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Equinix

Equinix SY 03

Acoustic Assessment Report

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Acoustic Assessment Report

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Contents

Appendices

1 Introduction

Arup Acoustics has been engaged by Equinix to conduct an acoustic assessment to accompany the development application to City of Botany Bay Council for the proposed use of Unit A at 639 Gardeners Road, Mascot as an internet exchange centre, to be known as the Equinix SY 03 centre.

Equinix currently operates internet exchange centres in Unit B (SY 01) and Unit C (SY 02) at 639 Gardeners Road, Mascot. Arup Acoustics has previously provided acoustic advice to Equinix regarding the design for the SY 02 centre, and for remedial acoustic treatment for centre SY 01.

The main acoustic objective for the design of SY 03 is to avoid any noise creep from the Equinix site. This means that the new data centre will be designed such that current noise levels from the site will not increase as a result of the introduction of SY 03.

This report presents appropriate design criteria for the SY 03 centre, including internal design criteria for various areas, and a discussion of environmental noise criteria for noise from the centre to surrounding noise-sensitive receivers.

2 Site Description

Since Equinix began operation at 639 Gardeners Road, the land use and zoning of the surrounding area has changed from industrial to mixed industrial and residential. The site at 639 Gardeners Road is surrounded by major roads to the north (Gardeners Road) and west (Bourke Street), by a local road (Church Avenue) to the south, and by a medium-rise residential development to the east.

Surrounding land uses are a mixture of industrial (to the north and west of the site), and residential (to the east and south of the site). The closest and most-sensitive receiver for noise emitted from the SY 03 centre is an apartment block located immediately to the south-east of the proposed SY 03 centre. The nearest part of the apartment block is located approximately 10 m from the south-east corner of SY 03.

This receiver is approximately 6 storeys in height, and residences on upper floors of this receiver are likely to overlook the proposed new SY 03 centre. This means that there may be direct line-of-sight from rooftop noise sources to upper-floor receivers, which may cause these upper-floor receivers to experience increased noise levels compared to ground-floor receivers.

The Equinix site already has two data centres currently operating, SY 01 and SY 02. SY 01 is the original data centre and is located immediately adjacent to the south of the proposed SY 03 centre. SY 02 has been recently completed and is up and running and located to the south of SY 01. Therefore SY 01 separates and shields SY02 and the proposed SY 03 from each other. This means that the introduction of SY 03 to the Equinix site is unlikely to add to the noise emission from SY 02. Whereas, given the close proximity of SY 01 and SY 03 to each other and the nearest noise sensitive receivers, SY 01 and SY 03 should be considered as a single source.

3 Noise Survey

A noise survey was conducted during April 2009 to determine the current ambient noise environment in the vicinity of the Equinix site and to assist in developing appropriate environmental noise criteria for the SY 03 centre.

Arup Acoustics has conducted several previous noise surveys at the Equinix site as part of work on SY 01 and SY 02; however since these surveys the SY 02 centre has been completed and commissioned and some remedial acoustic works have been conducted on SY 01, and therefore an additional noise survey was required to accurately represent the existing acoustic environment. Any existing noise from SY 01 and SY 02 is therefore included in the noise survey results.

Attended and unattended noise measurements were conducted during the survey, and the characteristics of the ambient noise environment were noted. Measurements were conducted at the eastern boundary of 639 Gardeners Road, Mascot, between the existing "Skilled" premises (currently occupying Unit A) and the SY 01 centre in Unit B. The logger location is shown in Figure 1:

