THE STAR

MODIFICATION 13 PLANNING SUBMISSION

NOISE IMPACT ASSESSMENT

PREPARED BY

WSP

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GLOSSARY

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 all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Ambient Noise is usually assessed as an energy average over a set time period 'T' ($L_{Aeq(T)}$).**
A-weighting	The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound. The purpose of the A-weighting is to approximate human response to frequency. It is added to noise descriptors to show that the weighting has been applied, for example dBA and L_{Aeq}.
Background noise	The background noise level is the minimum repeatable level of noise measured in the absence of the noise under investigation. It is commonly measured using the L_{90} descriptor and represent the noise level exceeded for 10% of the measurement period.
CRTN	Calculation of Road Traffic Noise (UK Department of Transport, 1988). A widely accepted method for calculating noise from road traffic.
Decibel (dB)	The decibel is a logarithmic unit used to describe a ratio between the measured level and a reference or threshold level of 0dB. An A-weighted decibel (dBA) describes the sound level with the A-weighting frequency response considered to approximate the sound level which a typical human would perceive.
Equivalent Continuous Sound Level, $L_{eq,T}$	Most sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. The L_{eq} describes one sound level with the same energy content as the time-varying acoustic signal. The L_{eq} is defined over a time period (T), commonly 15 minutes for operational noise applications e.g. $L_{Aeq(15min)}$
Offensive noise	The definition of offensive noise is contained within NSW Protection of the Environment Operations Act 1997.
Rating Background Level (RBL)	The RBL is the background noise level calculated according to the NSW Noise Policy for Industry. It is the median of the assessment background levels (ABL). The ABL is the lowest tenth percentile of all $L_{90(15min)}$ measurements taken in each day, evening or night period.
Sound Pressure Level (SPL)	The basic unit of sound measurement is the sound pressure level. The pressures are converted to a logarithmic scale and expressed in decibels (dB).
Sound Power Level (dB)	Sound power level is a logarithmic measure of the sound power in comparison to a specified reference level. (dB).
Statistical noise levels, L_n	Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors for example: The noise level, in decibels, exceeded for 90 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF90}, Typically, the L_{AF90}, T is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.
Peak Particle Velocity (PPV)	Defined as the greatest instantaneous particle velocity during a given time interval from a vibration source. The particle velocity is defined as the particles of a medium are displaced from their random motion in the presence of an external excitation. The units of PPV are mm/s
Vibration dose value (VDV)	The vibration dose value (VDV) is a cumulative measurement of the vibration level received over a defined period. It is defined in BS 6472-1:2008 and is measured as $m/s^{1.75}$

THE STAR

EXECUTIVE SUMMARY

1 EXECUTIVE SUMMARY

The Star Entertainment Group Limited (SEGL) is a leading operator of integrated resorts catering to both local and international visitors and is the operator of The Star Sydney (The Star). Consistent with SEGL's licence obligation to operate the site to an international standard, SEGL is proposing to advance a revitalisation of the existing complex.

The Star is embarking on a five year redevelopment journey to create a landmark, exemplar integrated resort within the City of Sydney. This proposed redevelopment will occur through the lodgement of two S75W applications with the Department of Planning and Environment, identified as Modification 14 and Modification 13. Modification 14 has been approved by the Department. Modification 13 will involve the design of a new Ritz-Carlton Hotel Tower and associated podium treatment.

The Star is proposing to attain the highest standard of built form outcomes for the site through the proposed redevelopment, by encouraging innovation and best practice approaches to achieve an environmentally sustainable development that positively contributes to the overall architecture of both Pyrmont and the City of Sydney. This will be done through the implementation of advanced ESD initiatives, improved people and movement connections, upgrades to the external appearance and presentation of the facility and improved integration with the adjacent urban fabric.

The Secretary's Environmental Assessment Requirements (SEARs) specify the assessment requirements for noise and vibration associated with Modification 13. The SEARs include two Key Issues that relate to acoustic performance; Key Issues 1 and 11. Key Issue 11 and the first dot point of Key Issue 1 requires that the environmental assessment address noise impacts during the construction and operation of the development and detail appropriate mitigation measures. In addressing these SEARs throughout this report, we have also taken into account the second part of Key Issue 1 which requires a demonstration that the proposal (as a whole) has limited environmental impacts beyond those already assessed as part of MP08_0098.

