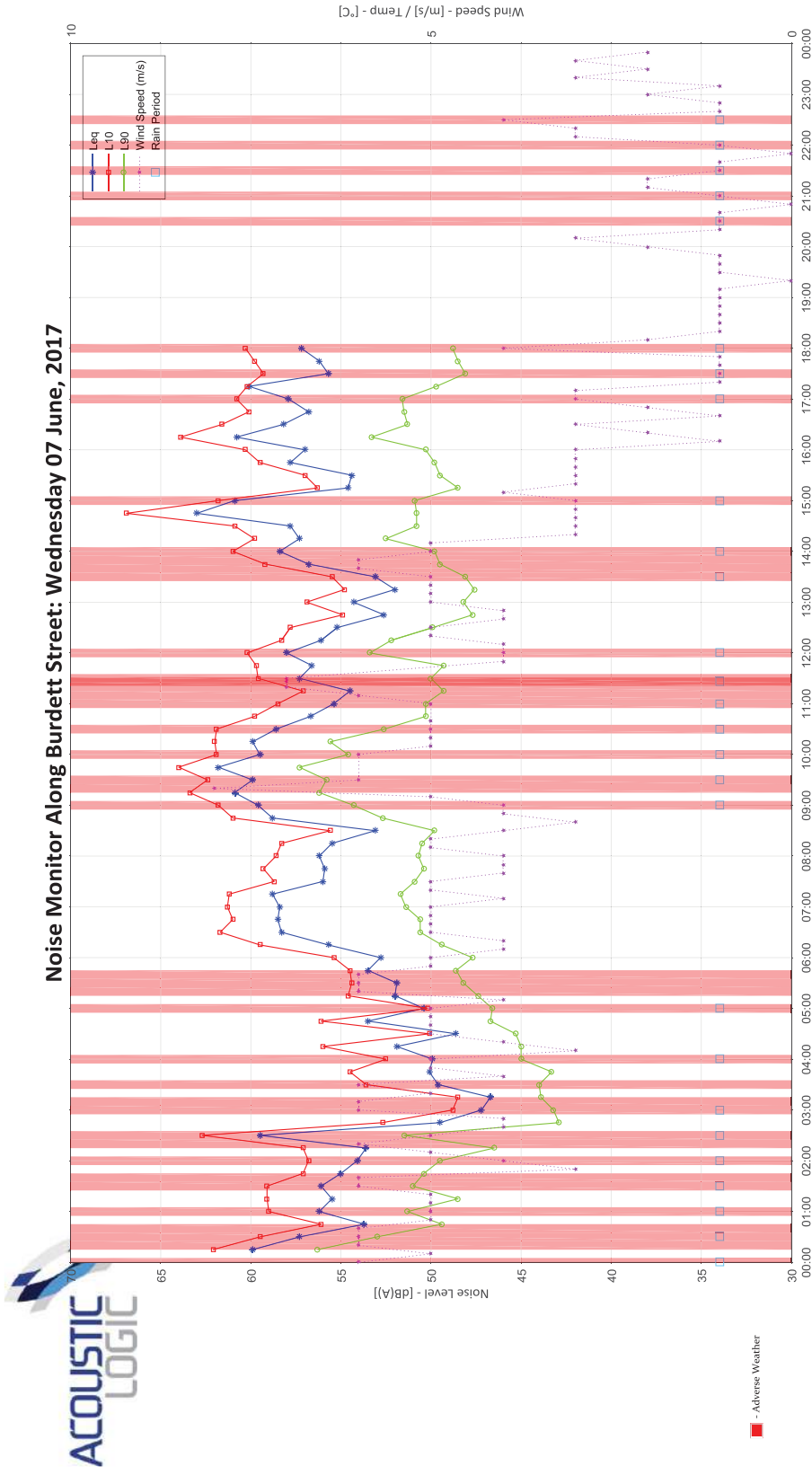






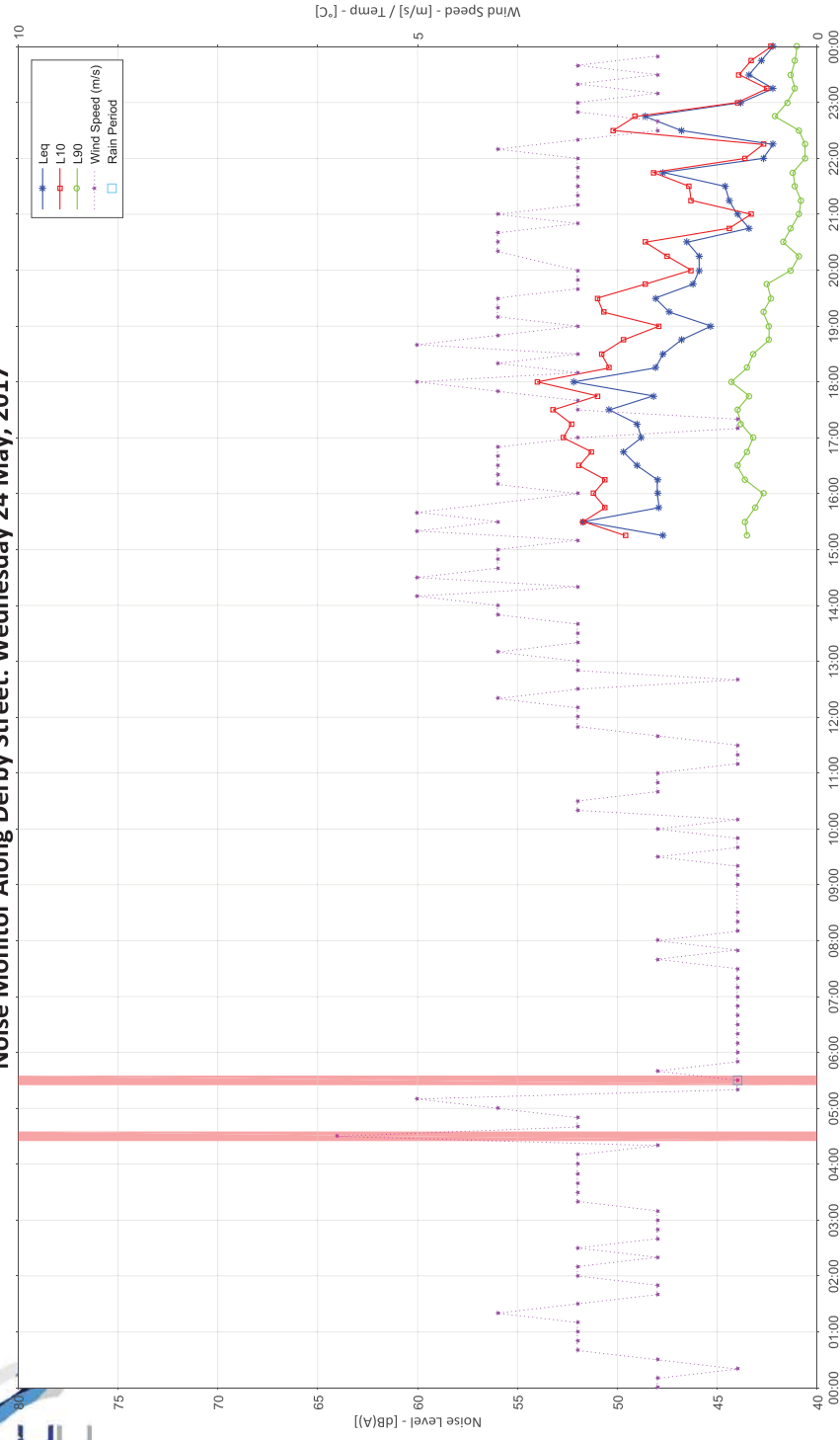
Noise Monitor Along Burdett Street: Tuesday 06 June, 2017

