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Environmental Noise Assessment

Guildford Swimming Centre – Modernisation and Renewal

Cnr Guildford Road & Tamplin Street, Guildford, NSW

REPORT No
6613-4.3R

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Prepared For:
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Report	Date	Prepared	Checked	Comment
Final	27/06/2024	William Wang	Stephen Gauld	

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1.0 EXECUTIVE SUMMARY

The Guildford Swimming Centre was opened in 1973 and is open throughout the year. The facility comprises three pools; a six-lane 25m indoor competition pool, a four-lane outdoor pool and a babies pool, all of which are heated. A car park is available for visitors with capacity for over 100 cars.

The facility is now over 40 years old and is showing signs of significant stress and ageing. Components of the pool and structure are failing and the disability access within the centre is inadequate.

Cumberland Council proposes to upgrade and modernise the Guildford Swimming Centre, which will include building works to improve and upgrade the amenities, disability access and ensure compliance with current regulations. Additional improvements include the replacement and additions to the filtration system.

The Guildford Swimming Centre is bounded by residential dwellings to the west and sporting grounds and the Guildford Leagues Club to the south. On the opposite side of Tamplin Road and Guildford Road to the east and north are residential dwellings.

According to the Cumberland Council website, the hours of operation for the Guildford Swimming Centre are as follows:

- Monday – Friday: 6 am – 8 pm
- Saturday: 6 am – 5:30 pm
- Sunday & Public Holidays: 7:30 am – 5:30 pm.

The current operating hours are not anticipated to change as a result of the proposed works.

Cumberland Council requires an acoustic assessment to demonstrate that the noise impact from the proposed works will not adversely affect the acoustic amenity of nearby premises.

Acceptable noise limits for nearby residential and commercial premises and recreation areas have been specified in accordance with the methodologies established in the NSW Noise Policy for Industry (NPI) and NSW State Environmental Planning Policy (SEPP Transport and Infrastructure) 2021.

Noise levels from operation of mechanical plant serving the facility have been modelled to the nearest residential and commercial premises and recreation areas. Recommendations are made in Section 7 of this report to reduce the level of noise at each receptor location to meet the noise limits specified in the NSW NPI and SEPP (Transport and Infrastructure) 2021.

2.0 CONSULTING BRIEF

2.1 Brief

Day Design Pty Ltd was engaged by Savills Australia on behalf of the client Cumberland Council to assess the potential environmental noise impact from proposed upgrades to the Guildford Swimming Centre located at the corner of Tamplin Road and Guildford Road, Guildford, NSW. This commission involves the following:

Scope of Work:

- Inspect the site and environs
- Measure the background noise levels at critical locations and times
- Establish acceptable noise level criterion
- Prepare a site plan identifying the development and nearby noise sensitive locations
- Quantify noise emissions from the Guildford Swimming Centre
- Calculate the level of noise emission, taking into account building envelope transmission loss, screen walls and distance attenuation
- Provide recommendations for noise control (if necessary)
- Prepare an Environmental Noise Impact Report.

2.2 Pre-DA Responses

Cumberland Council in a letter dated 24 April 2024 (reference PL24/0017) outlined the acoustic requirements for the development. The requirements are outlined below.

Pre DA Minutes	Addressed in Report
Provide a detailed acoustic assessment report, by a suitably qualified acoustic consultant*, detailing noise emissions and how amenity of the neighbourhood will be maintained.	Section 6
Identify noise impacts of the proposed development including noise from operational use, common areas, traffic generation and mechanical plants, roller doors (automatic or otherwise), operation of pool and pool pump, along with a cumulative noise impact assessment for the proposed development.	Section 6
Acoustic privacy/noise intrusion into the development.	N/A
Acoustic privacy/noise intrusions into the neighbourhood.	Section 6
Assess noise from excavation/demolition/construction works.	Report 6613-4.1R Rev A and 6613-4.2R
Provide recommendations to meet noise criteria including compliance with the relevant DCP requirements and guidelines and the *NSW EPA Noise Policy for Industry (2017) (NPfI).*	Section 7

3.0 SITE AND DEVELOPMENT DESCRIPTION

3.1 Site Description

The Guildford Swimming Centre is located on the south side of Guildford Road, on land zoned *RE1: Public Recreation* under the Cumberland Local Environmental Plan 2021, and is bounded by residential dwellings to the west and sporting grounds and the Guildford Leagues Club to the south. On the opposite side of Tamplin Road and Guildford Road to the east and north are residential dwellings.

The nearest noise sensitive receptors are shown in Figure 1 and in Table 1. These receptors are the closest and most exposed to noise generated by mechanical plant serving the facility. As such, compliance with the noise criteria applicable at these locations will ensure compliance at all other receptor locations.

Table 1 Noise Sensitive Receptors

Receptor and Type	Address	Direction From Site	Building type
R1 – Residential	520 Guildford Road	West	Two Storey
R2 – Residential	487 Guildford Road	North	Two Storey
R3 – Residential	10 Tamplin Road	East	Single Storey
R4 – Active Recreation	Guildford Leagues Club Bowling Greens	South	Bowling Greens
R5 – Commercial	Guildford Leagues Club	South	Three Storey

All residential receptor locations listed in Table 1, at which noise levels have been assessed, are representative of all adjacent residential receptors in the immediate area. Compliance at these nearest representative locations will ensure compliance at every other residential receptor.

3.2 Development Description

Cumberland Council proposes to upgrade and modernise the Guildford Swimming Centre, which will include building works to improve and upgrade the amenities, disability access and ensure compliance with current regulations. Additional improvements include the replacement and additions to the filtration system.

Figure 1 Location Plan; Cnr Guildford and Tamplin Road, Guildford, NSW.

4.0 MEASURED NOISE LEVELS

4.1 Long Term Noise Monitoring

The L_{90} background noise level is a statistical measure of the sound pressure level that is exceeded for 90% of the measurement period (typically 15 minutes).

The Rating Background Level (RBL) is defined by the NSW EPA as the median value of the (lower) tenth percentile of L_{90} ambient background noise levels for day, evening or night periods, measured over a number of days during the proposed days and times of operation.

The background noise level should be measured at a location representative of the potentially affected receptors, in the absence of any noise sources that may be associated with the proposed development.

An environmental noise logger was placed in the front yard of 8 Tamplin Road, Guildford, between Friday 23 February and Friday 1 March 2024. The logger location is designated as Logger 'A', as shown in Figure 1. Noise levels at this location are representative of background noise levels of adjacent dwellings with facades facing the facility to the east ('R3').

A second environmental noise logger was placed in the rear yard of 522 Guildford Road, Guildford, between Friday 23 February and Friday 1 March 2024. The logger location is designated as Logger 'B', as shown in Figure 1. Noise levels at this location are representative of background noise levels of adjacent dwellings with facades facing the facility to the west, with direct line-of-sight to the existing outdoor pool area.

Background noise levels at southern facades of residential dwellings to the north of the facility are likely to be higher given the exposure to traffic noise along Guildford Road. However, as a conservative approach, noise criteria established for receptor 'R3' has also been applied to 'R2'.