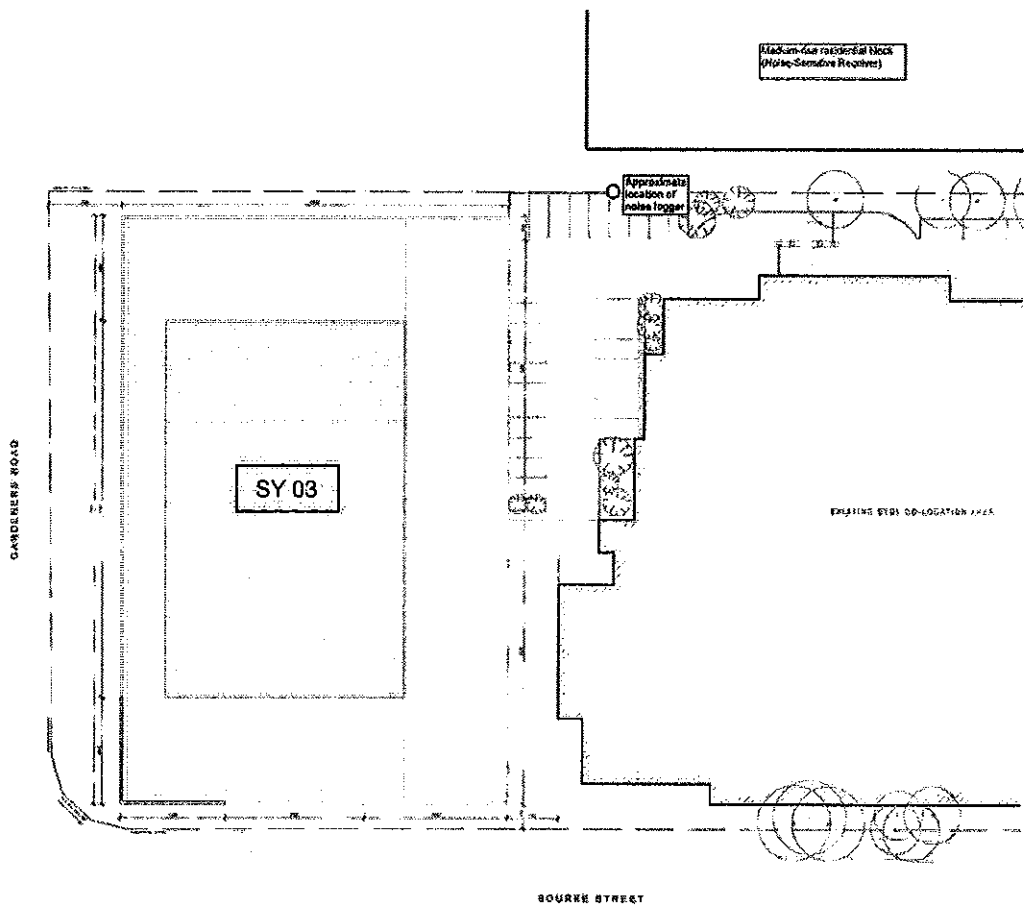

Figure 1: Site Plan of SY 03 showing approximate location of noise logger and nearest noise-sensitive receiver

A RTA Technology unattended noise logger was set up on the eastern site boundary from 6 April 2009 to 11 April 2009. The L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} statistical noise level parameters were recorded over 15 minute intervals continuously for the measurement period (See Appendix A for a glossary of acoustic terminology). Weather patterns were noted during this period and where noise levels were affected the data was not used. The logger was

checked for calibration before and after the monitoring period, and no significant drift in calibration occurred.

Average noise levels over the noise survey period are presented in Figure 2.

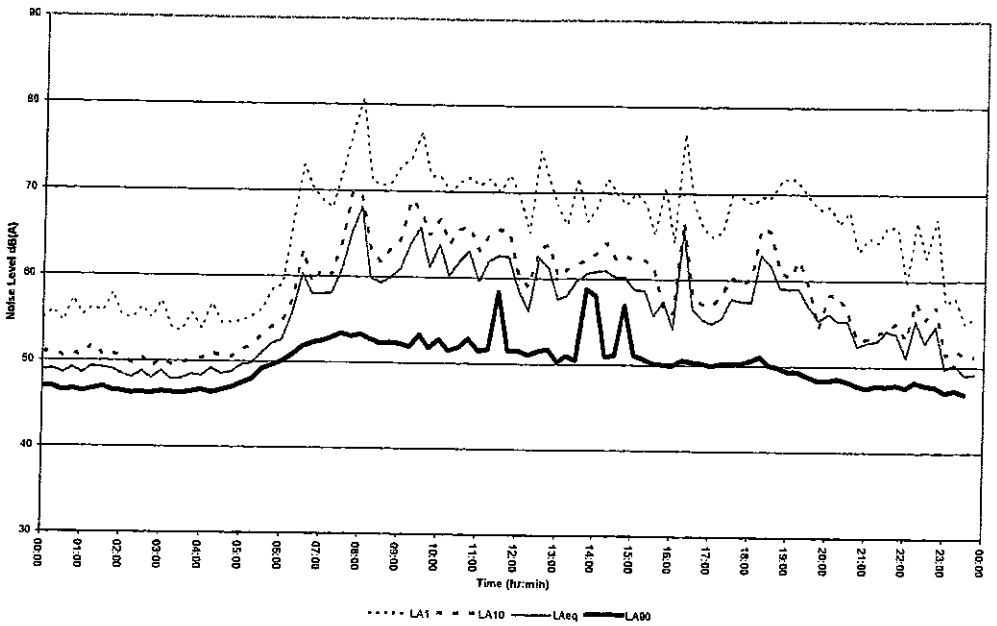

Figure 2: Average Noise Levels at Site Boundary of 639 Gardeners Road, 6 April 2009 to 11 April 2009, dB re 20µPa

Generally, the acoustic environment at the site boundary between the Equinix site and the nearest noise-sensitive receiver is characterised by constant plant noise from Equinix SY 01 and SY 02, transportation noise from aircraft flyovers and traffic on Gardeners Road and Bourke Street, and general domestic noise from the adjacent apartments.

Due to the location of the receivers adjacent to busy roadways and in industrial areas, the ambient noise environment is best characterised as an "urban" area according to the NSW Industrial Noise Policy (INP).

During the night time period, which is likely to be the period during which the greatest impact to residents may be expected, the background noise levels (represented by the L_{A90} noise parameter was essentially constant at approximately 47-48 dB(A). This is likely to be due to existing mechanical plant noise from SY 01, which is typically steady-state, however traffic noise on adjacent roads is also expected to contribute to the measured background noise levels.