The current approval, MP 08_0098 (Modification 14), was assessed against relevant policies, guidelines and approval conditions. To determine if the proposed Modification 13 works can be built to have limited environmental impact beyond that already approved, these same acoustic criteria are used. In addition, relative differences in noise levels between already assessed approvals for the project and proposed Modification 13 have been assessed and presented. It is considered that in assessing compliance with the applicable acoustic criteria and the assessment of the relative differences, the proposal will demonstrate and constitute limited environmental impact in line with the SEARs Key Issue 1.

In order to set the numerical noise emission criteria in line with the conditions of consent and determine the levels of existing ambient noise, an environmental noise survey was undertaken at seven locations representative of the surrounding sensitive receivers. Measurements were undertaken with reference to the NSW Noise Policy for Industry and Australian Standard AS 1055 Description and measurement of environmental noise.

To predict operational noise emissions, a three-dimensional noise model was developed using noise modelling software (SoundPLAN v7.4). Noise measurements and traffic counting around the site was used to develop this model. The existing noise emission from The Star was modelled to verify that the background noise measurements were not influenced by existing noise from The Star. Outputs from the model were used to assess the Modification 13 operational noise emissions and provide noise levels for assessment of façade noise ingress. The model considered the noise emissions from mechanical plant, patron and music noise in addition to other noise sources such as vehicle movements on site.

The assessment of mechanical plant and operational noise associated with the site-wide upgrades, the new tower and ribbon development predicted the development can comply with the existing conditions at the off-site residential and commercial receivers. During the detailed design process, consideration shall be made for the selection and design of all mechanical equipment that emits noise. If selected equipment is in excess of the established criteria, acoustic mitigation measures shall be provided. These may include, but are not limited to: location, attenuators, barriers and acoustic louvres.

The assessment of licensed premises noise from the outdoor pools, food and beverage areas, smoking terraces and unenclosed gaming areas predicted the modification can meet the existing entertainment noise condition criteria at the off-site residential and commercial receivers. During the detailed design process, noise emissions shall continue to be reviewed. If required, acoustic mitigation measures shall be provided. These may include, but are not limited to: acoustic absorption, acoustic barriers, restriction of patrons in specific areas, including the Level 07 ribbon pool bars and external areas fronting Pirrama Road on Level 05, sound system design and noise limiter levels.

The potential for road traffic noise impacts to occur on the surrounding roads as a result of the additional traffic generated by Modification 13 was assessed in line with the NSW Road Noise Policy. The assessment considered the forecast traffic growth and traffic generation from The Star, provided by the project's traffic engineer, and the impact of previous modifications on traffic growth. The assessment predicted that Modification 13 can comply with the provisions of the RNP.

The proposed works include both residential and hotel usages which are Class 2 and Class 3 buildings respectively, according to the Building Code of Australia (BCA). As such the building is required to be designed to meet the sound insulation and impact isolation requirements for these BCA classes, in addition to the requirements of the City of Sydney Development Control Plan.

The potential for sources external to The Star and The Star's own noise sources (industrial sources and entertainment sources) to impact hotel bedrooms and residential accommodation has been assessed. This assessment has shown that the internal amenity criteria as set out by the City of Sydney DCP (detailed in Section 7.1), can be met internally through use of appropriately selected glazing and attenuated natural ventilation paths.

The construction methodology is not able to be detailed until a contractor is appointed. A noise and vibration assessment of typical construction equipment was assessed in line with the Interim Construction Noise Guideline and Australian Standard AS 2436-2010. The assessment identified noise management levels and mitigation strategies for managing noise and vibration where these levels are exceeded.

The impact of construction traffic on road traffic noise levels was assessed in line with the NSW Road Noise Policy. The assessment predicted noise levels can comply with the provisions of the RNP.

The site is located above the Sydney Light Rail corridor. Measurements of the light rail vibration indicate that structure-borne noise and vibration will not impact the residential and hotel areas in the proposed modification.

The assessed noise emissions from mechanical plant and equipment, entertainment noise from licensed premises, other operational noise sources, and road traffic noise impacts, can meet the relevant policies, guidelines and approval conditions. In combination with the assessment of the relative difference between already assessed impacts and predicted Modification 13 impacts, it is determined the proposed development can be constructed to have limited environmental impact with regard to acoustics.

Updates to the conditions of consent are recommended to remove redundancy, ensure ongoing relevance to the site and strengthen understanding of future obligations from The Star.