Details of instrumentation used during the noise surveys can be seen in the attached Appendix A.

The results of the background noise survey at the logger position is shown in the attached Appendix B and Table 2. The facility is not proposed to operate during the night time period, however, noise levels during these times are shown to provide a complete overview of the acoustic environment.

Table 2 Ambient Background Levels – Guildford

Location	Time Period	L_{90} Rating Background Level - dBA	Existing L_{eq} Noise Levels - dBA
Logger A – 8 Tamplin Rd Guildford	Shoulder Period (6am – 7am)	43	N/A
	Day (7am – 6pm)	41	57
	Evening (6pm – 10pm)	44	58
	Night (10pm – 7am)	42	51
Logger B – 520 Guildford Rd Guildford	Shoulder Period (6am – 7am)	47	N/A
	Day (7am – 6pm)	44	52
	Evening (6pm – 10pm)	44	55
	Night (10pm – 7am)	43	55

Meteorological conditions during the measurement surveys typically consisted of clear skies with temperatures ranging from 12°C to 21°C. Atmospheric conditions were considered ideal for noise monitoring. No significant rainfall was recorded during the measurement period, therefore, noise level measurements were considered reliable and typical for the receptor area.

5.0 NOISE CRITERIA

5.1 NSW Noise Policy for Industry

The Environment Protection Authority (EPA) published their NSW Noise Policy for Industry (NPI) in October 2017. The NPI is specifically aimed at assessing noise from industrial noise sources scheduled under the Protection of the Environment Operations Act 1997 (POEO, 1997).

The NPI provides a useful framework to assess noise emission from non-scheduled premises, whether that premises produces intrusive or non-intrusive noise.

While the NPI is not strictly applicable to this site, as the site is not scheduled, in the absence of other relevant standards the limits set out in the NSW Noise Policy for Industry will be used as a guide in determining whether the level of noise is considered intrusive or not.

5.1.1 Amenity Criteria

Depending on the type of area in which the noise is being made, there is a certain reasonable expectancy for noise amenity. The NSW NPI provides a schedule of recommended L_{eq} industrial noise levels that under normal circumstances should not be exceeded. If successive developments occur near a residential area, each one allowing a criterion of background noise level plus 5 dB, the ambient noise level will gradually creep higher.

The recommended L_{eq} noise levels shown in Table 3 are taken from Section 2.4, Table 2.2 of the NPI.

Table 3 Amenity Criteria

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{eq} Noise Level, dBA
			Acceptable
Residence	Suburban	Day	55
		Evening	45
		Night	40
Commercial	All	When In Use	65
Active Recreation Areas	All	When in Use	55

The L_{Aeq} is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, the NPI assumes that the **$L_{Aeq,\ 15min}$** will be taken to be equal to the **$L_{Aeq,\ period}$ + 3 decibels (dB)**.

Compliance with the amenity criteria will limit ambient noise creep. Wherever the existing L_{eq} noise level from industrial noise sources approaches or exceeds the amenity criteria at a critical receptor location, the intrusive L_{eq} noise from the noise source in question must be reduced to a level that may be as much as 10 dB below the existing L_{eq} industrial noise level.

Therefore the project acceptable L_{Aeq} amenity criteria for residential areas is:

- (55 – 5 + 3 dB =) 53 dBA during the day.
- (45 – 5 + 3 dB =) 43 dBA during the evening.
- (40 – 5 + 3 dB =) 38 dBA during the night.

The acceptable L_{Aeq} amenity criteria for commercial premises is:

- (65 – 5 + 3 dB =) 63 dBA when in use.

The acceptable L_{Aeq} amenity criteria for active recreation areas is:

- (55 – 5 + 3 dB =) 53 dBA when in use.

5.1.2 Intrusiveness Criteria

The EPA states in Section 2.3 of its NSW Noise Policy for Industry that the L_{eq} level of noise intrusion from broad-band industrial noise sources may be up to 5 dB above the L_{90} background noise level at a residential receptor without being considered intrusive.

The $L_{90,\ 15\ minute}$ Rating Background Level in Guildford is shown in Table 2.

Therefore the acceptable L_{eq} noise intrusiveness criteria at the nearest residential areas will be as shown in Table 4.

Table 4 Project Intrusiveness Criteria

Location	Time Period	L_{90} Rating Background Level - dBA	Intrusiveness L_{eq} Noise Levels - dBA
Receptors R2 and R3	Shoulder Period (6am – 7am)	43	48
	Day (7am – 6pm)	41	46
	Evening (6pm – 10pm)	44	49
	Night (10pm – 7am)	42	47
Receptor R1	Shoulder Period (6am – 7am)	47	52
	Day (7am – 6pm)	44	49
	Evening (6pm – 10pm)	44	49
	Night (10pm – 7am)	43	48

5.1.3 Sleep Disturbance

Given that facility begins operations at 6 am Monday – Saturday, it follows that patrons will arrive during the period to use the Swimming Centre. As such, the potential for sleep disturbance during the shoulder period between 6 am and 7 am has been considered.

The Noise Policy for Industry provides the following guidance (NPI, Section 2.5) for setting appropriate trigger levels for sleep disturbance:

> *'Sleep disturbance is considered to be both awakenings and disturbance to sleep stages. Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - $L_{Aeq,15min}$ *40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - L_{AFmax} *52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken.*

Given that the character of noise emission from mechanical plant is typically steady-state, the acceptable $L_{eq,\ 15min}$ criterion for sleep disturbance is:

Receptor R1

- (47 + 5=) 52 dBA during the shoulder period.

Receptors R2 and R3

- (43 + 5=) 48 dBA during the shoulder period.

Given these levels for the early morning period are higher than the criteria during the daytime period, the early morning period criteria has been limited to the daytime period criteria.

5.2 Project Specific Noise Criteria

The measured background noise levels have been used to establish the most stringent noise criteria at each receptor location as follows:

At the most affected point on or within the boundary of residential premises:

Receptor R1

- **49 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission during the day.
- **43 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission during the evening.
- **38 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission during the night.
- **49 dBA** $L_{eq,\ 15\ minute}$ for broadband, steady-state noise emission during the early morning.

Receptor R2 and R3

- **46 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission during the day.
- **43 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission during the evening.
- **38 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission during the night.
- **46 dBA** $L_{eq,\ 15\ minute}$ for broadband, steady-state noise emission during the early morning.

Compliance with the residential noise criteria is assessed at 1 metre from the façade of the receptor or outside the most affected first floor window.

At the most affected point on or within the boundary of commercial premises:

Receptor R5

- **63 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission when the premises are in use.

Within active recreation areas:

Receptor R4

- **53 dBA** $L_{eq,\ 15\ minute}$ for broadband noise emission when the area is in use.

For Sleep Disturbance:

Receptor R1

- (47 + 5=) 52 dBA during the shoulder period.

Receptors R2 and R3

- (43 + 5=) 48 dBA during the shoulder period.