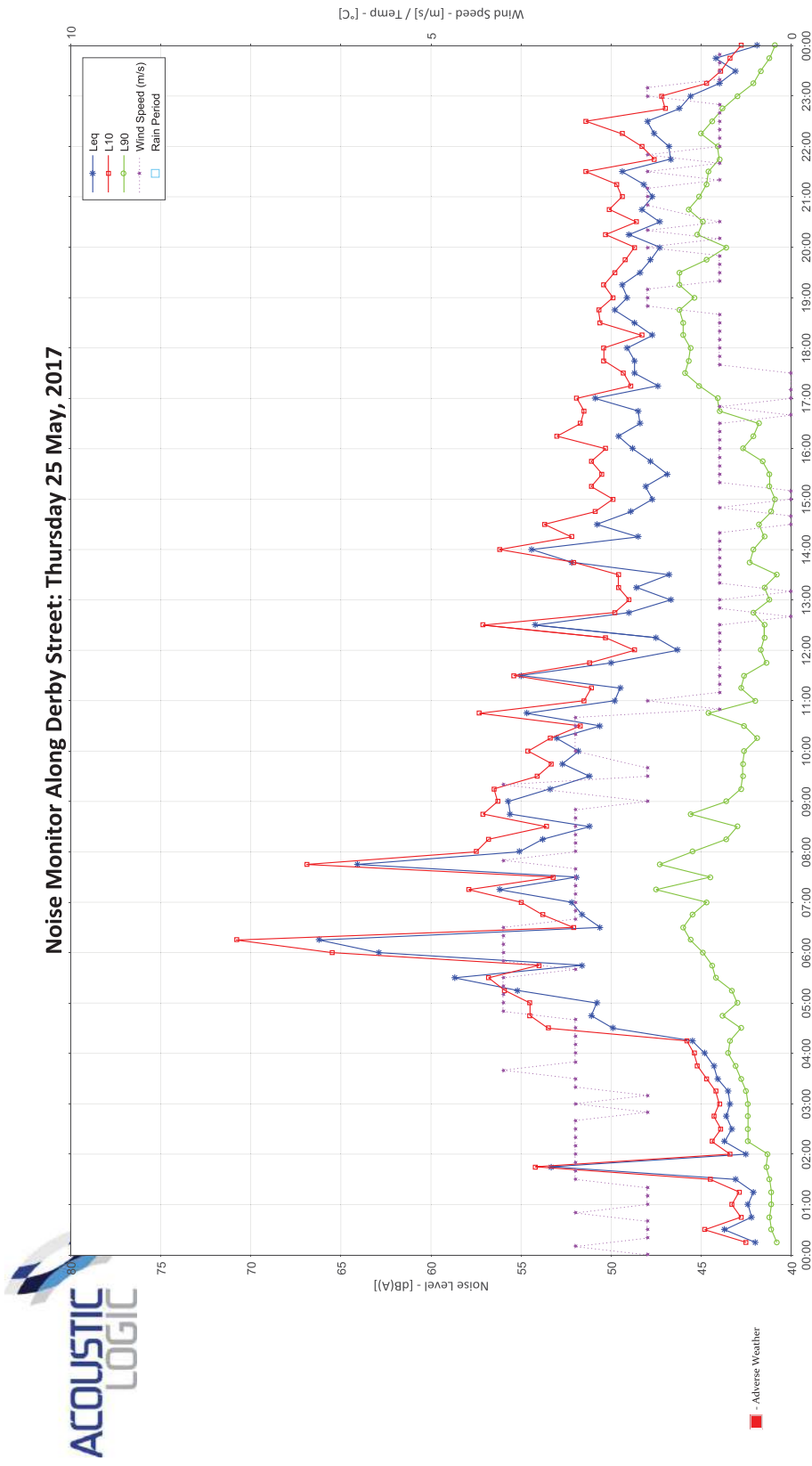


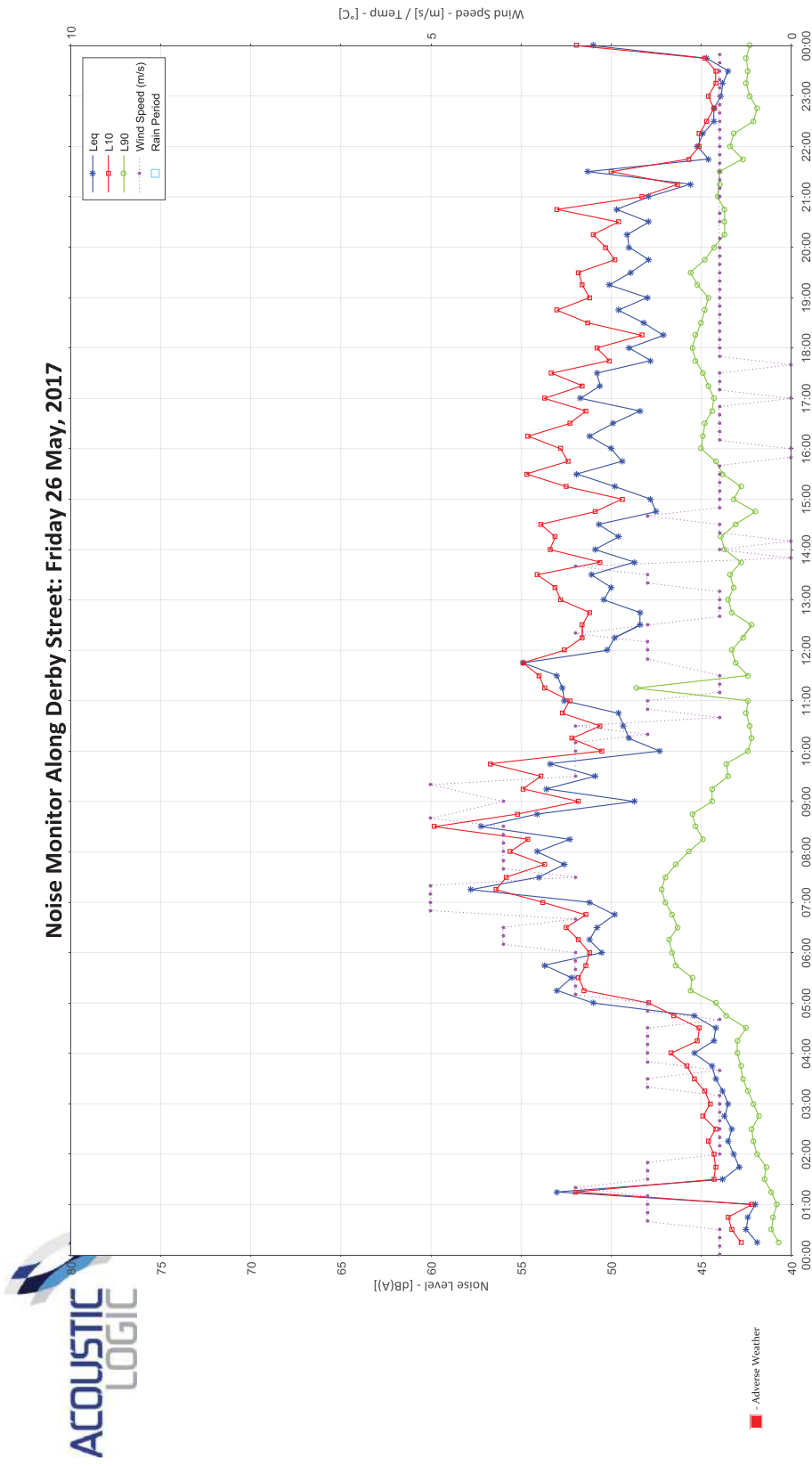


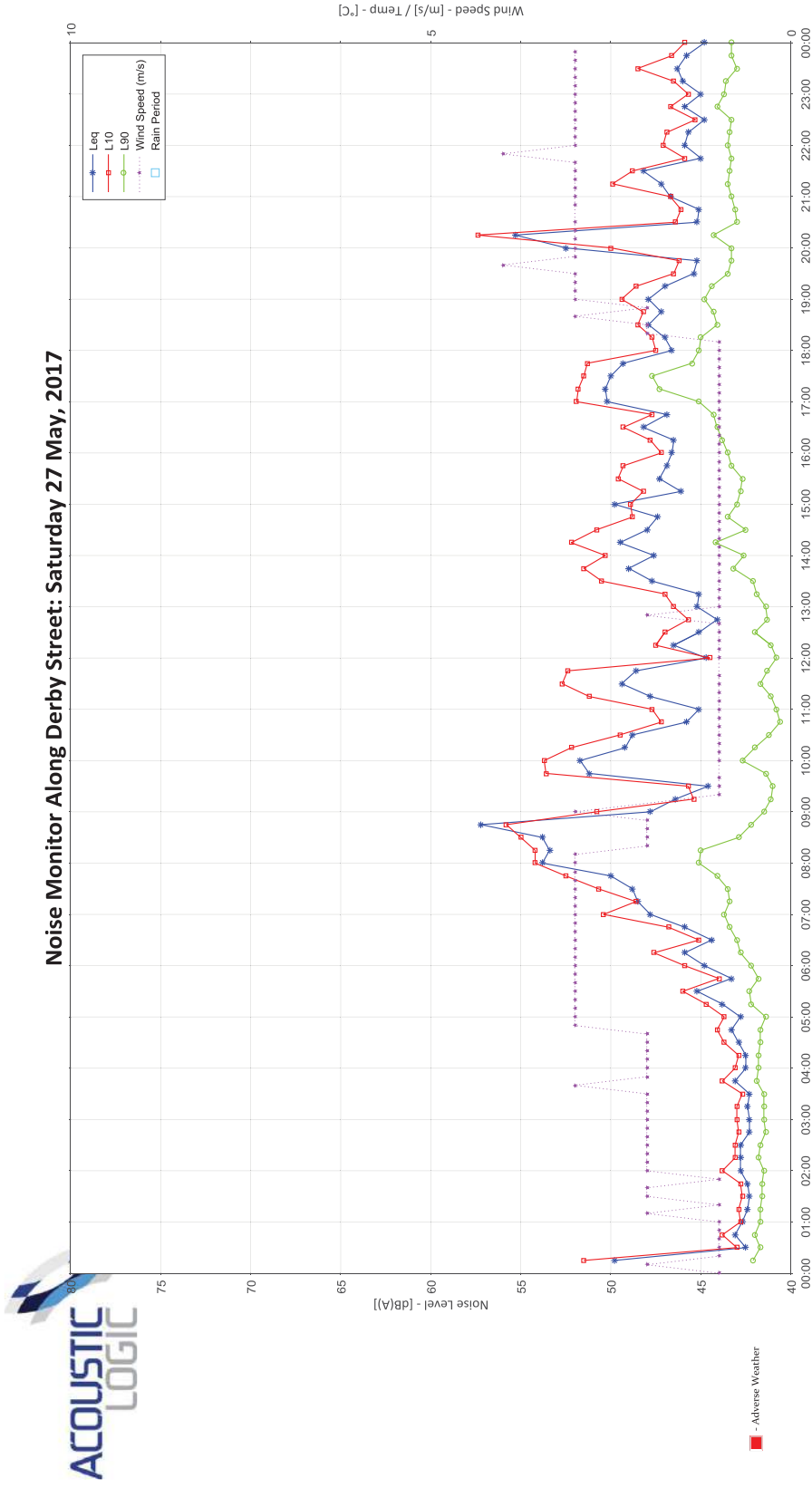
APPENDIX 2 – NOISE MONITORING ALONG DERBY STREET