Based on the assessments presented in this document, it is determined that the development can be built to meet all noise limits imposed by the conditions of approval and all applicable policies and guidelines. Therefore, demonstrating compliance with the SEARs Key Issues 1 and 11.

The assessment also reviewed the change in noise level between the existing approved development and the proposed Modification 13 in combination with the criteria set out in the relevant policies, guidelines and conditions of consent. On the basis of this review, noise and vibration aspects of Modification 13 will have limited environmental impact as per the second dot point of SEAR Key Issue 1.

THE STAR

MODIFICATION 13
PROPOSED WORKS

2 MODIFICATION 13 PROPOSED WORKS

Modification 13 includes the following proposed works:

2.1 NEW RITZ-CARLTON HOTEL AND RESIDENTIAL TOWER

- Demolition of part of the existing building in the northern portion of the site, including part of the Pirrama Road façade and part of the Jones Bay Road façade.
- Construction of a new Tower, 237.0 metres AHD (approximate, 234 metres from Pirrama Road);
- Residential uses across 35 levels, comprising:
  - A residential vehicular drop off lobby on Level B2
  - A residential lobby on Level 00 to be accessed from Jones Bay Road;
  - Residential communal space on Level 07 to be accessed via Level 08; and
  - 204 residential apartments located from Levels 05 to 06 and from Levels 08 to 38, featuring one-bedroom, two-bedroom and three-bedroom unit types (Note – no Level 13)
- Hotel uses across 31 levels, comprising:
  - A hotel arrival lobby on Level B2 to be accessed from the new Ritz-Carlton porte-cochere along Pirrama Road;
  - A hotel Sky Lobby for guest check-in on Level 39 and 40, featuring a restaurant, bar and lounge;
  - 220 hotel rooms located from Level 42 to 58 and from Level 60 to 61
  - A hotel spa and gym on Level 07
  - A VIP link to the Sovereign Room on Level 04 and 04 Mezzanine
  - A Ritz-Carlton Club lounge and terrace on Level 59
  - Hotel staff end-of-trip facilities on Level B3
  - Hotel staff arrival point on Level 00
  - Hotel back-of-house and plant on Level B2, 02, 03, 05, 41 and 42
  - A Neighbourhood Centre consisting of the following proposed uses including street level cafe, library, learning / innovation hub, multipurpose function centre, practice rooms (functional use to be finalised in conjunction with a neighbourhood panel)
- A new car-parking stacker system below the new porte-cochere of the Ritz-Carlton Hotel, with a total capacity of 221 spaces, to serve the new hotel and apartments
- Vertical transport associated with the tower and podium; and
- A new drop-off / pick up area (short-term parking) on Jones Bay Road for the proposed apartments.

2.2 LEVEL 07

- A 'Ribbon' at Level 07 connecting the new Hotel and Residential Tower to the existing building along Pirrama Road, comprising:
  - Two pools and associated pool decks (one for the new Hotel, one for The Star); and
  - Two food and beverage premises with associated store rooms and facilities;
- Lift access from the Level 05 Terrace to Level 07;
- Residential communal open space associated with the new residential apartments, comprising pool and landscaped terrace at the base of the Tower adjacent to Jones Bay Road;
- Gym and associated change rooms and facilities for the residents;
- Gym and associated change rooms and facilities for hotel guests; and
- Landscaping treatments.

2.3 LEVEL 05 TERRACE

- Three food and beverage outlets with external areas;
- Completion of the Vertical Transportation drum to connect with Level 05 Terrace;
- Designated event spaces on the Terrace; and
- Landscaping treatment.

2.4 LEVEL 05 ASTRAL HOTEL AND RESIDENCES RECREATIONAL FACILITY UPGRADE

- New pool deck, pool, spa, gym and amenities upgrade for Astral Hotel and Residences.

2.5 LEVEL 04 MEZZANINE / 04 / 03 TOWER TO SOVEREIGN LINK BY ESCALATOR AND LIFT

- Link from the Tower to the Sovereign Resort along the Level 04 Mezzanine, down by escalators to Level 04, and then down by lift to Level 03; and
- Extension of the latter lift above to service Level 00, 01, 03, 04 and 05.

2.6 TOWER TO SOVEREIGN LINK BY ESCALATOR AND LIFT

- Link from the Tower (across Level 04 and Level 04 Mezzanine) to the Sovereign Resort and MUEF at Level 03, connected via Lift G4, Lift VIP 1 and escalators.
- Extension of the lift service to stop at Level 00, 01 and 05 in addition to Level 3, 4 and 4M.