6.0 SWIMMING CENTRE NOISE EMISSION

The noise impacts to the nearby noise sensitive areas have been assessed from noise generated by the operation of mechanical plant serving the facility and patrons attending the facility.

6.1 Mechanical Plant Noise Emission

We have been provided with preliminary information regarding items of mechanical plant likely to be installed as part of the upgrades. The sound power levels for various items of mechanical plant proposed for installation within the facility are presented in Table 5 and have been used in this assessment.

Table 5 Swimming Centre Mechanical Plant L_{eq} Sound Power Levels

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Pool Pump 15kW – 1 off	**67**[1]	59	59	58	50	52	52	59	47
Pool Pump 7.5kW – 2 off	**64**[1]	56	56	55	47	49	49	56	44
Shunt Pump 1.1kW – 6 off	**53**[1]	45	45	47	36	38	38	48	36
AC Unit PoolPac 3600 – 2 off	**96**	88	88	87	79	91	91	88	76
AC Unit PoolPac 6500 – 1 off	**99**	91	91	90	82	94	94	91	79

Noise modeling is based on preliminary drawings provided by NBRS Architecture, dated 26 June 2024, as shown in Appendix C.

[1] Spectral data estimated

6.2 Noise Emission from Patrons

We have been informed that the capacity of the Swimming Centre site is likely to be approximately 550 patrons. This includes both the indoor and outdoor areas.

Assuming the typical scenarios and from our observations of other sites, we have modelled the noise emission from the Swimming Centre as follows:

- We have assumed the patrons will likely to be 100% inside during the early morning at 25% capacity (150 patrons);
- We have assumed the patrons will likely to be 50% inside and 50% outside during the day at 100% capacity (600 patrons);
- We have assumed the patrons will likely to be 80% inside and 20% outside during the evening at 25% capacity (150 patrons);
- Adults talking loudly (5%), talking with a raised voice (15%) and talking normally (30%) with the remaining adults not talking or listening (50%); and
- Children actively playing (100%).

Based on information in Harris[2] and in our noise level database gathered over many years, we calculate the sound power levels shown in Table 6.

Table 6 L_{eq} Sound Power Levels

Description	Sound Power Levels, dBA
One man talking loudly	**83**
One man talking with a raised voice	**72**
One man talking normally	**66**
1 Child playing	**78**
150 Children playing	**90**
150 People (75 Adults, 75 Children)	**96**
300 People (150 Adults, 150 Children)	**99**
600 People (300 Adults, 300 Children)	**102**

[2] Handbook of Acoustical Measurements and Noise Control, Third Edition, Cyril M. Harris, McGraw-Hill Inc, New York, (Page 16.2)

6.3 Calculated Noise Level at Receptor Locations

Knowing the sound power level of a noise source (refer Table 5 and Table 6), the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, sound barriers, etc.

6.3.1 Calculated Noise Level of Mechanical Plant

The following noise level calculations are shown for the nearest residential dwellings, commercial premises and active recreation areas. The calculated noise level at each receptor location from the operation of mechanical plant serving the facility are shown in Table 7.

Calculations assume that all mechanical plant is housed within plant rooms with the following construction:

- Walls are constructed from single skin masonry such as brick or concrete blocks;
- Roof is of metal deck construction fixed to;
- Minimum 90mm timber or steel joists;
- Minimum 50mm thick insulation in cavity (min density 11kg/m^2);
- 1 internal layer of 13mm water rated plasterboard or 7.5 mm fibre cement sheet;
- Minimum 35mm thick solid core access door with acoustic seals fitted; and
- 600 mm deep acoustic louvres to the southern wall.

$L_{eq,\ 15\ min}$ noise levels at the nearest residential dwellings, commercial premises and active recreation areas are shown in Table 7 in comparison with the most stringent noise criteria, as established in Section 5.2. Compliance with the most stringent noise criteria during the night period, will ensure compliance at any other time when the facility is in operation.

Table 7 $L_{eq,\ 15\ minute}$ Noise Levels – Swimming Pool Plant at Night (R1 – R5)

Receptor Location	Calculated Noise Level $L_{eq\ (15\ min)}$	Noise Criterion	Compliance (Yes/No)
R1 – 520 Guildford Road	35 dBA	38 dBA	Yes
R2 – 487 Guildford Road	29 dBA	38 dBA	Yes
R3 – 10 Tamplin Road	38 dBA	38 dBA	Yes
R4 – Guildford Leagues Club Bowling Greens	42 dBA	53 dBA	Yes
R5 – Guildford Leagues Club	38 dBA	63 dBA	Yes

The calculated $L_{eq,\ 15\ min}$ levels of noise from mechanical plant serving the facility at each receptor location are summarised in Table 5. With the aforementioned assumptions, it can be seen that the noise levels from the operation of mechanical plant is below the most stringent noise level criteria, as established in Section 5, at all receptor locations.

At the time of preparing this report, the mechanical systems were yet to be finalized. We recommend that a detailed noise assessment is conducted when the selection of plant and equipment has been determined.

6.3.2 Calculated Noise Level of Patrons

The following noise level calculations are shown for the nearest residential dwellings, commercial premises and active recreation areas. The calculated noise level at each receptor location from patrons within the Swimming Centre are shown in Tables 8 to 10.

The calculations include the noise control recommendations for the main building and boundary fencing outlined in Section 7.

Table 8 shows the level of noise emission from patrons during the early morning period, from 6 am to 7 am, with all patrons inside (150 patrons).

Table 8 $L_{eq,\ 15\ minute}$ Noise Levels – Patrons Inside Early Morning (R1 – R5)

Receptor Location	Calculated Noise Level $L_{eq\ (15\ min)}$	Noise Criterion	Compliance (Yes/No)
R1 – 520 Guildford Road	35 dBA	49 dBA	Yes
R2 – 487 Guildford Road	24 dBA	46 dBA	Yes
R3 – 10 Tamplin Road	32 dBA	46 dBA	Yes
R4 – Guildford Leagues Club Bowling Greens	27 dBA	53 dBA	Yes
R5 – Guildford Leagues Club	24 dBA	63 dBA	Yes

The noise levels shown in Table 8 for Receptor R1 to R3 are also below the sleep disturbance criteria and considered acceptable.

Table 9 shows the level of noise emission from the maximum capacity of patrons during the daytime period, from 7 am to 6 pm, with 50% of patrons inside (300 patrons) and 50% of patrons outside (300 patrons).