Noise Monitor Along Derby Street: Wednesday 24 May, 2017

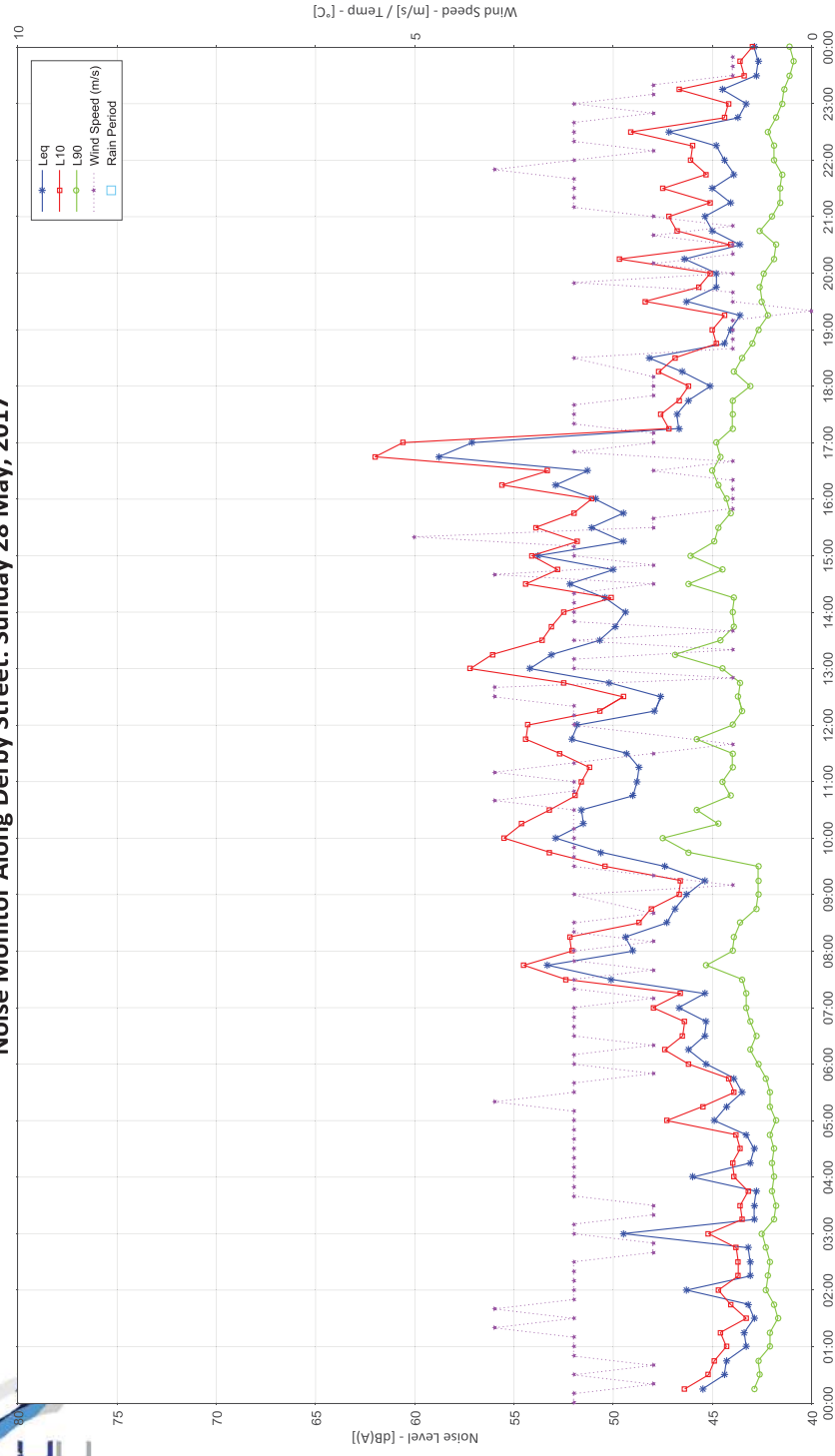


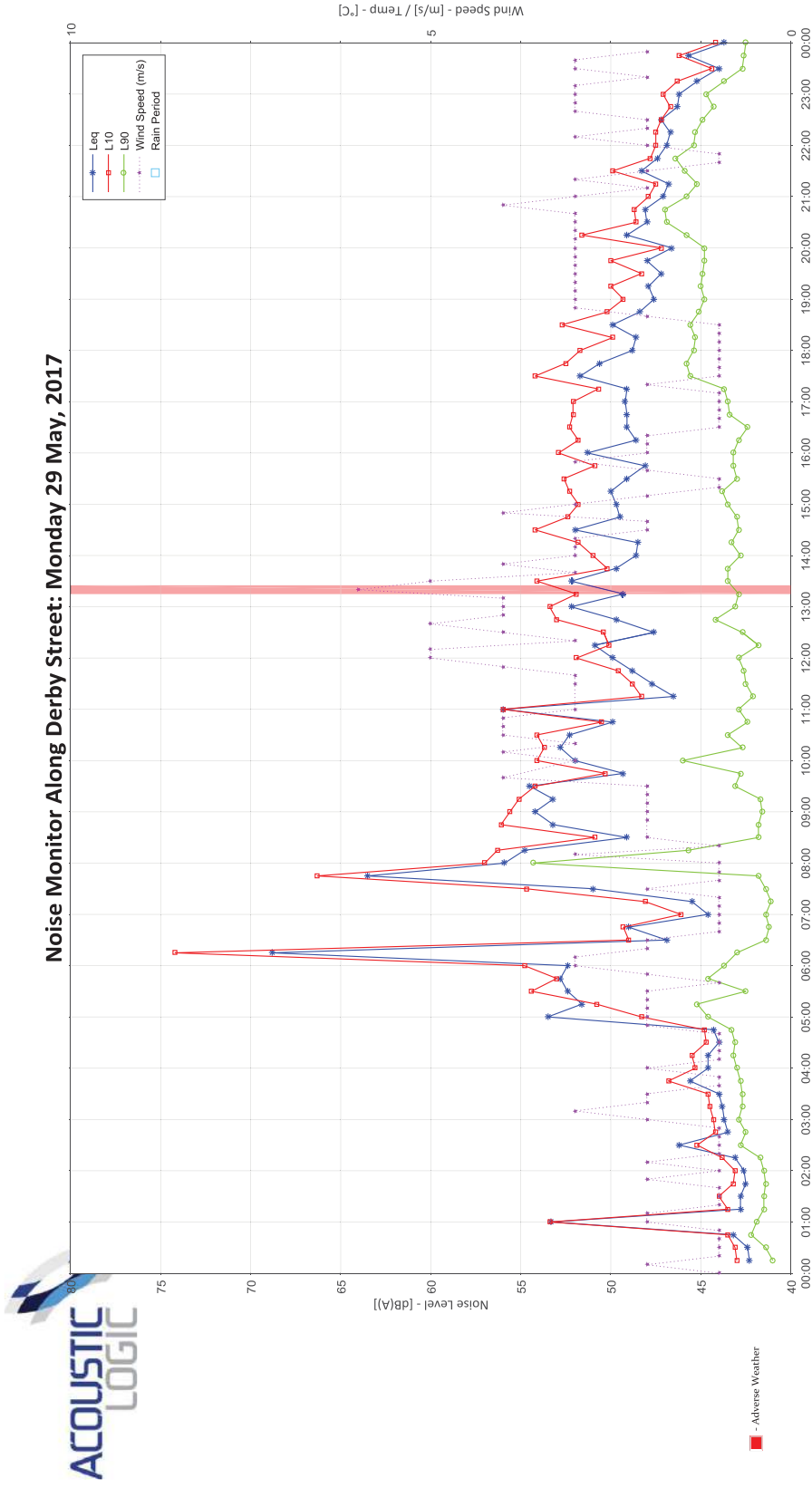


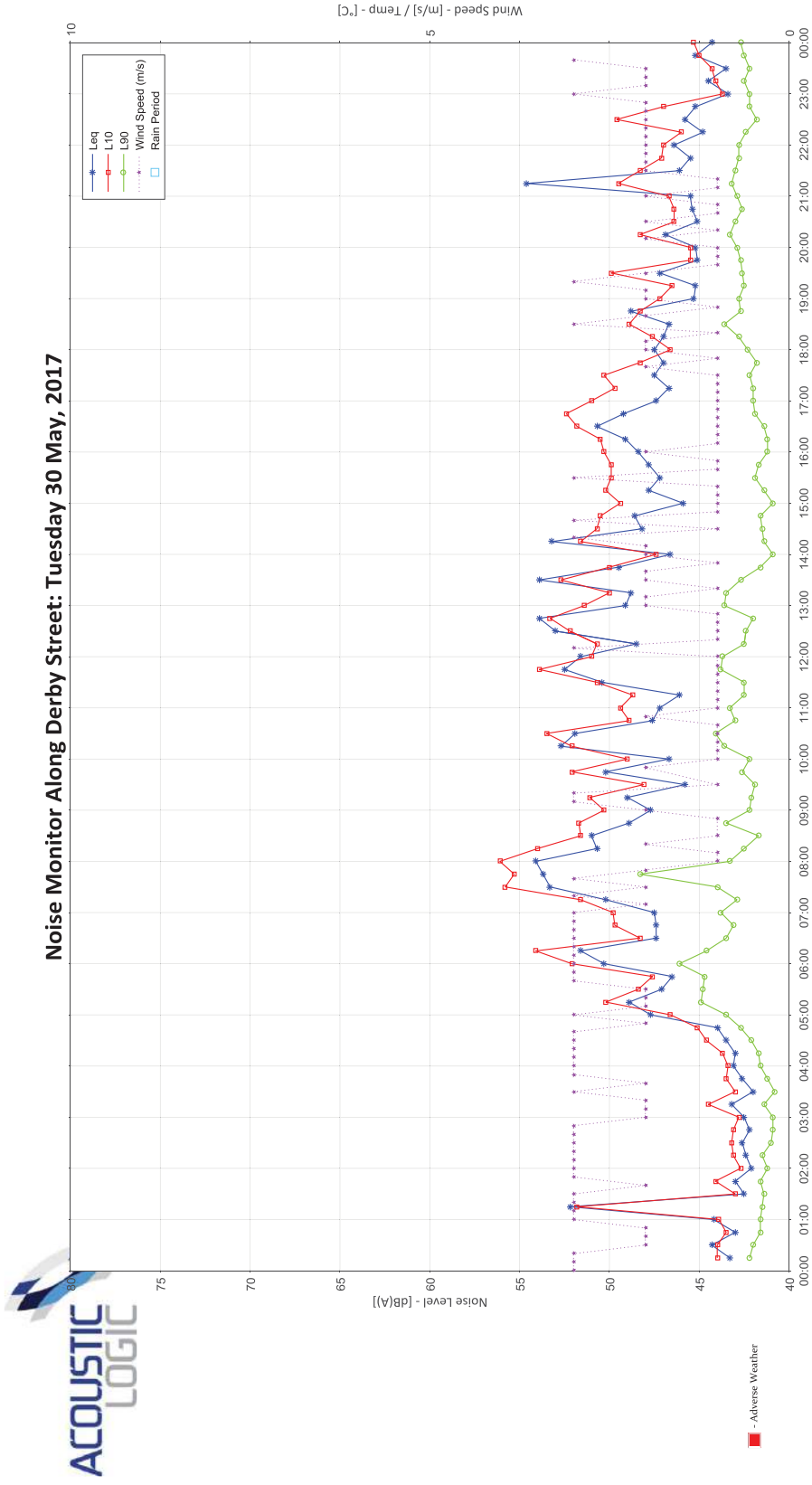




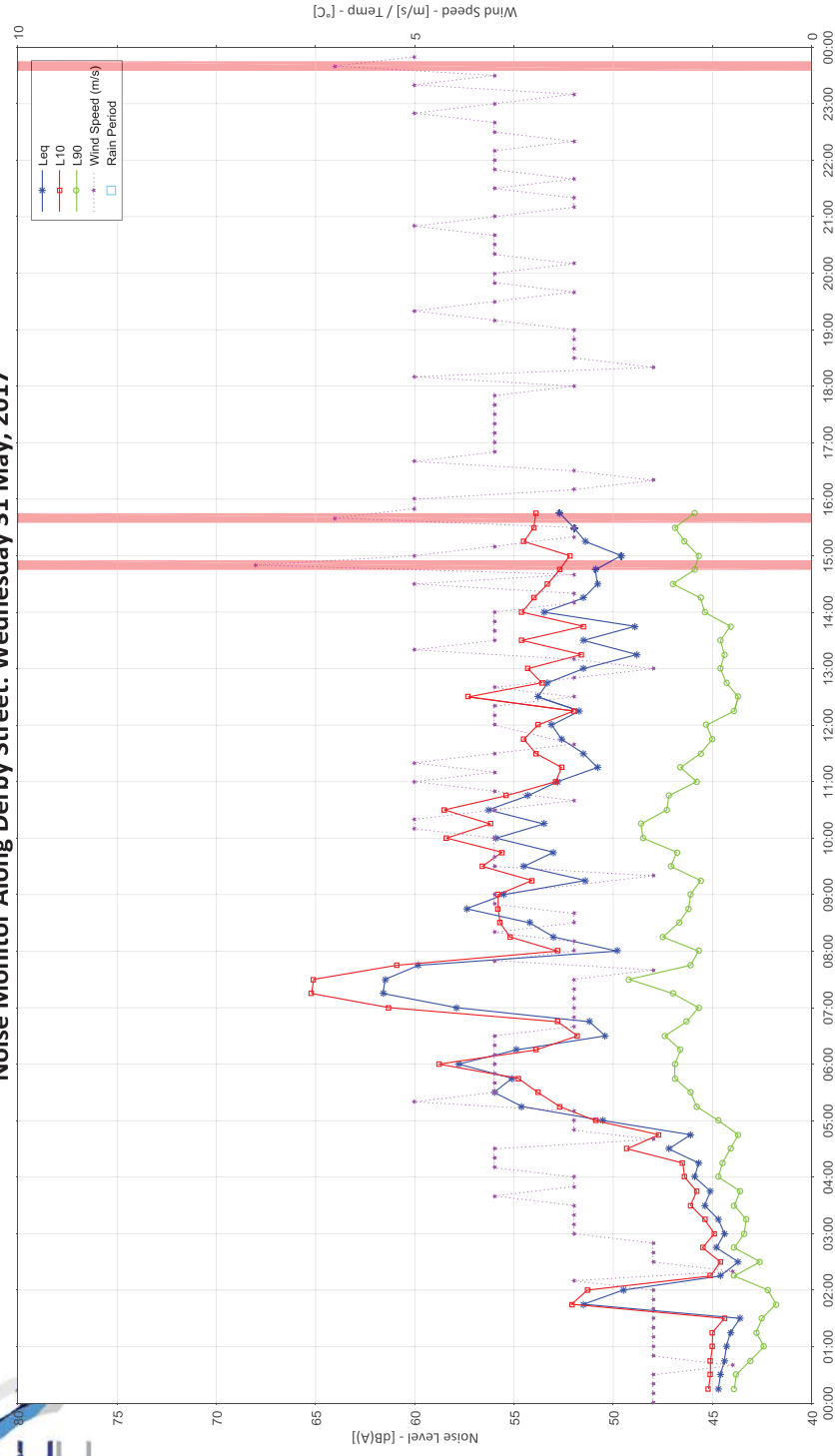
Noise Monitor Along Derby Street: Sunday 28 May, 2017