Furthermore, the measured L_{A1} noise level, which represents short-duration noise events, was approximately 10 dB(A) above the background noise level throughout the night time period. This indicates that the night-time noise environment at the site boundary also features short-term noise events (likely to be traffic pass-bys) and therefore the measured L_{Aeq} noise level is a combination of noise from existing industrial sources and traffic noise.

The existing noise exposure from industrial noise sources is an important parameter in determining noise criteria according to the INP. As discussed above, due to the presence of traffic noise impacts, the measured L_{A90} noise level is the most appropriate descriptor for the "industrial noise level" at the site boundary.

4 Noise Criteria

4.1 Internal Design Criteria

Recommended satisfactory and maximum internal noise levels and reverberation times for various types of building occupancy are given in AS2107. The AS2107 internal noise levels apply to steady-state background noise within the building occupancy, such as mechanical services noise.

For the co-location area, there is no specific guidance in AS2107. For "industrial processing or manufacturing areas", AS2107 recommends noise levels be below 70 dB(A). For SY 02, noise levels in the co-location area were designed to 65 dB(A). This is considered an appropriate criterion for SY 03.

Recommended internal design levels for various spaces for the Equinix development are presented in Table 1. In general, Arup Acoustics recommends designing to the maximum sound levels.

Type of Occupancy	Recommended Sound Level, dB L_{Aeq}	
	Satisfactory	Maximum
Foyer	40	45
Meeting Rooms	30	40
Control Rooms	50	60
Co-Location	N/A	65
Loading Dock	55	65

Table 1: Recommended Internal Design Sound Levels, dB L_{Aeq}.

4.2 Existing Equinix Consent Conditions

4.2.1 SY 01 (Unit B)

The existing noise criteria for SY 01 in Unit B of 639 Gardeners Road, specified in DA 01/113 are given in Condition 4 Clauses (a) and (b):

(a) *The L_{Aeq} 15min sound pressure level emitted from the operation of the diesel generators shall not exceed **55 dB(A)**, when assessed at or on any other property.*

(b) *The cumulative L_{Aeq} 15min sound pressure level emitted from the operation of all plant and equipment installed on the site, excluding the diesel generators, shall not exceed **50 dB(A)**, when assessed at or on any other property.*

4.2.2 SY 02 (Unit C)

The criteria for SY-03 are stated in *The City of Botany Bay NSW Environmental Planning and Assessment Act, 1979, Section 96(1A), Modification of Development Consent No. 08/071, Clause 22(e):*

(i) *The operation of all plant and equipment shall not give rise to an equivalent continuous (L_{Aeq}) sound pressure level at any point on any residential property on any residential property shall not give rise to a sound pressure level at any point on any residential property greater than 5 dB(A) above the existing background L_{A90} level (in the absence of the noise under consideration).*

(ii) *(1) The operation of all plant and equipment when assessed on any residential property shall not give rise to a sound pressure level that exceeds L_{Aeq} **50 dB(A)** day time and L_{Aeq} **48 dB(A)** (DA08/071/01) night time.*

(2) The spectral allowance of 5 dB(A) noted in (i) above is not applicable to the assessment of this condition. (DA08/071/01)

(iii) *The operation of all plant and equipment when assessed on any neighbouring commercial/industrial shall not give rise to a sound pressure level that exceeds L_{Aeq} 65 dB(A) day time/ night time.*

For assessment purposes, the above L_{Aeq} sound level shall be assessed over a period of 10-15 minutes and adjusted in accordance with DECC (formerly EPA) guidelines for tonality, frequency, weighting, impulsive characteristics, fluctuations and temporal content where necessary.

4.3 City of Botany Bay Standard Noise Criteria

The City of Botany Bay Standard Noise Criteria adopted by the council 23 May 2001 sets the minimum acoustical requirements that any proposed development must achieve as a minimum to ensure that acoustical amenity is provided.

Standard Noise Criteria adopted by Council are:

- *The operation of all plant and equipment shall not give rise to an equivalent continuous (L_{Aeq}) sound pressure level at any point on any residential property greater than 5dB(A) above the existing background L_{A90} level (in the absence of the noise under consideration).*

- *The operation of all plant equipment when assessed on any residential property shall not give rise to a sound pressure level that exceeds **L_{Aeq} 50dB(A)** day time and **L_{Aeq} 40dB(A)** night time.*

- *The operation of all plant and equipment when assessed on any neighbouring commercial/industrial premises shall not give rise to a sound pressure level that exceeds L_{Aeq} 65dB(A) day time/night time.*

4.4 Industrial Noise Policy

The New South Wales environmental noise policy relating to industrial noise is the *New South Wales Environment Protection Authority Industrial Noise Policy* (INP) dated January 2000, which covers noise emission from plant and equipment on the proposed facility. The INP serves as guidance to other regulatory authorities (including Councils).

The objective of the INP is to protect residential areas from noise generated by commercial, industrial or trade premises. Noise limits are set based on land use in the area and existing background noise levels. Compliance is achieved if the adjusted L_{eq} noise level at any residence affected by noise from the facility is below the noise limit. The adjusted L_{eq} is determined by applying corrections for such noise characteristics as duration, intermittency, tonality, and impulsiveness.