Table 9 $L_{eq,\ 15\ minute}$ Noise Levels – Patrons Day (R1 – R5)

Receptor Location	Calculated Noise Level $L_{eq\ (15\ min)}$	Noise Criterion	Compliance (Yes/No)
R1 – 520 Guildford Road			
Patrons Inside	37 dBA		
Patrons Outside	49 dBA		
Cumulative Total	49 dBA	49 dBA	Yes
R2 – 487 Guildford Road			
Patrons Inside	26 dBA		
Patrons Outside	45 dBA		
Cumulative Total	45 dBA	46 dBA	Yes
R3 – 10 Tamplin Road			
Patrons Inside	34 dBA		
Patrons Outside	44 dBA		
Cumulative Total	44 dBA	46 dBA	Yes
R4 – Guildford Leagues Club Bowling Greens			
Patrons Inside	30 dBA		
Patrons Outside	52 dBA		
Cumulative Total	52 dBA	53 dBA	Yes
R5 – Guildford Leagues Club			
Patrons Inside	26 dBA		
Patrons Outside	49 dBA		
Cumulative Total	49 dBA	63 dBA	Yes

Table 10 shows the level of noise emission from the approximate capacity of patrons being 50% of the maximum capacity during the evening period as the Swimming Facility winds down for the day, from 6 pm to 8 pm, with 80% of patrons inside (120 patrons) and 20% of patrons outside (30 patrons).

Table 10 $L_{eq,\ 15\ minute}$ Noise Levels – Patrons Evening (R1 – R5)

Receptor Location	Calculated Noise Level $L_{eq\ (15\ min)}$	Noise Criterion	Compliance (Yes/No)
R1 – 520 Guildford Road			
Patrons Inside	33 dBA		
Patrons Outside	43 dBA		
Cumulative Total	43 dBA	43 dBA	Yes
R2 – 487 Guildford Road			
Patrons Inside	23 dBA		
Patrons Outside	39 dBA		
Cumulative Total	39 dBA	43 dBA	Yes
R3 – 10 Tamplin Road			
Patrons Inside	31 dBA		
Patrons Outside	37 dBA		
Cumulative Total	38 dBA	43 dBA	Yes
R4 – Guildford Leagues Club Bowling Greens			
Patrons Inside	26 dBA		
Patrons Outside	45 dBA		
Cumulative Total	45 dBA	53 dBA	Yes
R5 – Guildford Leagues Club			
Patrons Inside	23 dBA		
Patrons Outside	42 dBA		
Cumulative Total	42 dBA	63 dBA	Yes

The calculations in Table 7 to Table 10 show that, with the noise control recommendations as outlined in Section 7, the Swimming Centre is able to meet the acceptable noise criteria and will be considered acceptable.

7.0 NOISE CONTROL RECOMMENDATIONS

7.1 Sound Barrier Wall

To reduce the level of noise emission from the outdoor areas, we recommend that an acoustic barrier be constructed around the northern and western sides to a height of 2.4 metres (refer Appendix C).

The wall should be constructed from a solid material such as masonry, lapped and capped timber or Colorbond steel. A combination of the above may be combined with alternative materials such as 10 mm thick solid polycarbonate (clear and will allow light to pass through). For example a 0.8 metre earth mound with 1.8 metre lapped timber fence above. The construction shall be free of visible air gaps to provide an impervious sound barrier.

The southern side may remain acoustically open, constructed from standard pool fencing or similar.

The eastern side of the outdoor area is the main Swimming Centre building.

7.2 Vibration Isolation

We recommend that all mechanical plant be vibration isolated from the building structure.

7.3 Acoustic Louvres to Plant Room

To allow for ventilation in the plant room, we recommend that acoustic louvres be installed to the southern side of the plant room. The acoustic louvres should have a minimum depth of 600 mm and have minimum insertion loss as follows:

Table 11 Acoustic Louvre Insertion Loss

Description	Insertion Loss(dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic Louvre – 600 mm deep (based on Fantech SBL2)	5	10	14	22	27	25	21	17

7.4 Plant Room Sound Absorptive Treatment

We recommend that as much surface area as practical within the plant room be covered with high density sound absorptive insulation such as 50 mm thick CSR Martini Absorb HD50 to reduce the reverberant build up within the plant room.

The insulation should be faced with a perforated steel facing (minimum 20% open area).

7.5 Plant Room Access Door

We recommend that the access door to the plant room be minimum 45 mm thick solid core door, with full perimeter acoustic seals (Raven RP10 Si or equivalent) and drop down bottom seal (Raven RP99Si or equivalent).

7.6 Swimming Centre Building Construction

The Swimming Centre building is recommended the have the following minimum construction:

7.6.1 External Walls

All external walls may be of brick veneer construction.

7.6.2 Ceiling and Roof System

- All roofs may be of metal deck construction with a heavy duty vapour barrier laid below the roof.
- Insulation batts are to be placed between the ceiling joists. The recommended insulation specifications are a minimum 160 mm thick glasswool (min 10 kg/m^3 density).
- Ceilings under the roof are to be perforated plasterboard or perforated metal.

7.6.3 Glazing and Glazed Doors

All external glazed windows, glass louvres and doors are of minimum 6.38 mm thickness laminated glass with minimum R_w 32.

7.7 Construction Disclaimer and Copyright

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Recommendations made in this report are intended to resolve acoustical problems only. We make no claim of expertise in other areas of building construction and therefore the recommended noise controls should be implemented into the building design in consultation with other specialists to ensure they meet the structural, fire, thermal or other aspects of building construction.

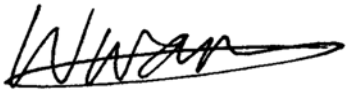
We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. For example, a small gap between the top of a wall and a ceiling can reduce the effective sound transmission loss of a wall from R_w 50 to R_w 40. Therefore the use of contractors that are experienced in acoustic construction is encouraged.

8.0 CONCLUSION

Day Design Pty Ltd was engaged by Savills Australia on behalf of the client Cumberland Council to assess the potential environmental noise impact from mechanical plant associated with proposed upgrades to the Guildford Swimming Centre located at the corner of Tamplin Road and Guildford Road, Guildford, NSW.

Measurements and calculations show that the level of noise emitted by the items of mechanical plant serving the facility, will meet the acceptable noise level requirements of the NSW Noise Policy for Industry, detailed in Section 5 of this report, and is considered acceptable. Provided the aforementioned assumptions are included in the design of the facility, no further noise controls are required.



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for and on behalf of Day Design Pty Ltd

AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

APPENDICES

Appendix A – Instrumentation
Appendix B – Ambient Noise Survey
Appendix C – Architectural Drawings
AC108-1 to 4 – Glossary of Acoustical Terms

NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis in this report were made with instrumentation as follows:

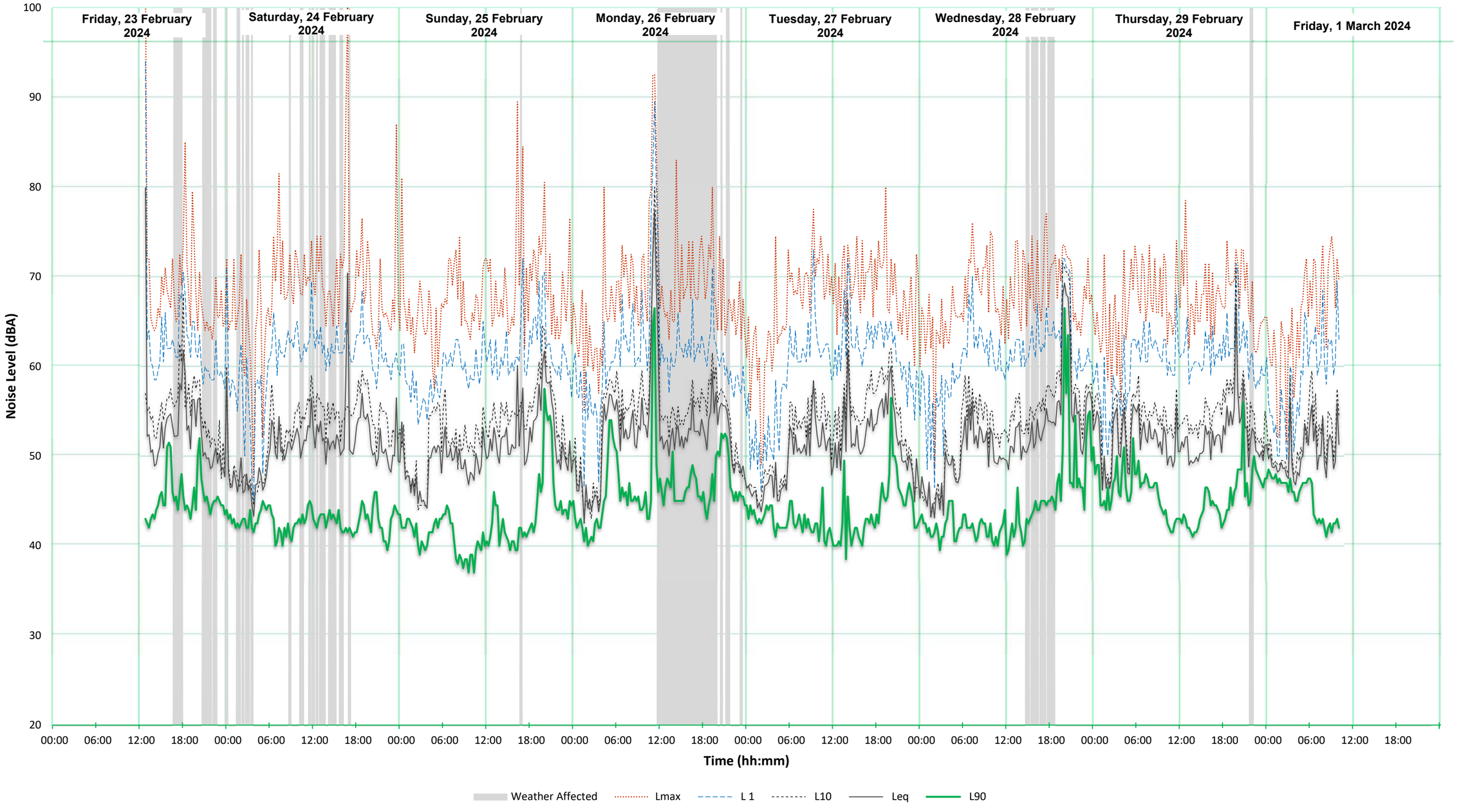
Table A1 Noise Survey Instrumentation

Description	Model No	Serial No
Infobyte Noise Logger(Type 2)	iM4	113
Condenser Microphone 0.5” diameter	MK 250	113

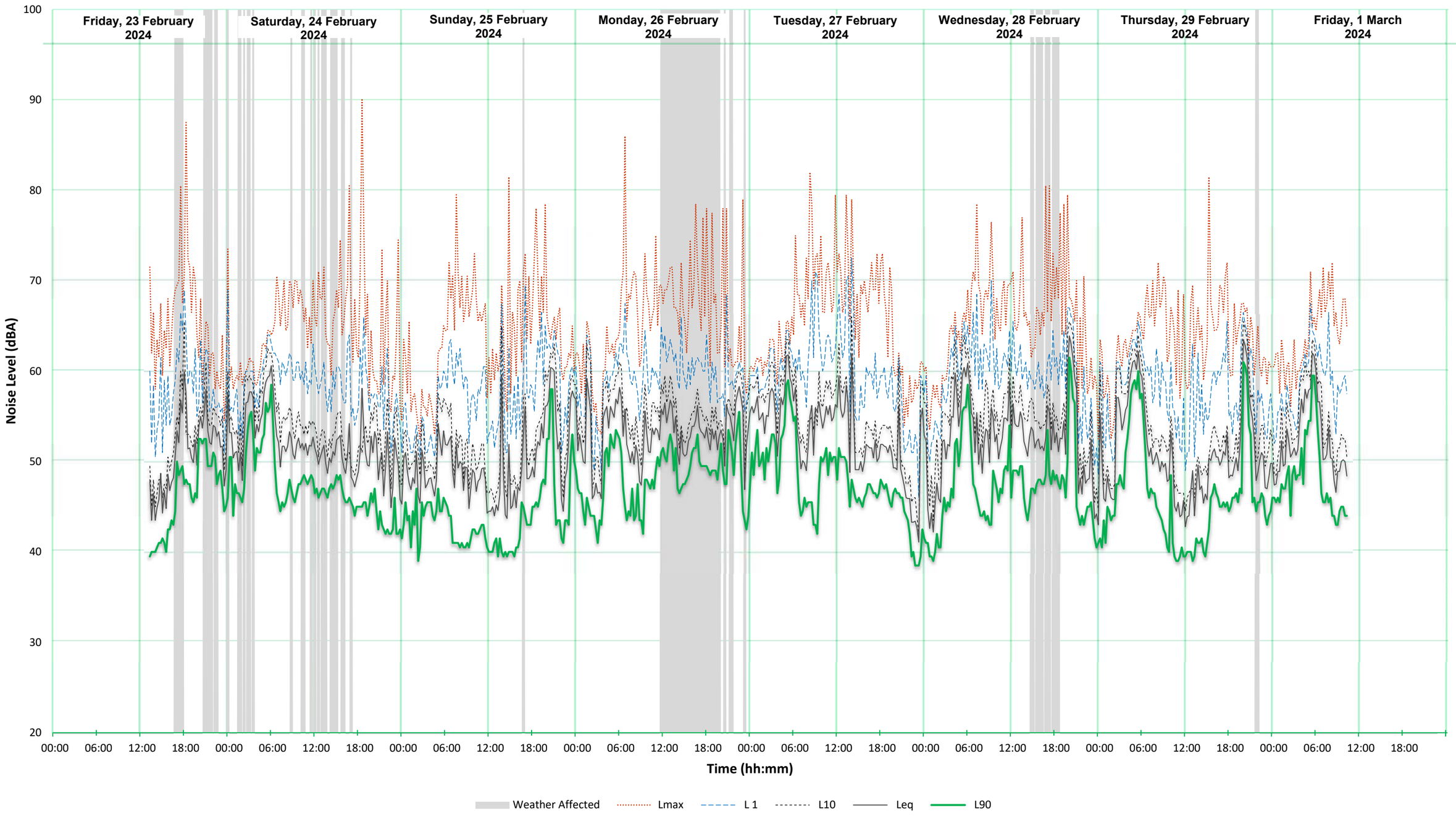
An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The Infobyte Noise Monitor iM4 is a Type 2 (#113) precision environmental noise monitors meeting all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