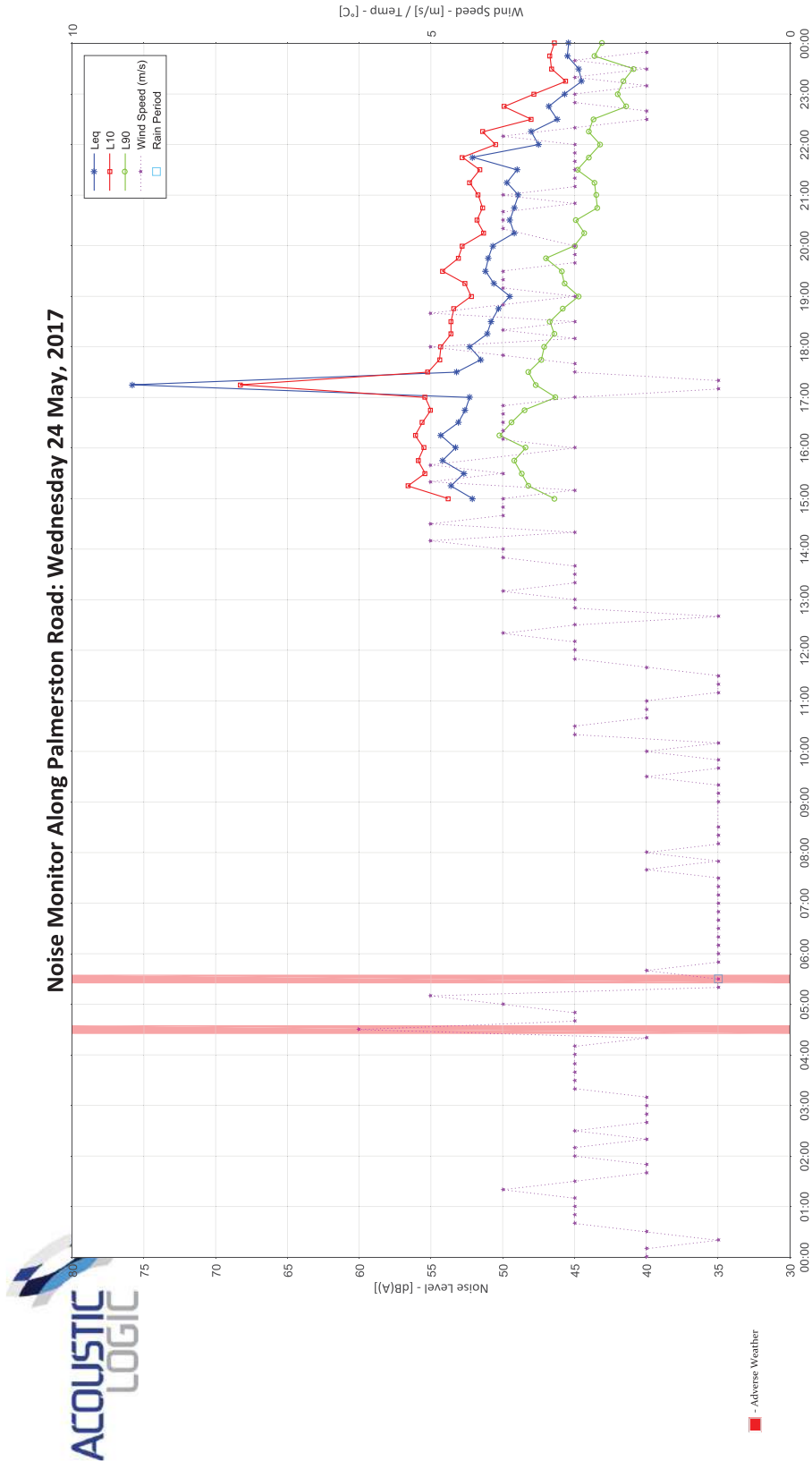
Noise Monitor Along Derby Street: Wednesday 31 May, 2017