The assessment of noise emission under INP is based on the calculation of a noise limit at a receiver position, taking into account the land-use in the surrounding area and the background noise level.

INP separates the day into three different time periods – day, evening and night. These time periods are detailed in Table 2.

Period	Day of Week	Time period
Day	Monday-Saturday	0700-1800hrs
	Sunday, Public Holidays	0800-1800hrs
Evening	Monday-Sunday	1800-2200hrs
Night	Monday-Saturday	2200-0700hrs
	Sunday, Public Holidays	2200-0800hrs

Table 2 – INP Time Periods

The INP provides guidance on acceptable noise levels from the introduction of new industrial noise sources to an area. The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences.
- Protecting noise level amenity for particular land uses such as residences and commercial offices etc.

Both of these components result in noise criteria that should not be exceeded in order to avoid any adverse noise impacts on the affected areas. Both criteria should be taken into account when assessing the noise impact of industrial source(s) associated with the proposed development, and where the intrusiveness and the amenity criterion differ, the lower of the noise criteria should be adopted as the project-specific noise criterion.

4.4.1 Intrusiveness Criterion

A 15-minute sampling period is typically used when measuring the level of intrusive noise. This is taken to be a reasonable estimate of the period over which annoyance may occur. Therefore the intrusiveness criterion is summarised as follows:

$L_{Aeq\ (15\ min)} \leq L_{A90\ (15\ min)}$ Background Level + 5 dB

Because of the variable nature of background noise levels, the INP specifies single number background noise levels for use in setting the intrusiveness noise criterion. The Assessment Background Level (ABL) for each time period of a day is the level exceeded by 90 % of the $L_{A90,15min}$ measurements. The Rating Background Level (RBL) for a particular time period is the median of the ABL values for that time period for each day of the measurement period.

Noise from mechanical plant from the subject building should be controlled to not exceed the Rating Background Level (RBL) + 5 dB at the boundary of any noise sensitive receiver.

Location	Time Period	RBL	Intrusiveness Criterion
		dB(A)	RBL + 5 dB(A)
Eastern Boundary of 639 Gardeners Road	Day	50	**55**
	Evening	48	**53**
	Night	46	**51**

Table 3 – Intrusiveness criteria along boundary of proposed new facility

4.4.2 Amenity Criterion

Criteria for the protection of amenity are given for various types of receiver and different times of the day. The amenity criterion is set so that the L_{Aeq} noise level from the industrial noise source does not increase the total industrial noise levels at the receiver above the acceptable noise level (ANL) for that receiver.

The amenity criterion is set based on how close the existing average L_{Aeq} industrial noise levels are to the ANL, using the adjustment factors given in Table 2.2 of the INP.

In cases where the existing $L_{Aeq,average}$ noise levels exceed the ANL by more than 2 dB(A), and the existing noise levels are unlikely to decrease in future, then the amenity criterion is set to be 10 dB(A) lower than the existing noise levels at the receiver. This is to prevent a creeping background noise environment.

Note that the L_{Aeq} industrial noise level is not necessarily the measured L_{Aeq} noise level from a noise logger or attended measurements; in cases where the existing industrial noise

sources are steady-state the measured L_{A90} noise level may be a better representation of the existing industrial noise levels.

As discussed in Section 3, the existing industrial noise exposure at the eastern site boundary of 639 Gardeners Road is essentially steady-state, and therefore the measured L_{A90} values from the noise logger have been used to represent the $L_{Aeq,average}$ from industry.

A summary of the amenity criteria using data from the loggers is presented below:

Noise Sensitive Receiver	Time period	Existing dB L_{Aeq}*	ANL** dB L_{Aeq}	Modification to acceptable noise limit***	Amenity Criterion Existing L_{Aeq} + modification of ANL dB L_{Aeq}
Eastern Boundary of 639 Gardeners Road	Day	52	60	ANL-0 dB	**60**
	Evening	49	50	ANL-6 dB	**44**
	Night	48	45	L_{Aeq} – 10 dB	**38**

* Measured L_{A90} noise levels from logger used to represent L_{Aeq} noise levels as existing industrial noise is quasi-stationary

** Acceptable Noise Level, according to Table 2.1 (NSW Industrial Noise Policy, 2000)

***According to Table 2.2 (NSW Industrial Noise Policy, 2000)

Table 4 Derivation of Amenity Criteria for Residential Receivers

4.4.3 Industrial Noise Policy Project Specific Noise Level

The most stringent of the intrusiveness and the amenity criteria is the limiting criterion according to the INP, and sets the Project Specific Noise Level to be met by the development of SY 03. Table 5 compares the intrusiveness and the amenity criteria at the Noise Sensitive Receivers, and identifies the PSNL for each time period.

Noise Sensitive Receiver	Time Period	Intrusiveness Criterion	Amenity Criterion	Project Specific Noise Level (PSNL)
Eastern Boundary of 639 Gardeners Road	Day	55	60	**55**
	Evening	53	44	**44**
	Night	51	38	**38**

Table 5 Project Specific Noise Level, dB L_{Aeq}

The most stringent noise criteria over all time periods would normally be adopted as the Project Specific Noise Level for the proposed development. Table 5 shows that for the Evening and Night time periods, the amenity criterion is the PSNL.