2.7 LEVEL 03 SOVEREIGN COLUMN FAÇADE TREATMENT ALONG PIRRAMA ROAD

- New glazed detail to enclose exposed Level 03 Sovereign columns along the Pirrama Road façade.

2.8 VARIOUS RECONFIGURATION WORKS AROUND VERTICAL DRUM LEVEL 00 TO L5

- Revolving door at L00 main entrance landing Pirrama Road end
- Sliding door at L00 landing at stairs from Light Rail
- Reconfiguring of existing L1 and 2 void edge
- New escalators from L2 to L3 due to revised landing at Level 3
- Infill of L2 atrium void to main entrance at Pirrama Road

2.9 FAÇADE INTEGRATION WORKS

- Upgrades to the Pirrama Road and Jones Bay Road façades to integrate the new Ritz Carlton Hotel and Residential Tower with the existing building.

2.10 INFRASTRUCTURE UPGRADES

- A new plant room located within the podium over Levels 03, 04, 05 and 06 of the proposed Hotel and Residential Tower;
- Relocation of the current Level 03 cooling towers (adjacent to the MUEF) to the Level 09 plant room above the Level 06 plantroom adjacent to the Astral Hotel;
- New capstone microturbine units and associated flues in the proposed plant room at Level 03 between the Darling Hotel and the Astral Residence Tower;
- New capstone microturbine units and associated flues in the new Level 03 plant room at the base of the Tower;
- Relocation of the existing main switch-room to the new plant room on Level 02, south of the demolition cut line;
- Relocation of the existing data recovery centre to the new plant room on Level B1 of the Darling Hotel;
- Relocation of diesel generator flues to the side of the new Level 09 plantroom, adjacent to Astral Hotel

2.11 LEVEL B2 TRANSPORT INTERCHANGE

- Upgrades to the Event Centre Loading Dock;
- Entry into Basement car stacker for the Tower apartments and Ritz-Carlton Hotel;
- New commuter bike parking and hire bike system;
- Upgrade of finishes to light rail station surrounds (but not within Light Rail corridor) and removal of existing wall barrier to the Pirrama Road frontage;
- Upgraded taxi-rank arrangements;
- Designated Star coach parking along Service Road in front of Light Rail station; and
- Realignment of kerbs and line-marking.
- *Note – no works within the Light Rail corridor*

2.12 TRANSPORT IMPROVEMENTS – OTHER LOCATIONS

- Reconfiguration of existing median strips on Jones Bay Road and addition of new median strip on Pyrmont Street, with associated line-marking to enable a new right-hand turning lane into the Astral Hotel Porte-Cochere;
- New Pyrmont Street carpark entry and exit, associated line marking, changes to internal circulation, and reconstruction of the pedestrian footpath along Pyrmont Street; and
- Relocation of existing feeder taxi-rank from Jones Bay Road to the Level B2 transport interchange.

2.13 SITE WIDE LANDSCAPE AND PUBLIC DOMAIN UPGRADES

- Upgrades to street frontages along Pirrama Road (for the Hotel Porte Cochere) and Jones Bay Road (for the residential entry);
- Upgrades to street frontage to Pyrmont Street, due to new car parking entry; and
- Entrance upgrade to the SELS building at the corner of Jones Bay Road and Pyrmont Street.

2.14 LEVEL 00 - RESTAURANT STREET

- Creation of a new destination Restaurant Street by:
  - Incorporating existing Food and Beverage premises on Level 00; and
  - Converting existing retail shops into new Food and Beverage tenancies, including the new Century tenancy at the Jones Bay Road end.

2.15 PIRRAMA ROAD AND JONES BAY ROAD FOOD AND BEVERAGE

- A revised food and beverage tenancy at the existing Pizzaperta outlet along Pirrama Road;
- A new food & beverage tenancy at the Marquee street entry; and
- A small café outlet adjacent to the residential lift lobby at Jones Bay Road
- A new food & beverage tenancy accessed off existing walkway from Jones Bay Road.