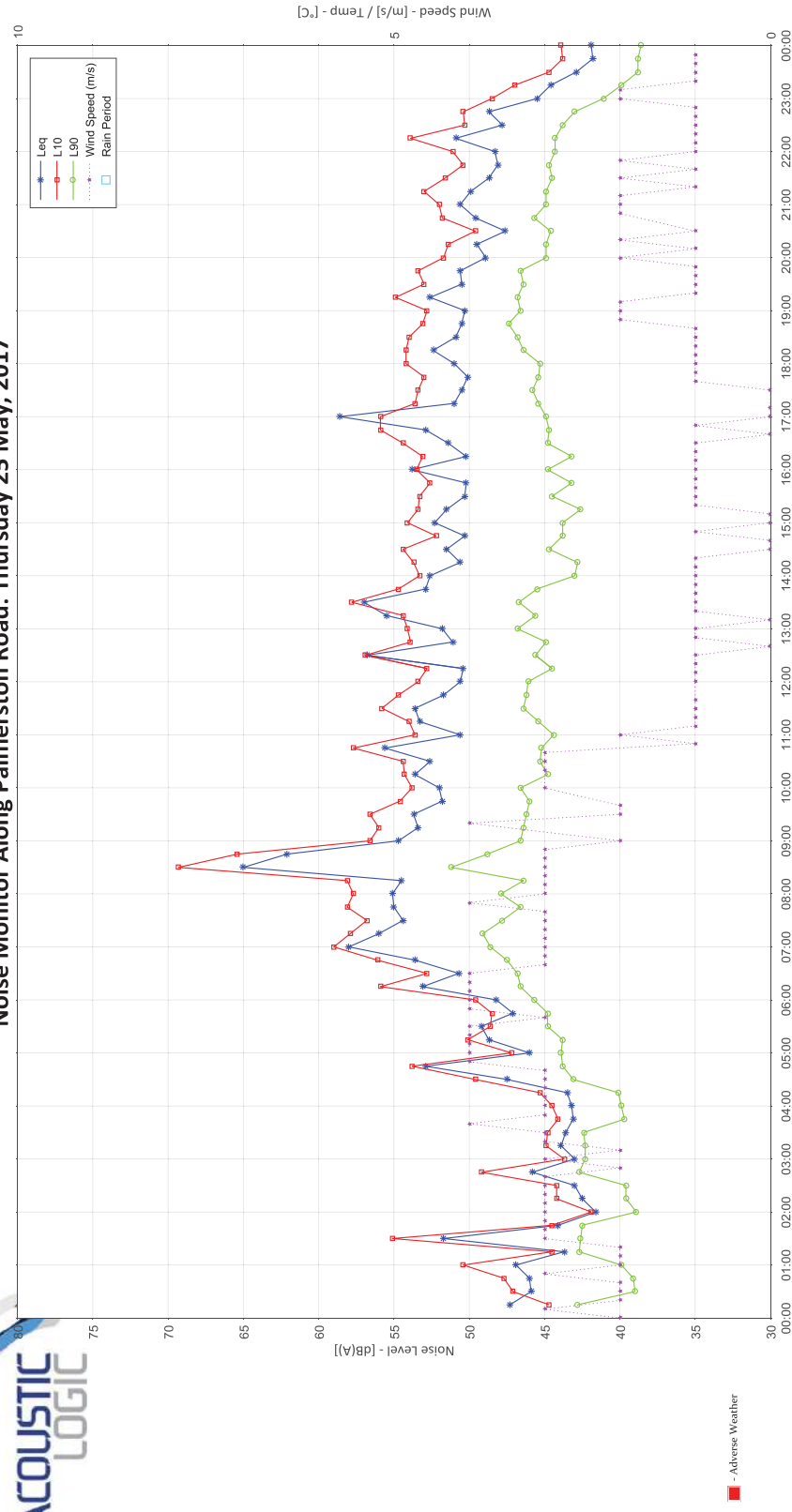
■ - Adverse Weather

APPENDIX 3 – NOISE MONITORING ALONG PALMERSTON ROAD

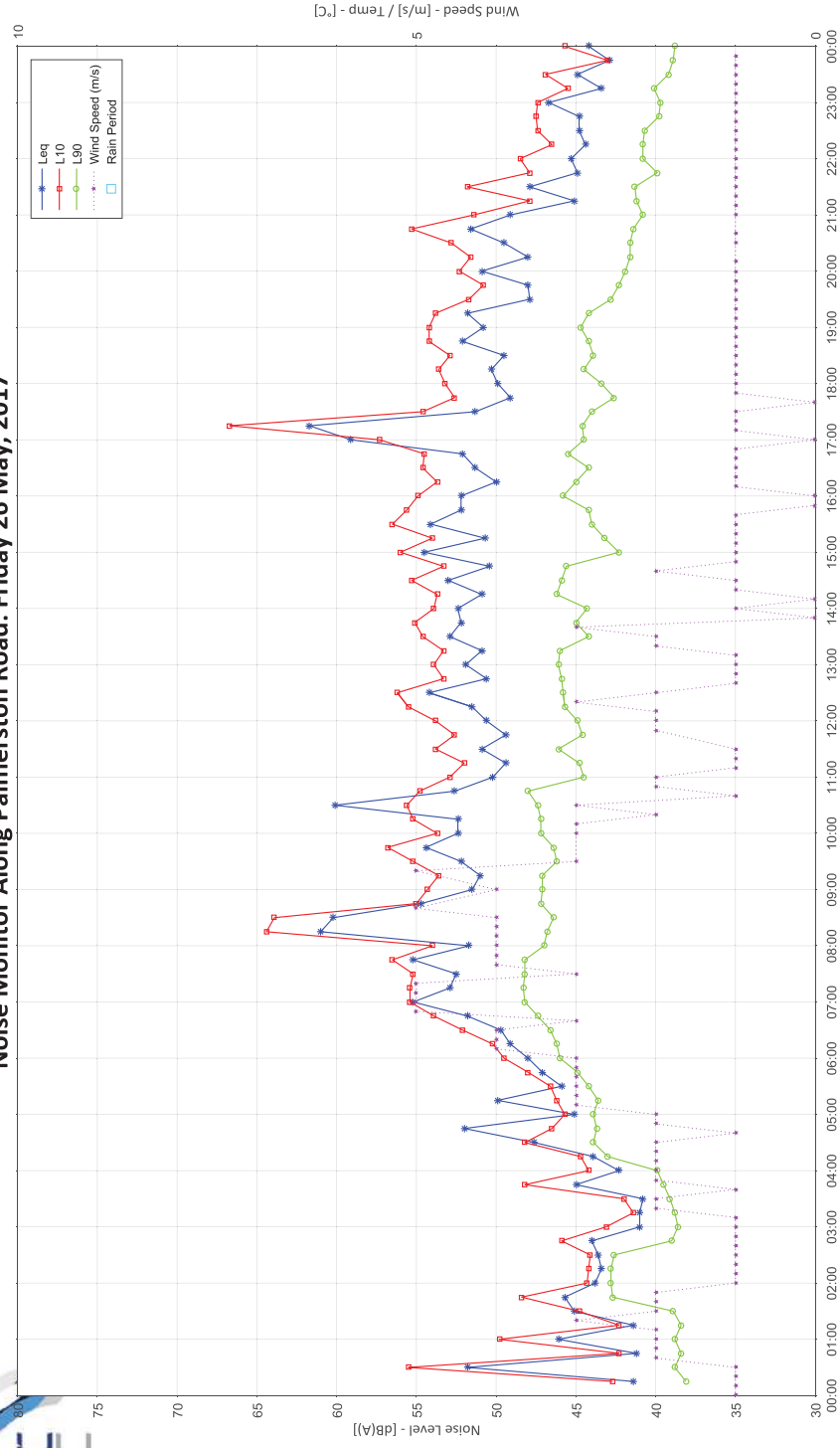
draft



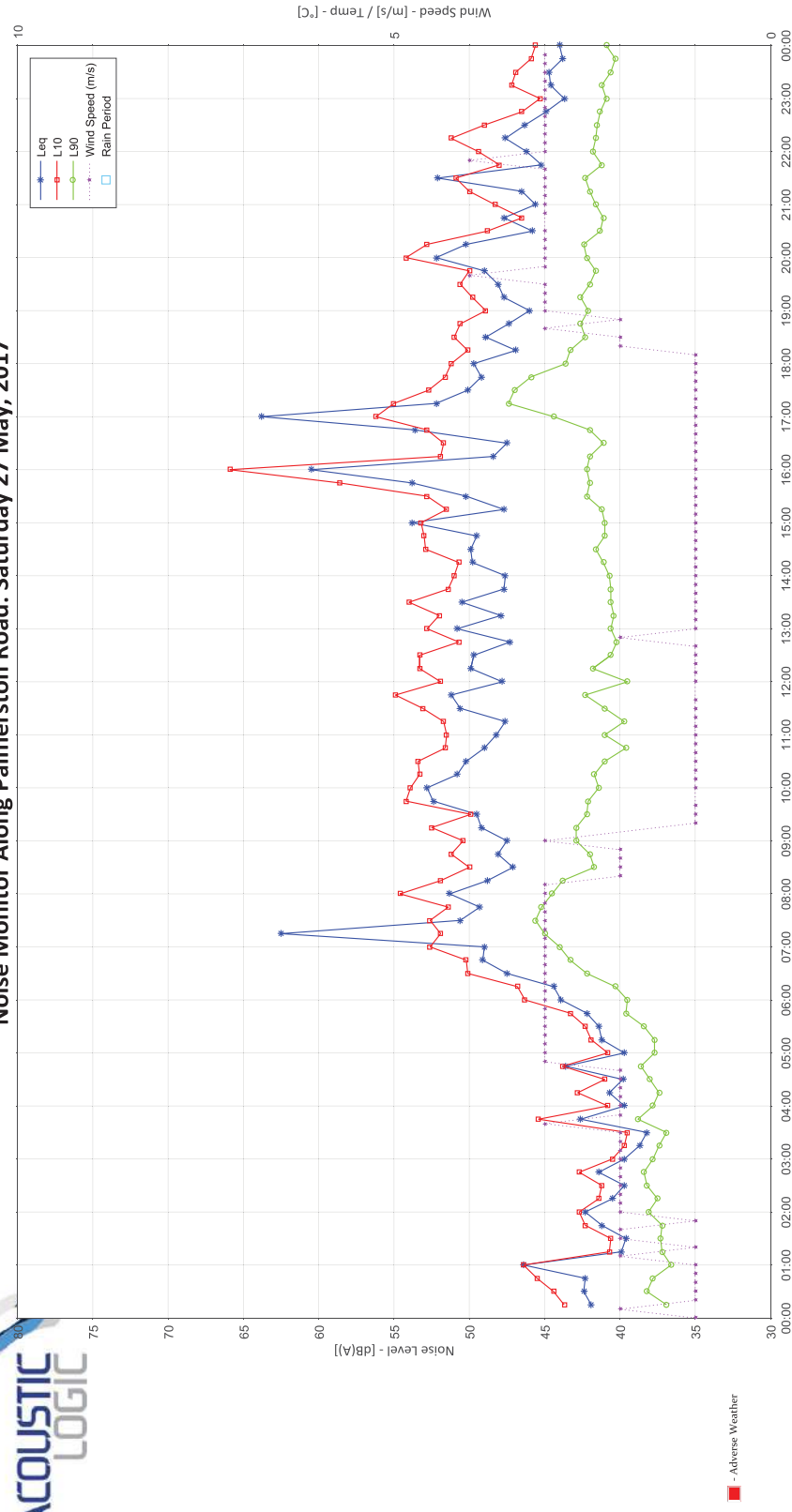
Noise Monitor Along Palmerston Road: Thursday 25 May, 2017



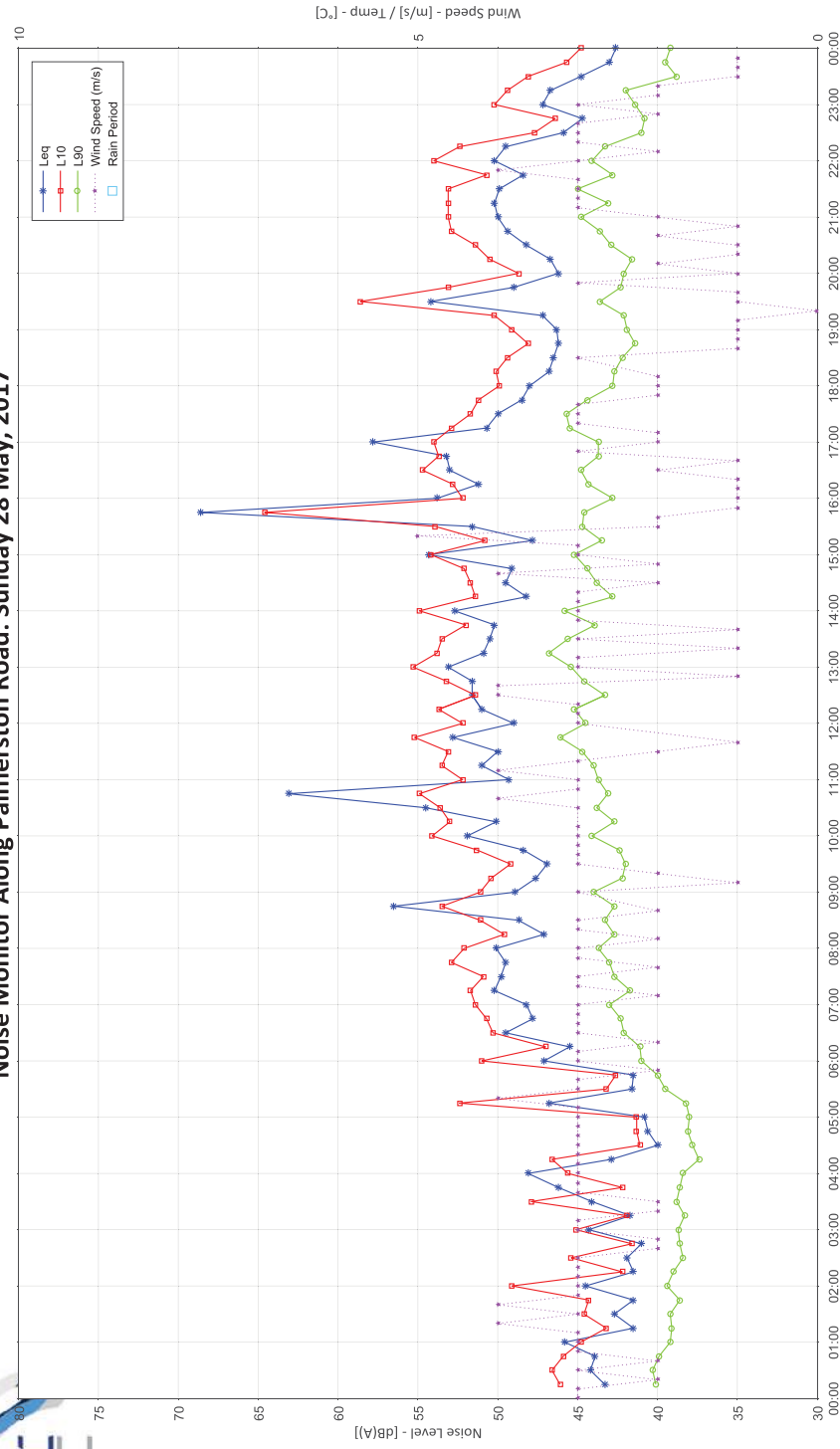
Noise Monitor Along Palmerston Road: Friday 26 May, 2017



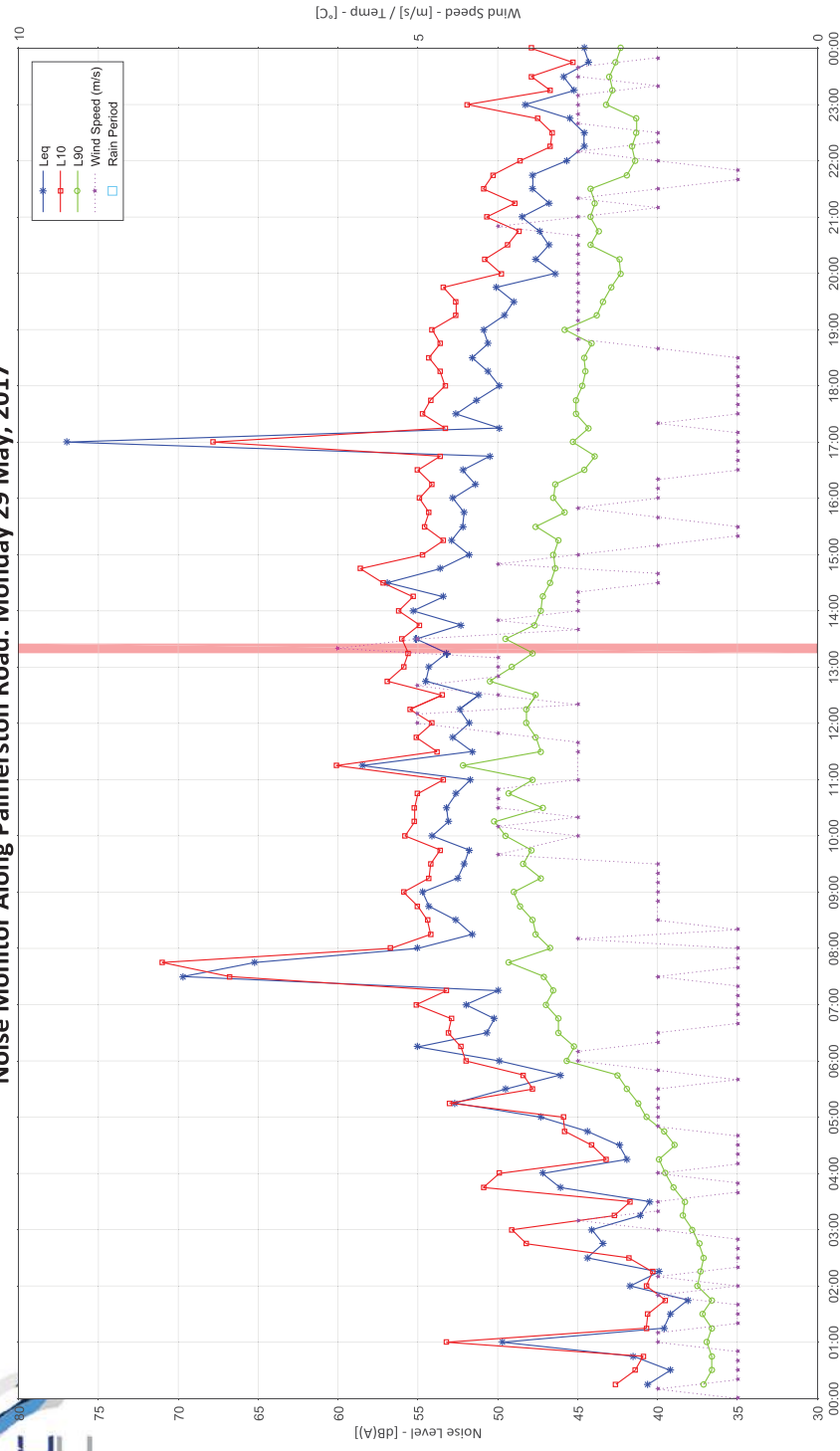
Noise Monitor Along Palmerston Road: Saturday 27 May, 2017