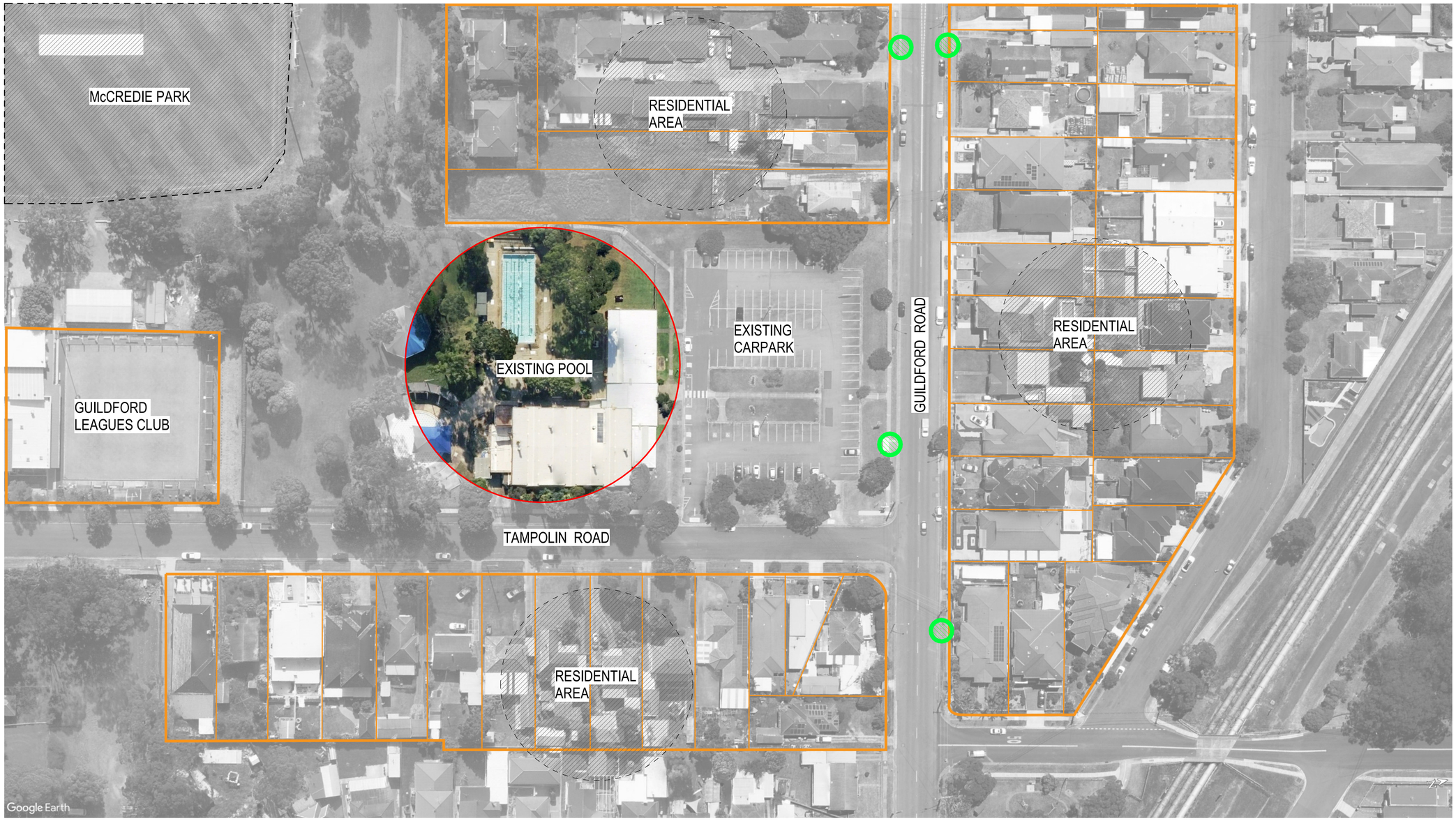
All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 1 dB during unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

Located at Front yard, 8 Tamplin Rd, Guildford, NSW



Located at Rear yard, 522 Guildford Rd, Guildford, NSW





1 PLAN BLOCK ANALYSIS PLAN
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LEGEND

BUS STOPS

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E	FROZEN ARCHITECTURE SET			21/06/2024
F	FROZEN ARCHITECTURE SET			24/06/2024
G	FROZEN ARCHITECTURE SET			25/06/2024
H	FROZEN ARCHITECTURE SET			26/06/2024

STATUS
DEVELOPMENT APPLICATION

0m 1 2 3 4 5

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PROJECT
GUILDFORD POOL MODERNISATION PROJECT
LOT 21, DP 1018330, 1 TAMPLIN ROAD, GUILDFORD

DRAWING TITLE
BLOCK ANALYSIS PLAN

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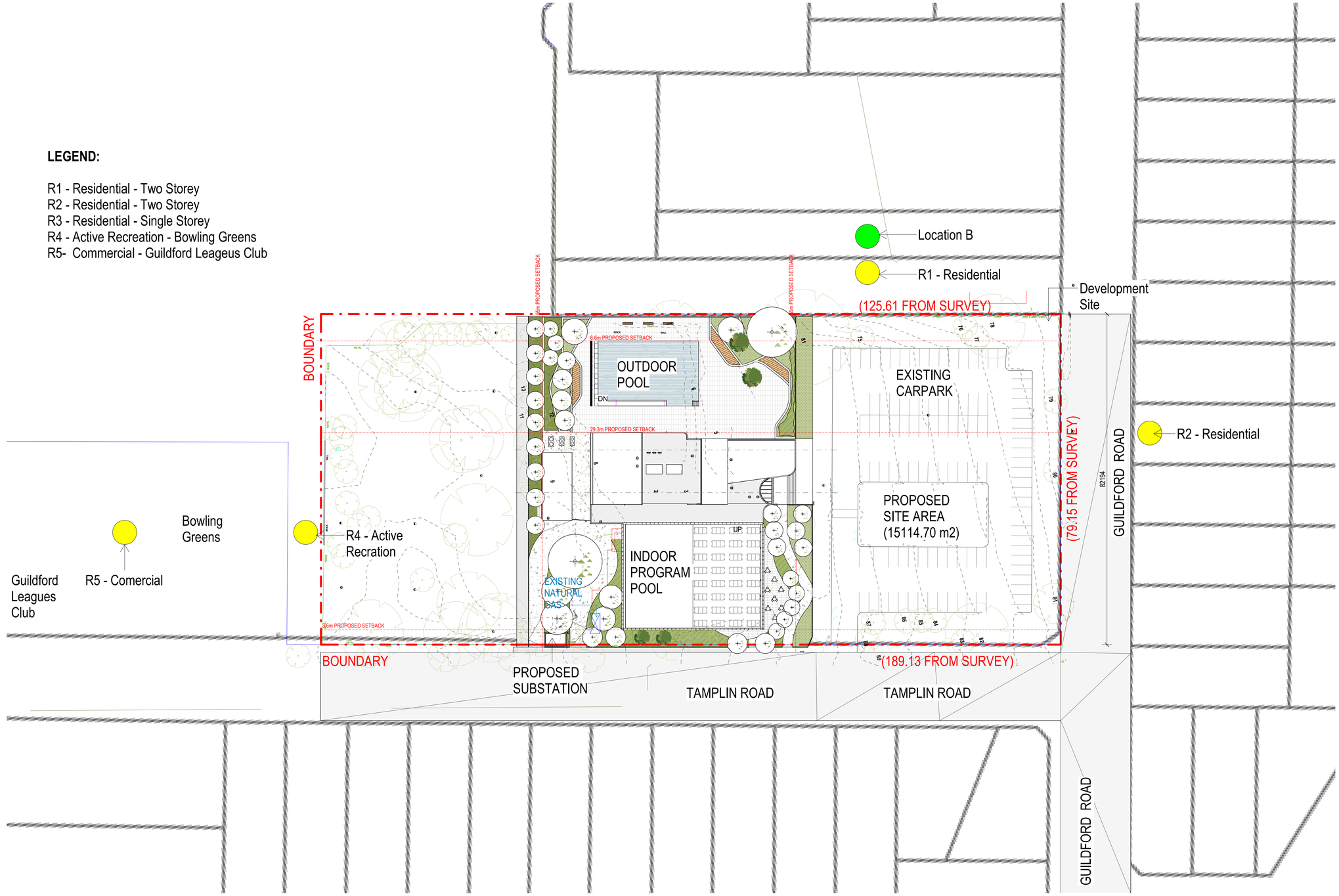
26/06/2024 2:14:52 PM