4.4.4 Comparison of Operational Noise Criteria

The most stringent criterion for operational noise from Equinix SY 03 is the amenity criterion for the night time period from the Industrial Noise Policy, which is 38 dB(A) at the site boundary (approximately 10 m from the proposed SY 03 building).

This is 2 dB(A) more stringent than the City of Botany Bay Standard Noise Criteria, which has as a limiting value of 40 dB(A) (the background + 5 dB(A) criterion of the City of Botany Bay criteria is equivalent to the Intrusiveness criterion in the Industrial Noise Policy).

Both these criteria are approximately 10 dB(A) more stringent than the criteria adopted for Equinix's existing operations in SY 01 and SY 02, which are 50 and 48 dB L_{Aeq} respectively

The amenity criterion of the INP is more stringent when calculated for SY 03 than when previously calculated for SY 02 (i.e. in Arup's SY 02 *'Acoustic Report with Reference to Noise Conditions in DA 08/071' dated February 2008)*, primarily due to the existing noise exposure from the adjacent SY 01centre (SY 02 is not considered to add to the noise environment at the location of the noise logger set up close to the proposed SY 03 location).

However, based on previous experience from SY 01 and SY 02, it is considered difficult to achieve a noise level of 38-40 dB(A) at 10 m from the centre, given that the existing SY 02 centre is designed to meet 48 dB(A) at 30 m using all feasible and reasonable noise mitigation measures.

Nevertheless, a commitment to avoid noise creep from the site will be made and all reasonable and practical efforts to achieve this shall be employed.

Since the long term noise survey undertaken for this SY 03 DA noise assessment shows that the existing noise emission from the Equinix site at the site boundary nearest the closest noise sensitive receiver is 47 – 48 dB(A), it follows that SY 03 should be designed to emit a minimum of 10 dB(A) less in order to not increase the overall noise emissions for Equinix operations on the site.

This results in a noise target for SY 03 of 38 dB(A), as shown by the INP assessment.

4.4.5 Emergency Equipment

Criteria for control of environmental noise from SY 03 are not given in the City of Botany Bay Standard criteria, the Industrial Noise Policy, or the consent conditions for SY 02.

The consent conditions for SY 01 included a separate criterion for noise from diesel generators of 55 dB(A), compared to the "operational noise" criterion of 50 dB(A).

A criterion of 55 dB(A) for emergency equipment from SY 03 is considered to be an achievable and reasonable criterion. It is also in keeping with the emergency criteria used by Equinix's existing operations. Given that emergency events (by definition) do not form part of the typical operation of the Equinix site, an increased criterion for emergency equipment noise is considered reasonable. However, regular testing of the generators will occur, but for short durations and not every day. Further, testing of more than one centre is not expected to occur at the same time

4.4.6 Summary of Environmental Noise Criteria

Table 6 presents a comparison of the environmental noise criteria for Equinix SY 03:

Noise Source	Time Period	SY 01 DA Conditions Criteria (§ 4.2.1)	SY 02 DA Conditions Criteria (§ 4.2.2	Industrial Noise Policy Criteria (§ 4.4.3)	Botany Bay Standard Criteria (§ 4.3)
Operational Noise	Day	50	50	55	50
	Evening	50*	50*	44	50*
	Night	50	48	38	40
Emergency Noise	N/A	55	N/A	N/A	N/A
Testing	N/A	55***	N/A	N/A	N/A

* *City of Botany Bay criteria do not define criteria for evening time periods, or define the hours of operation for "day" and "night" periods. Day criteria considered reasonable to apply for evening time periods.*

Table 6: Summary of Potential Environmental Noise Criteria for Equinix SY 03.

4.5 Recommended Criteria

As discussed in Section 4.4.4 it is likely to be challenging to meet the Industrial Noise Policy criterion at night time as SY 03 must be designed to emit noise that is at least 10 dB(A) below the existing noise level from the Equinix site, measured at 47-48 dB(A).

The guidance of the Department of Environment and Climate Change (DECC) states that the criteria of the Industrial Noise Policy may not always be the most suitable criteria for a development:

> *It is important that the project-specific noise levels are not automatically interpreted as conditions for consent, without consideration of other factors. In many instances, it may be appropriate to set noise limits for a development above the project-specific noise levels.*
>
> *(Section 1.4.7, Industrial Noise Policy)*

Despite this guidance from the INP, the overriding noise target is to avoid 'noise creep' in the area. This means that the total noise emission at the boundary of the Equinix site should not exceed that currently existing from the operation of SY 01 and SY 02.