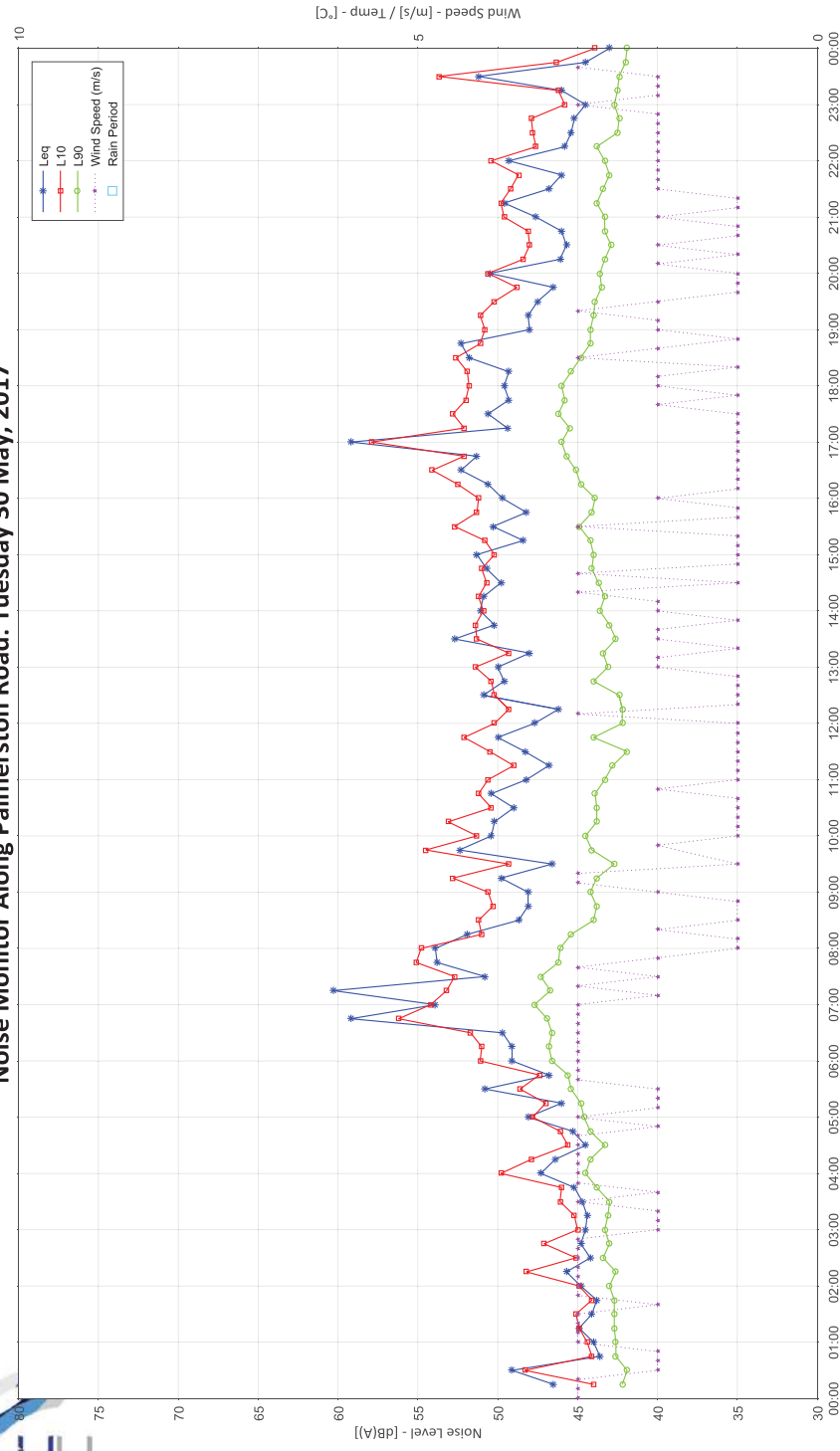
Noise Monitor Along Palmerston Road: Sunday 28 May, 2017



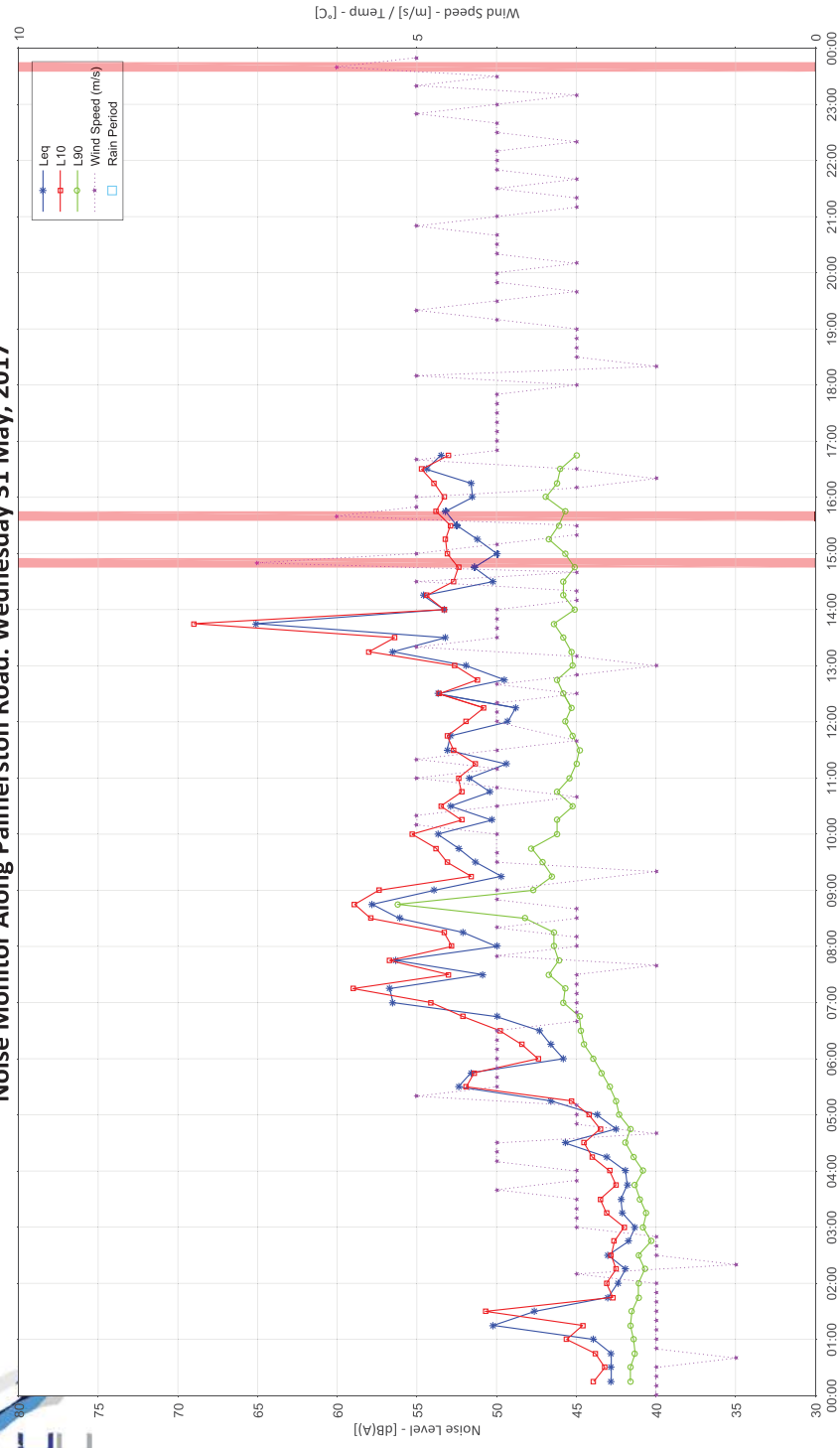
Noise Monitor Along Palmerston Road: Monday 29 May, 2017



Noise Monitor Along Palmerston Road: Tuesday 30 May, 2017



Noise Monitor Along Palmerston Road: Wednesday 31 May, 2017



APPENDIX 2 – CALIBRATION CERTIFICATES

Calibration Certificate for Noise Monitor Along Burdett Street and Derby Road



**Acoustic
Research
Labs Pty Ltd**

Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter

IEC 61672-3:2006

Calibration Certificate

Calibration Number C16216

Client Details Acoustic Logic Consultancy Pty Ltd
9 Sarah Street
Mascot NSW 2020

Equipment Tested/ Model Number : ARL Ngara
Instrument Serial Number : 87807E
Microphone Serial Number : 320559
Pre-amplifier Serial Number : 28296

Pre-Test Atmospheric Conditions
Ambient Temperature : 22.2°C
Relative Humidity : 46%
Barometric Pressure : 99.33kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 20.9°C
Relative Humidity : 41%
Barometric Pressure : 99.6kPa

Calibration Technician : Jeff Yu
Calibration Date : 23/05/2016

Secondary Check: Riley Cooper
Report Issue Date : 24/05/2016

Approved Signatory :

Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10: Self-generated noise	Pass	14: Level linearity on the reference level range	Pass
11: Acoustical tests of a frequency weighting	Pass	15: Level linearity incl. the level range control	Pass
12: Electrical tests of frequency weightings	Pass	16: Toneburst response	Pass
13: Frequency and time weightings at 1 kHz	Pass	17: Peak C sound level	Pass
		18: Overload Indication	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Least Uncertainties of Measurement -			
Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	±0.12dB	Temperature	±0.05°C
12.5kHz	±0.18dB	Relative Humidity	±0.46%
16kHz	±0.31dB	Barometric Pressure	±0.017kPa
Electrical Tests			
31.5 Hz to 20 kHz	±0.12dB		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

Calibration Certificate for Noise Monitor Along Palmerston Road



**Acoustic
Research
Labs Pty Ltd**

Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C15643

Client Details Acoustic Logic Consultancy Pty Ltd
9 Sarah Street
MASCOT NSW 2020

Equipment Tested/ Model Number : ARL EL-315
Instrument Serial Number : 15-203-518
Microphone Serial Number : 149333
Pre-amplifier Serial Number : 26941

Atmospheric Conditions

Ambient Temperature : 21.4°C
Relative Humidity : 51%
Barometric Pressure : 99.78kPa

Calibration Technician : Dennis Kim
Calibration Date : 08/12/2015
Secondary Check: Sandra Minto
Report Issue Date : 08/12/2015

Approved Signatory :

Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10.2.2: Absolute sensitivity	Pass	10.3.4: Inherent system noise level	Pass
10.2.3: Frequency weighting	Pass	10.4.2: Time weighting characteristic F and S	Pass
10.3.2: Overload indications	Pass	10.4.3: Time weighting characteristic I	Pass
10.3.3: Accuracy of level range control	Pass	10.4.5: R.M.S performance	Pass
8.9: Detector-indicator linearity	Pass	9.3.2: Time averaging	Pass
8.10: Differential level linearity	Pass	9.3.5: Overload indication	Pass