LEGEND:

R1 - Residential - Two Storey
R2 - Residential - Two Storey
R3 - Residential - Single Storey
R4 - Active Recreation - Bowling Greens
R5- Commercial - Guildford Leageus Club



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F	FROZEN ARCHITECTURE SET			24/06/2024
G	FROZEN ARCHITECTURE SET			25/06/2024
H	FROZEN ARCHITECTURE SET			26/06/2024

STATUS: DEVELOPMENT APPLICATION
0m 1 2 3 4 5

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PROJECT: GUILDFORD POOL MODERNISATION PROJECT
LOT 21, DP 1018330, 1 TAMPLIN ROAD, GUILDFORD

DRAWING TITLE: SITE PLAN
SITE PROPOSED AREA: 15114.70m²

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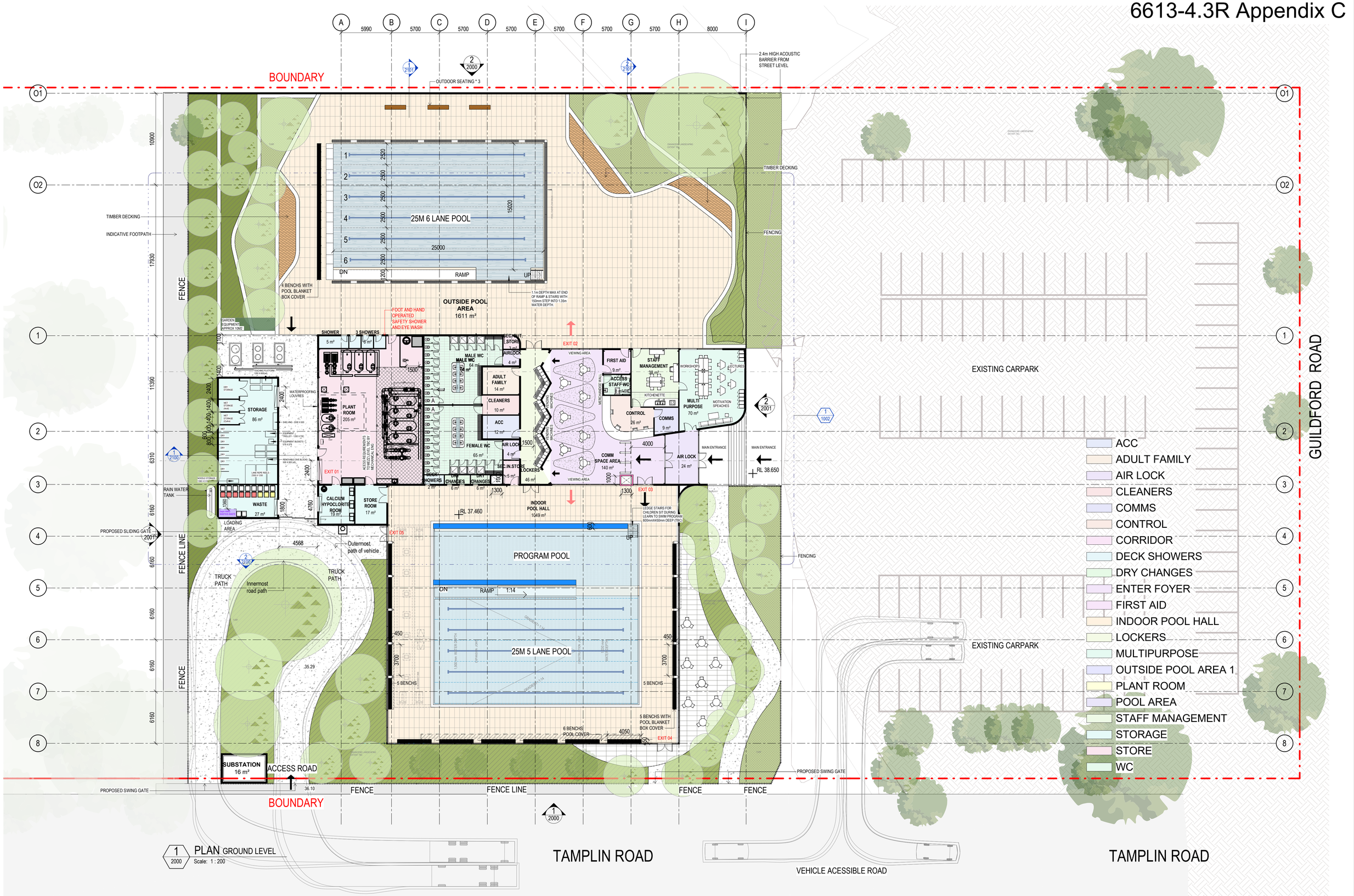

1 2000 PLAN GROUND LEVEL
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H	FROZEN ARCHITECTURE SET			21/06/2024
I	FROZEN ARCHITECTURE SET			24/06/2024
J	FROZEN ARCHITECTURE SET			25/06/2024
K	FROZEN ARCHITECTURE SET			26/06/2024