2.16 FOOD AND BEVERAGE – OTHER LOCATIONS

- Reconfiguration of Harvest Buffet, including new escalators from Level 00 Food Court to Level 01; and
- Refurbishment of Bistro 80 into the interim Century tenancy

2.17 DARLING HOTEL CORNERS

- Upgrade of the corner plaza at the Union/Edward Street property entry:
  - A new Food and Beverage premises on Level 01 and 02;
  - A new entry foyer leading to the Food Court;

- A relocated awning enclosure at street level;

- Upgrade of the corner plaza at the Union/Pyrmont Street property entry:
  - A new awning enclosure at for the existing café;
  - Eight (8) luxury display cases at Darling Hotel car park entry; and
  - Two car display areas at Darling Hotel car park entry.

2.18 SITE-WIDE ACOUSTIC STRATEGY

- A site-wide acoustic monitoring strategy applied to assess impact of potential noise generating sources in Mod13.

2.19 SITE-WIDE LIGHTING STRATEGY

- A site-wide lighting strategy integrating and improving the existing lighting across the precinct, with new lighting the proposed Tower, Podium and Ribbon, including:
  - Internal lighting of Hotel and Residential spaces;
  - Illuminated highlights at the Sky Lobby and Club Lounge levels;
  - Integrated lighting on the eastern and western vertical façade slots and angled roof profile;
  - Podium external illumination from awnings, and under retail and lobby colonnades;
  - Landscape lighting on Level 07 open terraces and pool decks;
  - Feature lighting accentuating the wing-like profile of the Ribbon and vertical element;
  - Internal and external lighting to Food and Beverage outlet at Union/Edward Street corner;
  - Façade LED lighting to the heritage SELS Building.

2.20 SPECIAL LIGHTING EVENTS

- Approval for fifty three (53) Special Lighting Event nights per year for the use of permanent installation of moving projector lights on the rooftop of the Astral Hotel.

2.21 SIGNAGE UPGRADES

- Consolidation of existing signage approvals and new signage, including:
  - Approved signs
  - Wayfinding signs;
  - Business identification (including for Food and Beverage outlets); and
  - Signage on the Tower and Podium.

2.22 STORMWATER UPGRADES

- Stormwater upgrade works, including increased pit inlets and pipe capacities at the low points along Pyrmont Street and Edward Street.

2.23 FIGURES

Figures 2-1 to 2-8 present the relevant aspects of the Modification 13 development.