Least Uncertainties of Measurement -

Acoustic Tests

31.5 Hz to 8kHz $\pm 0.120dB$
12.5kHz $\pm 0.165dB$
16kHz $\pm 0.245dB$

Electrical Tests

31.5 Hz to 20 kHz $\pm 0.098dB$

Environmental Conditions

Temperature $\pm 0.3^{\circ}C$
Relative Humidity $\pm 4.1\%$
Barometric Pressure $\pm 0.1kPa$

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

The sound level meter under test has been shown to conform to the type 2 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

**Calibration Certificate for Sound Level Meter Used for Attended Background Noise
Measurements Conducted on 18/01/2018**

CERTIFICATE OF CALIBRATION

CERTIFICATE No.: **SLM 19054 & FILT 1319**

Equipment Description: Sound Level Meter

Manufacturer: Norsonic

Model No: NOR-140 **Serial No:** 1405928

Microphone Type: 1225 **Serial No:** 208208

Filter Type: 1/3 Octave **Serial No:** 1405929

Comments: All tests passed for class 1.
(See over for details)

Owner: Acoustic Logic Consultancy
9 Sarah Street
Mascot, NSW 2020

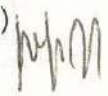
Ambient Pressure: 1012 hPa ± 1.5 hPa

Temperature: 23 °C $\pm 2^\circ$ C **Relative Humidity:** 30% $\pm 5\%$

Date of Calibration: 29/06/2016 **Issue Date:** 29/06/2016

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

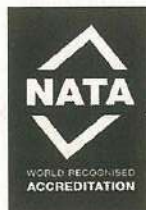
CHECKED BY: 

AUTHORISED SIGNATURE: 

Jack Kielt

Accredited for compliance with ISO/IEC 17025

The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.



Accredited Lab. No. 9262
Acoustic and Vibration
Measurements



HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02) 96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

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AVCERT10 Rev. 1.2 03.02.15

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 19053 & FILT 1316**

Equipment Description: Sound Level Meter

Manufacturer: Norsonic

Model No: NOR-140 **Serial No:** 1405928

Microphone Type: 1225 **Serial No:** 208206

Filter Type: 1/3 Octave **Serial No:** 1405928

Comments: All tests passed for class 1.
(See over for details)

Owner: Acoustic Logic Consultancy
9 Sarah Street
Mascot, NSW 2020

Ambient Pressure: 1000 hPa ± 1.5 hPa

Temperature: 21 °C $\pm 2^\circ$ C **Relative Humidity:** 38% $\pm 5\%$

Date of Calibration: 27/06/2016 **Issue Date:** 27/06/2016

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

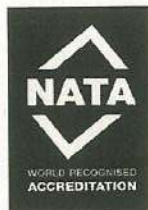
CHECKED BY: *AK*

AUTHORISED SIGNATURE:

Jack Kiehl

Accredited for compliance with ISO/IEC 17025

The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.



Accredited Lab. No. 9262
Acoustic and Vibration
Measurements



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web site: www.acu-vib.com.au

Page 1 of 2
AVCERT10 Rev. 1.2 03.02.15

CERTIFICATE No.: SLM 19054 & FILT 1319

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	Clause	Result
<i>Absolute Calibration</i>	10	Pass
<i>Acoustical Frequency Weighting</i>	12	Pass
<i>Self Generated Noise</i>	11.1	Entered
<i>Electrical Noise</i>	11.2	Entered
<i>Long Term Stability</i>	15	Pass
<i>Electrical Frequency Weightings</i>	13	Pass
<i>Frequency and Time Weightings</i>	14	Pass
<i>Reference Level Linearity</i>	16	Pass
<i>Range Level Linearity</i>	17	N/A
<i>Toneburst</i>	18	Pass
<i>Peak C Sound Level</i>	19	Pass
<i>Overload Indicator</i>	20	Pass
<i>High Level Stability</i>	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.
A full technical report is available if required.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

Least uncertainty for relative attenuation (at 95% c.l.) k=2:

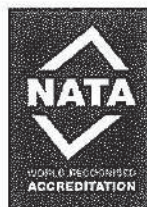
- ±0.1 dB for attenuation equal to or less than 6 dB
- ±0.3 dB for RA from above 6 dB to 18 dB
- ±0.6 dB for RA from above 18 dB to 80 dB

Date of Calibration: 29/06/2016 **Issue Date:** 29/06/2016

Checked by: *[Signature]*

Accredited for compliance with ISO/IEC 17025

The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

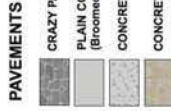


Accredited Lab. No. 9262
Acoustic and Vibration
Measurements



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Mobile: 0413 809805
web site: www.acu-vib.com.au

Appendix B. L01E Landscape Masterplan



ISSUE	DATE	COMMENT
A	7/8/17	Concept For Review
B	9/8/17	Minor Updates
C	7/9/17	Update Civil Drawing
D	27/9/17	DA Approval
E	3/11/17	Updated to show finishes

AMENDMENTS

Project	HORNSBY KU-RING-GAI HOSPITAL STAGE 2
Address	PALMERSTON ROAD HORNSBY NSW 2070
Drawing Title	LANDSCAPE MASTERPLAN
Client	NSW HEALTH INFRASTRUCTURE

SYDNEY NORTH STUDIO
PO Box 265
SEAFORTH NSW 2092
0417685846
p 1300 22 44 55
info@sdstudios.com.au
www.sdstudios.com.au

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Page L01 E

Drawing No. **1032**

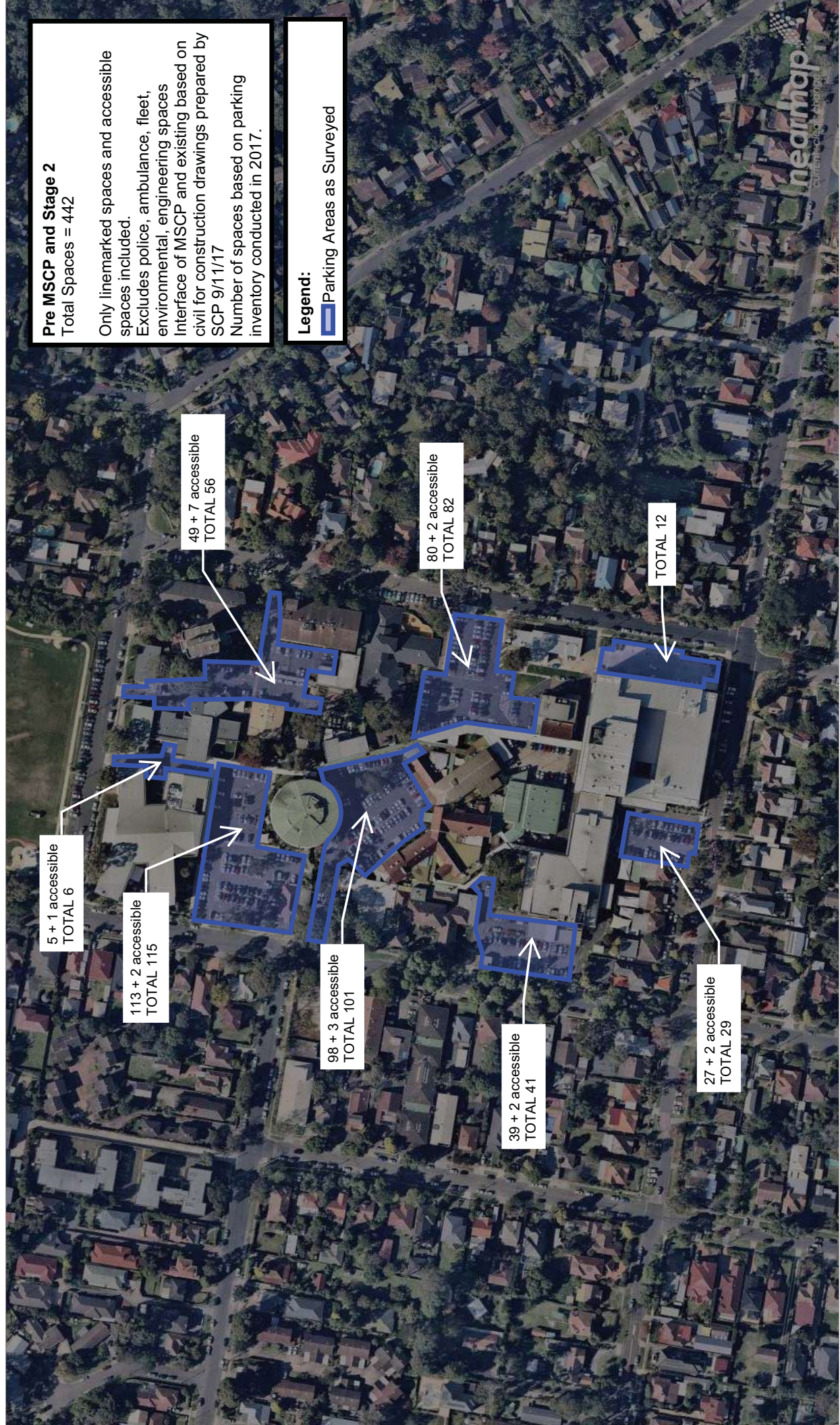
Appendix C. Pre & Post MSCP and Stage 2 Car Parking

Pre MSCP and Stage 2
Total Spaces = 442

Only lined marked spaces and accessible spaces included.
Excludes police, ambulance, fleet, environmental, engineering spaces
Interface of MSCP and existing based on civil for construction drawings prepared by SCP 9/11/17
Number of spaces based on parking inventory conducted in 2017.

Legend:

 Parking Areas as Surveyed



Post MSCP and Stage 2

Total Spaces = 788

Only lined marked spaces and accessible spaces included.

Excludes police, ambulance, fleet, environmental, engineering spaces

Interface of MSCP and existing based on civil for construction drawings prepared by SCP 9/11/17

Number of spaces based on parking inventory conducted in 2017.

Impact to bullring carpark and new main entry based on TTW Stage 2 Drawings.

MSCP numbers as advised by APP.