Therefore, the proposed noise criteria for SY 03 are recommended to be:

- *The noise emission from all operational plant on the Equinix site when measured on the Equinix site boundary should not exceed* ***48 dB*** $L_{Aeq,15\ minutes}$
- *The noise emission from all emergency plant on the Equinix site when measured on the Equinix site boundary should not exceed* ***55 dB*** $L_{Aeq,15\ minutes}$

5 Predicted Noise Levels

5.1 Proposed Methodology

Detailed predictions of noise levels from major items of mechanical plant at SY 03 have not yet been made at the nearest noise-sensitive receiver locations to the SY 03 site. This is because plant selection and configuration is yet to be confirmed. However, detailed calculations will be undertaken in due course and all practical and reasonable noise control will be applied to SY 03 to ensure that the total noise emission from the Equinix site does not increase above current levels.

Noise levels from equipment at SY 03 will be predicted at high and low level receivers taking into account the source-receiver separation, any directivity of noise sources, any screening provided by the building elements, and any reflections off the ground or the SY 01 façade. Façade reflections from the receiver façade will not be included as the proposed criteria will be at the Equinix site boundary rather than at the façade of the receiver building.

5.2 Noise Sources to be Considered

Major noise sources from plant and equipment proposed for SY 03 with a high risk of causing adverse impact to surrounding receivers are expected to be as follows:

- Four cooling towers (second floor/rooftop exhaust)
- Four chillers (first floor)
- 21 Air-Handling Units (rooftop exhaust)
- Load bank (second floor/rooftop exhaust)
- Six transformers (ground floor)
- Six generators/ generator radiator fans (second floor/rooftop exhaust)

Modifying factors to account for the character of some types of noise will be applied according to the guidance given in Section 4 of the INP.

Other noise sources, such as ventilation or exhaust fans, considered to have a lower risk of adverse impact will also be considered as part of detailed design of the SY 03 centre.

The following scenarios to represent the expected operational modes of plant at Equinix, are presented in Table 7:

Scenario	Noise Sources
Operational	Cooling Towers
	Chillers
	Air-Handling Units
	Transformers
Emergency	Cooling Towers
	Chillers
	Air-Handling Units
	Transformers
	6 Generators
Testing	Cooling Towers
	Chillers
	Air-Handling Units
	Transformers
	Load Bank
	1 Generator

Table 7: Operational Scenarios for Noise Predictions

5.3 Noise Control Measures

Previous experience on SY 02 and SY 01 suggests that extensive noise control measures would be required for SY 03, given the close proximity of noise-sensitive receivers. Attenuators/silencers and/or acoustic louvres are expected to be required on all air intake/exhaust paths for equipment.

Selection of noise control measures must consider also consider other non-acoustic issues such as, the effect of the noise control measures on the efficiency of the mechanical/electrical plant (which will put an upper limit on the allowable pressure drop through the noise control devices), and the physical constraints of the architectural design of the facility.

Therefore, at the present stage of design, it is not possible to finalise details about the length or pressure drop of attenuators/acoustic louvres, as these will require coordination with the mechanical, electrical and architectural design of SY 03.

However, noise control measures should be incorporated into the SY 03 design for these items of plant from the earliest design phase, but with final selection of these measures to be confirmed during detailed design.

The acoustic design for the remedial works on SY 01 included the use of a rooftop parapet/noise barrier to enclose rooftop plant. This was considered to be an effective noise-control treatment, and therefore a parapet enclosing the rooftop plant areas has been included as part of the noise-control scheme for SY 03. The proposed barrier extent is shown in Figure 3:

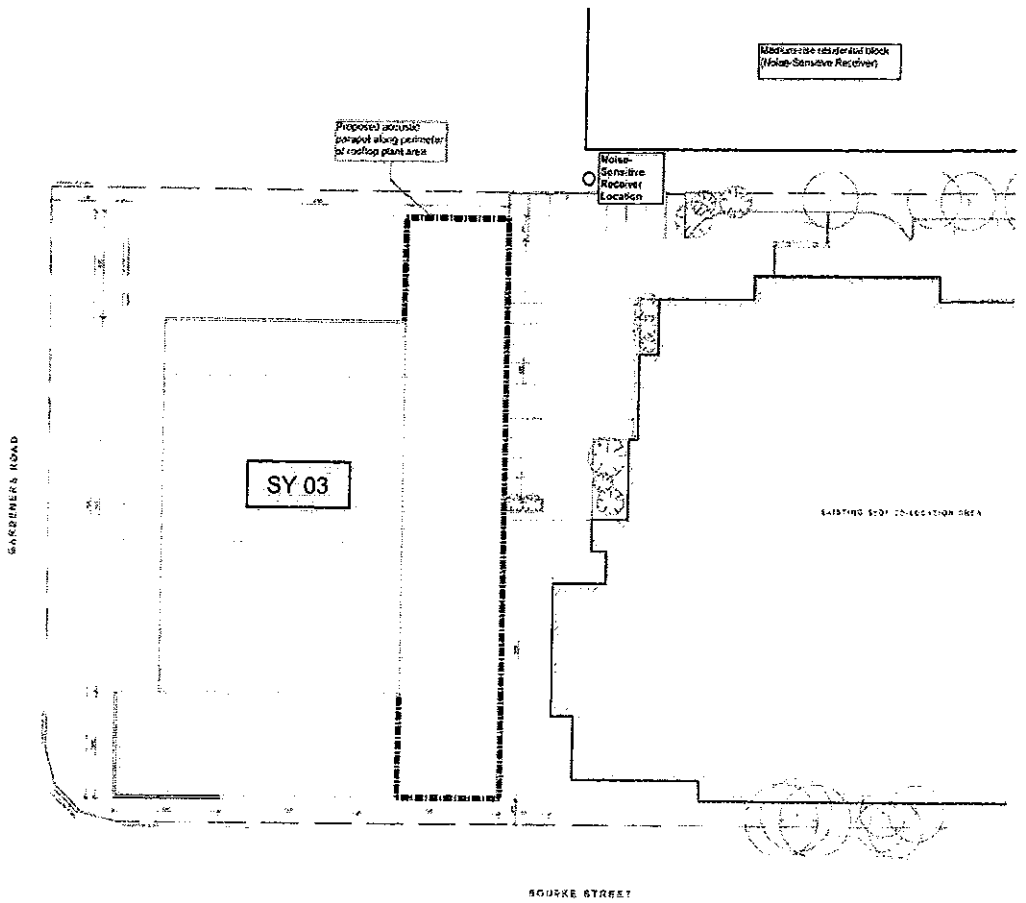

Figure 3: Proposed Rooftop Parapet Extent, Equinix SY 03.

A 4 m barrier height above the second floor level, finishing at approximately the height of the ridgeline of the raised AHU central roof section on SY 03 is currently proposed.

6 Typical Noise Control Measures

The following noise control methods are similar to those currently installed in SY 02, and are therefore considered representative of the typical type of noise control required for SY 03, although a higher performance of noise control is likely to be required as SY 03 will be subject to more stringent design criteria. The extent of noise control required will be determined during detailed design.

6.1 General Noise Control Measures

An approximately 4 m high acoustic barrier/parapet around the rooftop (as shown in Figure 3) has been incorporated into the architectural design for SY 03. This will assist to reduce noise levels from rooftop plant (e.g. cooling tower and generator exhausts), and will also provide a degree of visual privacy for residents at high-level by breaking the line-of-sight to the rooftop plant.

To be effective as a noise barrier, the construction of this parapet/barrier must be at least 10-15 kg/m² surface density, and must be well-sealed with no gaps.

It may also be required to line the inside face of the barrier with absorptive material.

6.2 Cooling Towers

6.2.1 Intake

The intake louvres to the cooling tower plantroom will be fitted with an attenuator bank, combined with acoustic louvres if necessary. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made.

The cooling tower plantroom will be acoustically treated with acoustic absorption to reduce the reverberant build-up of noise within the plantroom.

6.2.2 Exhaust

The exhaust ductwork for the cooling towers will be fitted with attenuators. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made.

6.2.3 Wall

The external walls of the cooling tower plantroom should achieve at least R_w 45 performance. This can be achieved with 140 mm hollow concrete blockwork, or an approved equivalent construction.

6.2.4 Roof

The roof of the cooling tower plantroom should achieve at least R_w 40 performance. This can be achieved with a metal deck roof with a 13 mm high-density plasterboard ceiling and mineral fibre insulation in the ceiling void (e.g. Boral C16F system; CSR 860 system), or an approved equivalent construction.

6.3 Chillers

The wall of the chiller plantroom should achieve at least R_w 50 performance. This can be achieved with 110 mm solid concrete blockwork, or an approved equivalent construction.

6.4 Air-Handling Units

The exhaust ductwork for the air-handling units will be fitted with attenuators. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made and ductwork layouts are developed further.

The exhaust ductwork from the AHUs will discharge into a common discharge plenum, internally lined with 50 mm mineral fibre insulation, similar to the discharge plenum fitted on

the AHUs on Equinix SY 02. This will assist in reducing environmental noise levels from the AHUs.

6.5 Transformers

6.5.1 Louvres

The ventilation openings to the transformer rooms will be fitted with acoustic louvres.

Size and selection of the acoustic louvres will be confirmed during detailed design of SY 03 once equipment selections are made.

6.5.2 Wall

The external walls of the transformer plantrooms should achieve at least R_w 45 performance. This can be achieved with 140 mm hollow concrete blockwork, or an approved equivalent construction.

6.6 Load Bank

6.6.1 Intake

The intake louvres to the load bank plantroom will be fitted with an attenuator bank, combined with acoustic louvres if necessary. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made.

The load bank plantroom should be acoustically treated with acoustic absorption to reduce the reverberant build-up of noise within the plantroom.

6.6.2 Exhaust

The exhaust ductwork for the load bank will be fitted with attenuators. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made.

6.6.3 Wall

The external walls of the load bank plantroom should achieve at least R_w 50 performance. This can be achieved with 110 mm solid concrete blockwork, or an approved equivalent construction.

6.6.4 Roof

The roof of the load bank plantroom should achieve at least R_w 40 performance. This can be achieved with a metal deck roof with a 13 mm high-density plasterboard ceiling and mineral fibre insulation in the ceiling void (e.g. Boral C16F system; CSR 860 system), or an approved equivalent construction.

6.7 Generators

6.7.1 Intake

The intake louvres to the generator plantrooms will be fitted with an attenuator bank, combined with acoustic louvres if necessary. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made.