STATUS
DEVELOPMENT APPLICATION

0m 1 2 3 4 5

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PROJECT
GUILDFORD POOL MODERNISATION PROJECT
LOT 21, DP 1018330, 1 TAMPLIN ROAD, GUILDFORD

DRAWING TITLE
GA PLAN - GROUND LEVEL

DRAWN	CHECKED
IZ	MW
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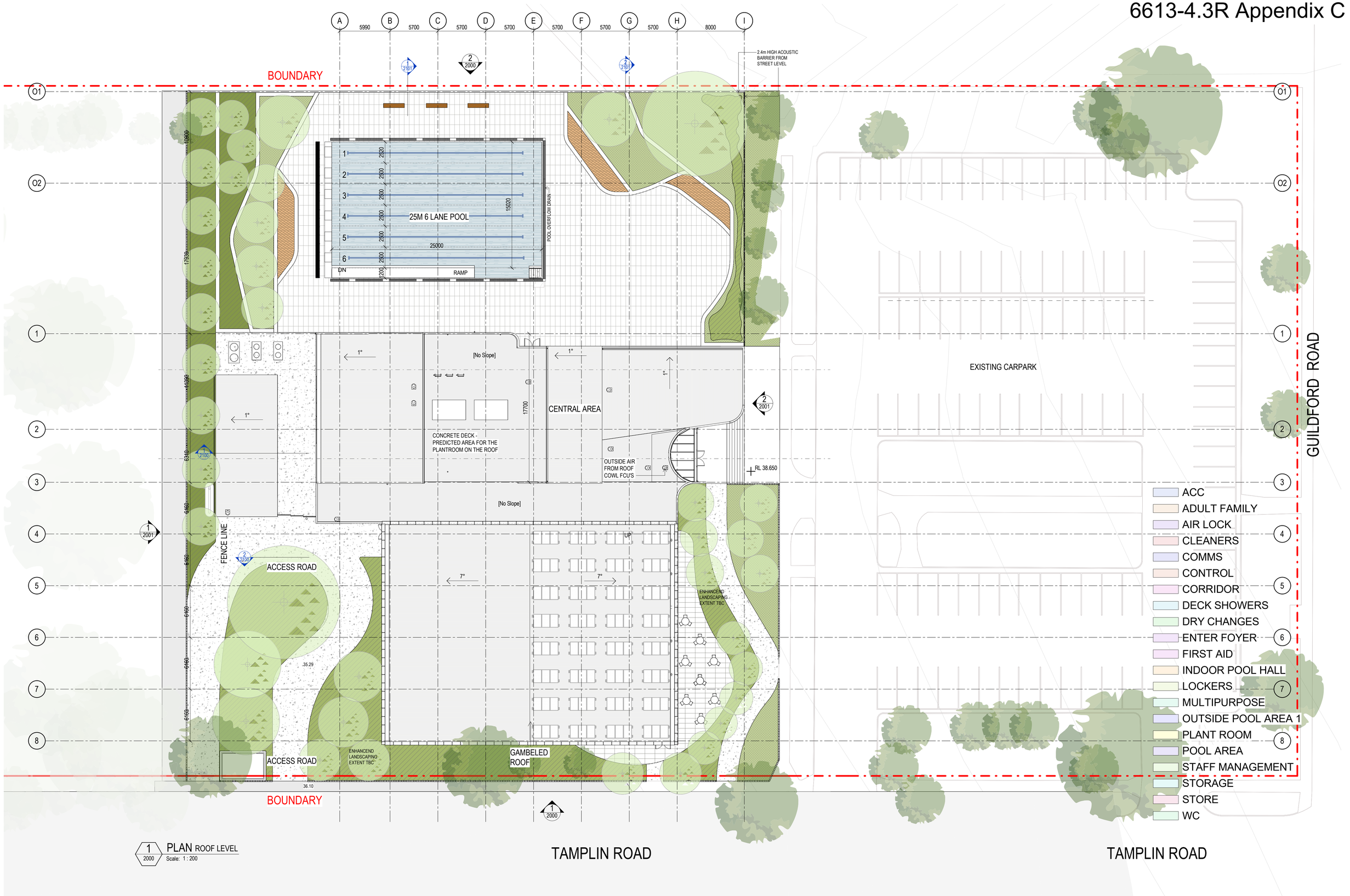
26/06/2024 2:18:15 PM



1 / 2000 PLAN ROOF LEVEL
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H	FROZEN ARCHITECTURE SET			25/06/2024
I	FROZEN ARCHITECTURE SET			26/06/2024

STATUS
DEVELOPMENT APPLICATION

0m 1 2 3 4 5

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PROJECT
GUILDFORD POOL MODERNISATION PROJECT
LOT 21, DP 1018330, 1 TAMPLIN ROAD, GUILDFORD

DRAWING TITLE
GA - ROOF PLAN

DRAWN	CHECKED
IZ	MW
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26/06/2024 2:21:30 PM

GLOSSARY OF ACOUSTICAL TERMS

ACOUSTICAL – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

AMBIENT NOISE – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

AUDIBLE – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:
"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".

It follows that the word "audible" in an environmental noise context means "clearly audible".

BACKGROUND NOISE LEVEL – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the L_{A90} or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels (L_{A90}) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure (L_{A90}) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of L_{90} background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

DECIBEL – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

dBA – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

dBC – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

EQUIVALENT CONTINUOUS NOISE LEVEL, L_{Aeq} – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or L_{Aeq} sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the L_{Aeq} noise level.

FREE FIELD – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

FREQUENCY – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

IMPACT ISOLATION CLASS (IIC) – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

IMPACT SOUND INSULATION ($L_{nT,w}$) – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

INTRUSIVE NOISE LEVEL, L_{Aeq} – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

LOUDNESS – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

MAXIMUM NOISE LEVEL, L_{Amax} – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the L_{Amax} noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

NOISE RATING NUMBERS – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

NOISE – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient".

OFFENSIVE NOISE - (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) 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, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T_{60} – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α – α Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

SOUND ATTENUATION – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

SOUND EXPOSURE LEVEL (SEL) – The total sound energy of a single noise event condensed into a one second duration or in other words it is an L_{eq} (1 sec).

SOUND PRESSURE LEVEL, L_p – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and P_o is a reference sound pressure of 20 µPa. L_p varies with distance from a noise source.

SOUND POWER LEVEL, L_w – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

SOUND TRANSMISSION CLASS (STC) – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

SOUND TRANSMISSION LOSS – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL EXCEEDENCE SOUND LEVELS, L_{A90}, L_{A10}, L_{A1}, etc – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The L_{A90} is the dBA level exceeded for 90 % of the time. In NSW the L_{A90} is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The L_{A10} is the dBA level that is exceeded for 10 % of the time. In NSW the L_{A10} measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the L_{Aeq} for describing level-varying noise.

The L_{A1} is the dBA level that is exceeded for 1 % of the time. In NSW the L_{A1} may be used for describing short-term noise levels such as could cause sleep arousal during the night.

STEADY NOISE – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

WEIGHTED SOUND REDUCTION INDEX, R_w – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

WHITE NOISE – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.