Legend:

Unaffected Parking Areas

Removed Parking Areas

Modified Parking Areas

5 + 1 accessible
TOTAL 6

36 + 2 accessible
TOTAL 38

MSCP 512
TOTAL 512

94 (includes
main entry
works)
TOTAL 94

39 + 2
accessible
TOTAL 41

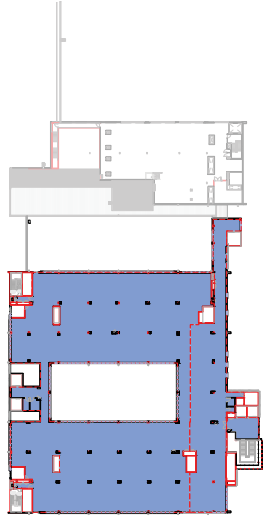
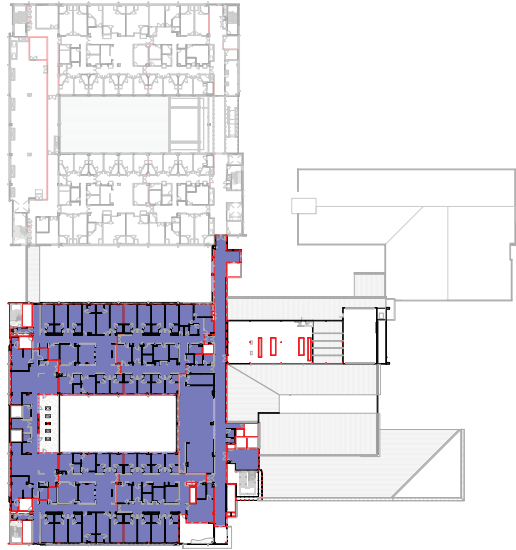
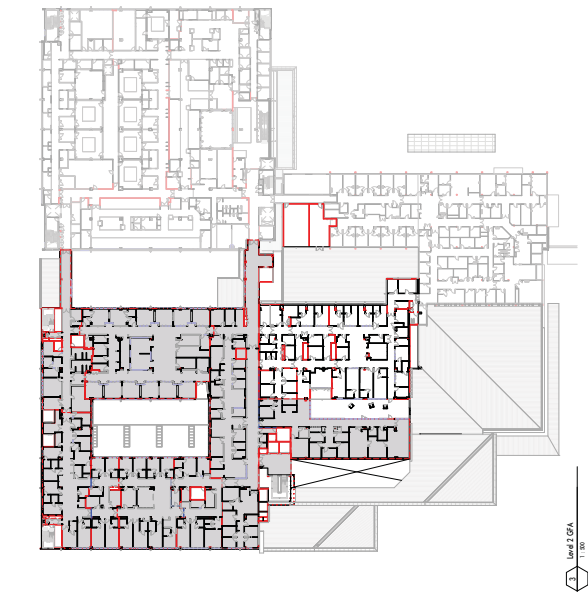
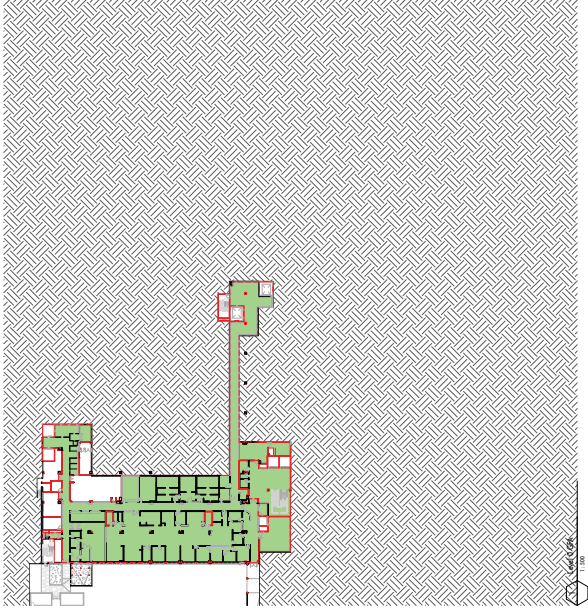
27 + 2 accessible
TOTAL 29

49 + 7 accessible
TOTAL 56

12

Appendix D. L03E Area 2 Landscape Plan

Appendix E. GFA Calculation



LEVEL	GROSS FLOOR AREA (m²)
LEVEL 0	1831.100
LEVEL 1	6347.784
LEVEL 2	4567.731
LEVEL 3	3341.440
LEVEL 4	3399.544
LEVEL 5	3379.772
TOTAL	22,287.298

Note: 1. Level 6 contains plant and is therefore excluded from the total GFA.

Note: 2. GFA for each level includes:

- Vertical circulation
- Plant Services (room)
- Outdoor spaces (if applicable)
- Voids above a floor



NOT TO SCALE

PROJECT: NEW SOUTH WALES HEALTH INFRASTRUCTURE
 LOCATION: SYDNEY
 CLIENT: NSW HEALTH
 ARCHITECT: NETTLETON RIBE
 DATE: 2020

LEGEND

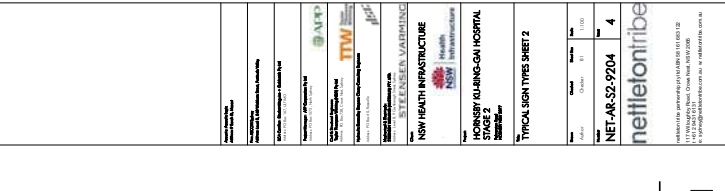
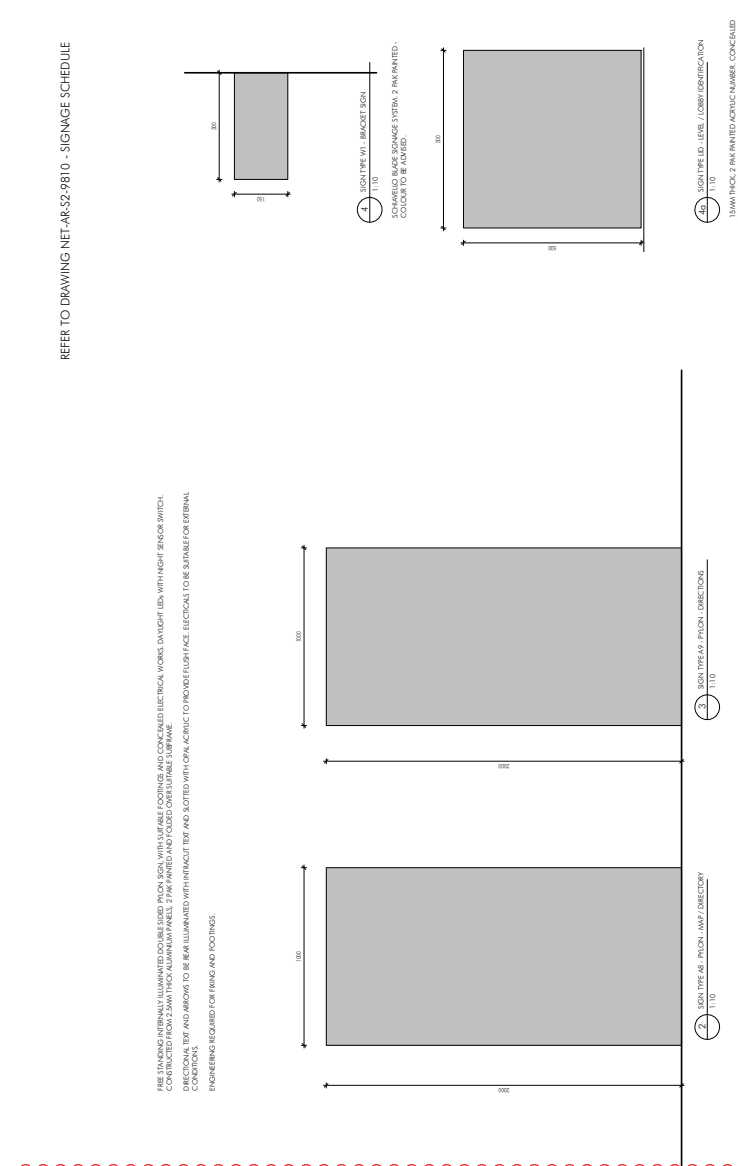
LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
LEVEL 6	LEVEL 7	LEVEL 8	LEVEL 9	LEVEL 10	LEVEL 11

NSW HEALTH INFRASTRUCTURE
 HEALTH
 HOSPITALS
 STAGE 2
 HOSPITAL KILLING-ON HOSPITAL
 STAGE 2
 GFA CALCULATION

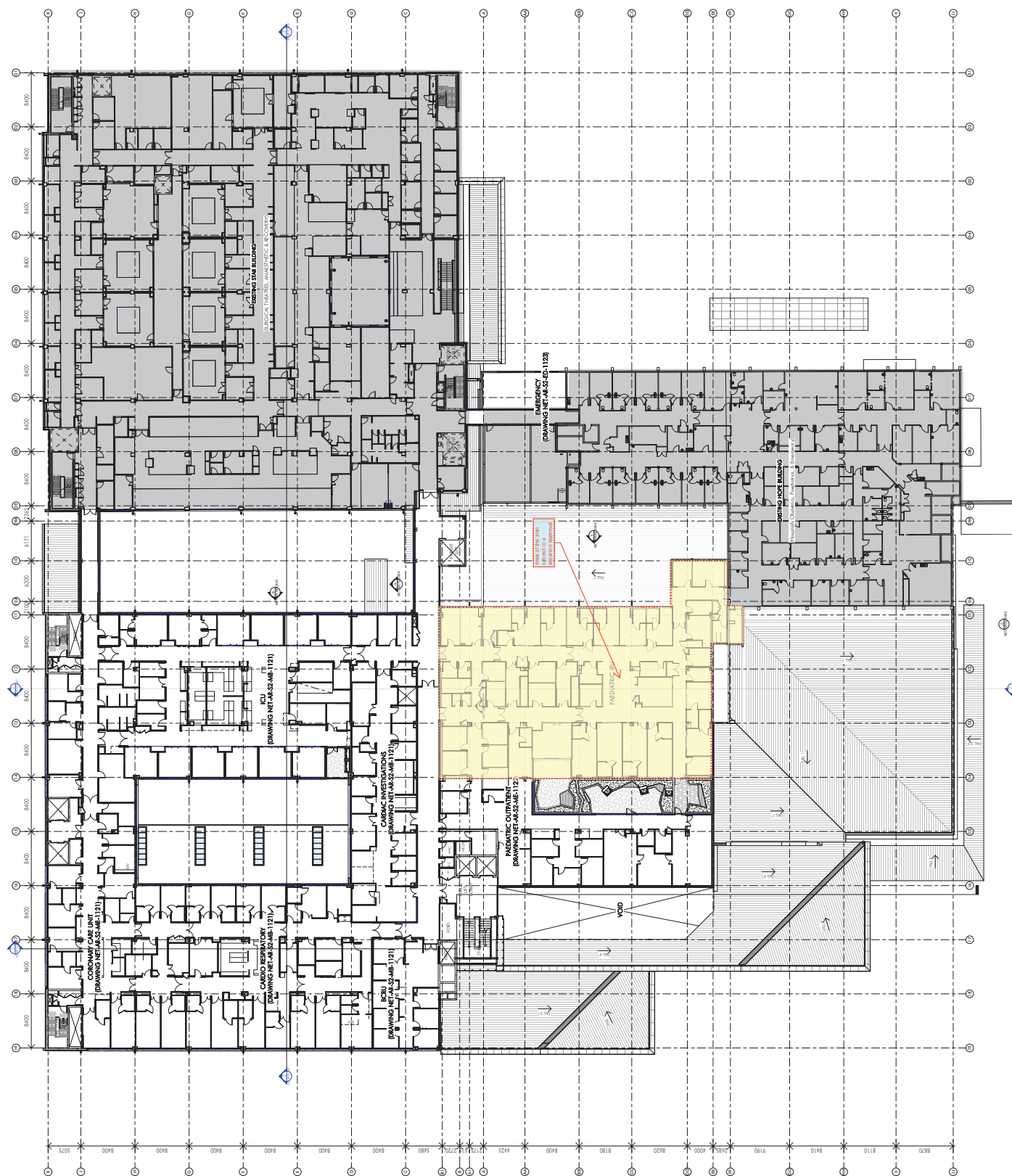
NET-AN-S2-GFA
 nettleton|ribe

PROJECT: NEW SOUTH WALES HEALTH INFRASTRUCTURE
 LOCATION: SYDNEY
 CLIENT: NSW HEALTH
 ARCHITECT: NETTLETON RIBE
 DATE: 2020

Appendix F. Typical Sign Types Sheet 2



Appendix G. Separate Approval Mark-up





APP

Property and Infrastructure Specialists