The generator plantrooms should be acoustically treated with acoustic absorption to reduce the reverberant build-up of noise within the plantroom.

6.7.2 Exhaust Flue

The exhaust flue for the generators will be fitted with primary and secondary residential-grade mufflers/silencers. Size and selection of silencers/mufflers will be confirmed during detailed design of SY 03 once equipment selections are made.

6.7.3 Radiator Fans

The exhaust ductwork for the radiator fans will be fitted with attenuators. Size and selection of attenuators will be confirmed during detailed design of SY 03 once equipment selections are made.

6.7.4 Wall

The external walls of the generator plantrooms should achieve at least R_w 50 performance. This can be achieved with 110 mm solid concrete blockwork, or an approved equivalent construction.

6.7.5 Roof

The roof of the generator plantrooms should achieve at least R_w 40 performance. This can be achieved with a metal deck roof with a 13 mm high-density plasterboard ceiling and mineral fibre insulation in the ceiling void (e.g. Boral C16F system; CSR 860 system), or an approved equivalent construction.

7 Conclusion

The acoustic impact of the proposed expansion of Equinix into Unit A of 639 Gardeners Road, Mascot (to be known as SY 03) has been assessed against appropriate criteria drawn from Equinix's previous consent conditions at 639 Gardeners Road, City of Botany Bay's Standard Noise Criteria, and the guidance of the NSW Department of Environment and Climate Change's Industrial Noise Policy.

The primary acoustic objective for the SY 03 data centre is to ensure that its introduction to the Equinix site does not cause 'noise creep'. That is, the total noise level from the Equinix site should not increase as a result of SY 03.

This means that SY 03 must be designed to be at least 10 dB(A) below the existing noise level from the Equinix site, which has been measured to be 48 dB(A).

To achieve this aim will require significant noise control design and is likely to consist of, as a minimum, the following:

- Attenuators/silencers and/or acoustic louvres are expected to be required on all air intake/exhaust paths for plant and equipment
- Appropriate acoustic construction of the building envelope
- A rooftop acoustic parapet/barrier

Noise sensitive Receivers at both low and high level will be considered to ensure that the likely range of noise impacts are understood and assessed.

Equinix are committed to applying all practical and reasonable noise control to ensure that total noise levels from the Equinix site are not increased as a result of the introduction of the proposed SY 03 data centre.

ArupAcoustics

Appendix A

Acoustic Terminology

A1 Glossary of Acoustic Terminology

ASSESSMENT BACKGROUND LEVEL (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time.

'A'-WEIGHTED SOUND LEVEL dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

DECIBEL

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million : one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

Some typical noise levels are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy lorries at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

EQUIVALENT CONTINUOUS SOUND LEVEL (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrow frequency bands.

RATING BACKGROUND LEVEL (RBL)

A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.

REVERBERATION TIME (RT_{60})

The time, in seconds, taken for a sound within a space to decay by 60 dB after the sound source has stopped is denoted at the reverberation time. The RT is an important indicator of the subjective acoustic within an auditorium. A large RT subjectively corresponds to an acoustically 'live' or 'boomy' space, while a small RT subjectively corresponds to an acoustically 'dead' or 'flat' space.

SOUND EXPOSURE LEVEL (SEL)

The Sound Exposure Level or Single Event Noise Exposure Level, denoted SEL or L_{AE}, is a measure of the total amount of acoustic energy contained in an acoustic event. The SEL is the constant sound pressure level that would produce in a period of one second the same amount of acoustic energy contained in the acoustic event.

SOUND POWER AND SOUND PRESSURE

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

SOUND REDUCTION INDEX (R)

The sound reduction index (or transmission loss) of a building element is a measure of the loss of sound through the material, i.e. its sound attenuation properties. It is a property of the component, unlike the sound level difference, which is affected by the common area between the rooms and the acoustics of the receiving room. The weighted sound reduction index, R_w, is a single figure description of sound reduction index and is defined in BS EN ISO 717-1: 1997. R_w values are calculated from measurements in an acoustic laboratory. Sound insulation ratings derived from site (which are invariably lower than the laboratory figures) are referred to as apparent sound reduction index (R'_w) ratings.

STATISTICAL NOISE LEVELS

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index that allows for this variation. 'A'-weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, eg. $dBL_{A10,\ 5min}$ or $dBL_{A90,\ 8hr}$.

$L_{A90(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 90% of the time interval (T) –i.e. measured noise levels were greater than this value for 90% of the time interval. This is also often referred to the background noise level.

$L_{A10(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

$L_{A10(1hr)}$

For traffic noise, $L_{A10(1hr)}$ is the highest hourly L_{A10} noise level measured over each day of a measurement period. $L_{A10(1hr)}$ is the average maximum noise level resulting from the "worst hour" of the traffic flow.

$L_{A10(18hr)}$

$L_{A10(18hr)}$ refers to the arithmetic average of the eighteen 1-hour L_{A10} traffic noise levels over the time period from 6:00 am to midnight. $L_{A10(18hr)}$ is representative of the average maximum traffic noise level from each day of measurements.