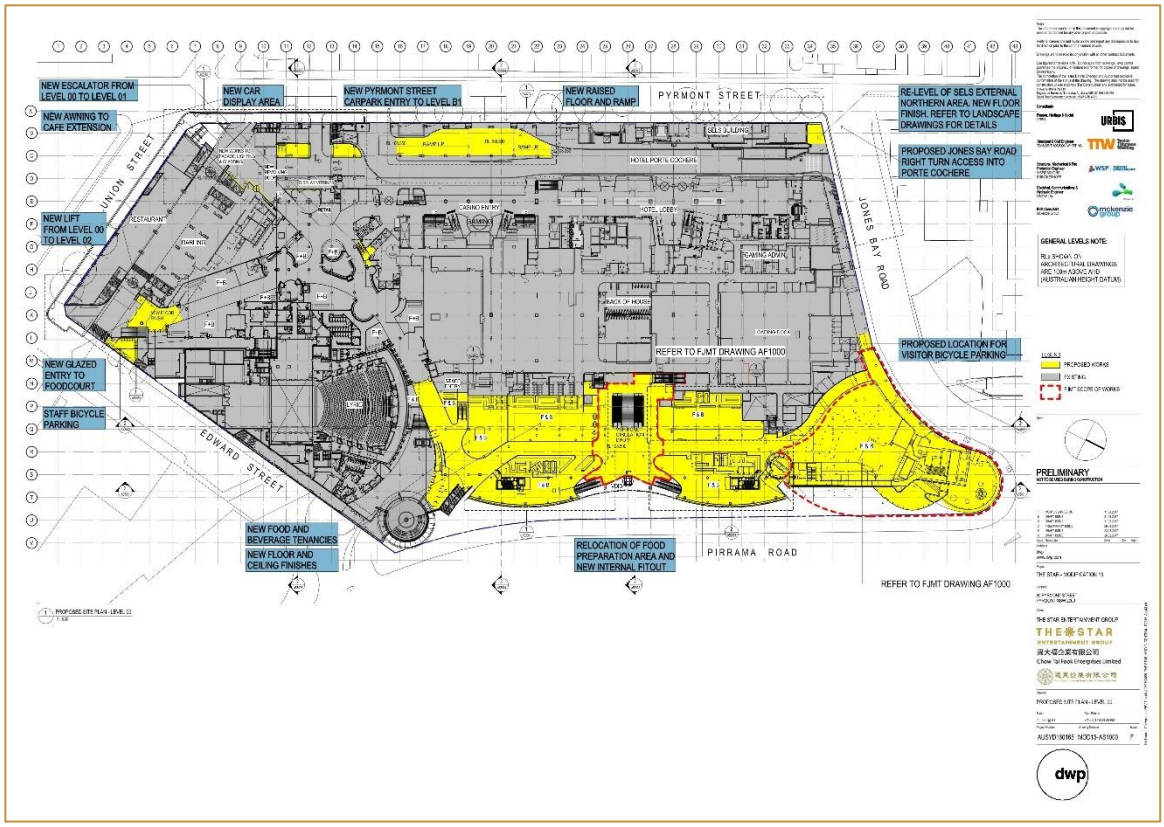

FIGURE 2-1 - PROPOSED LEVEL 00 SITE WIDE UPGRADES SHOWING ADDITIONAL RETAIL AND DINING AREAS

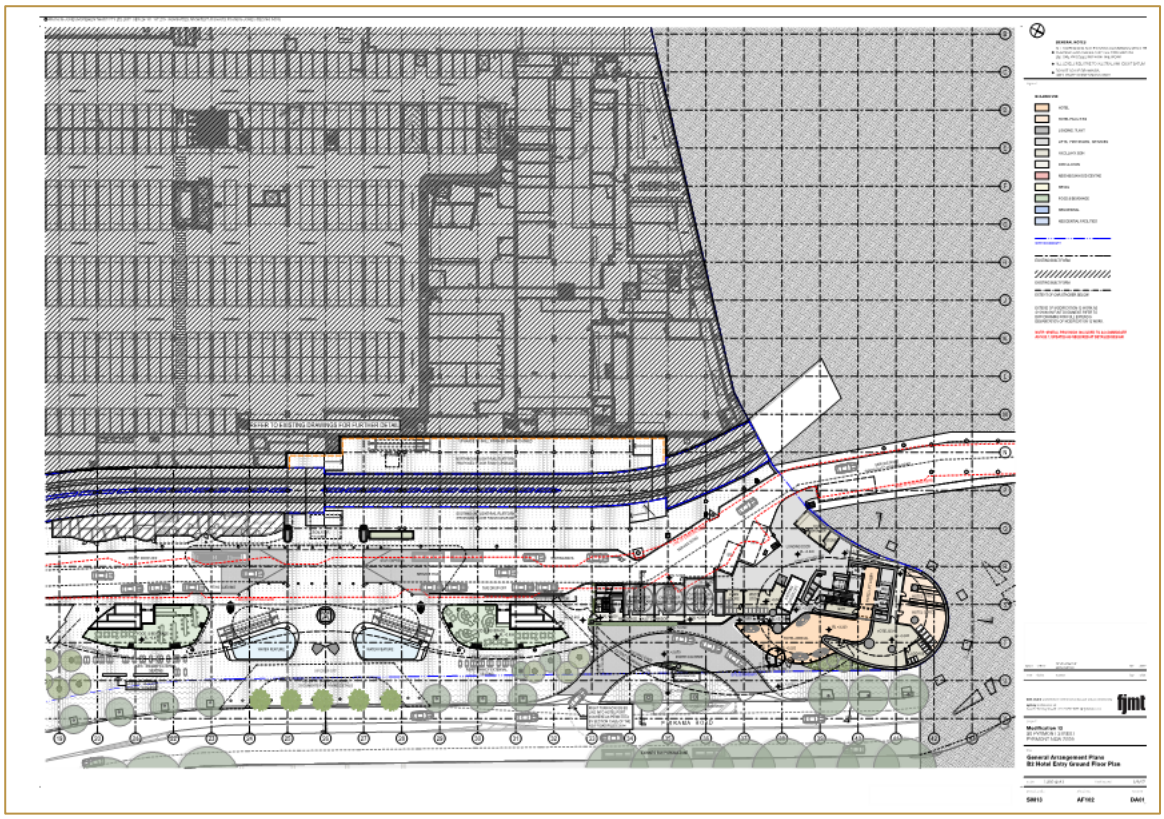

FIGURE 2-2 - PROPOSED LEVEL B2

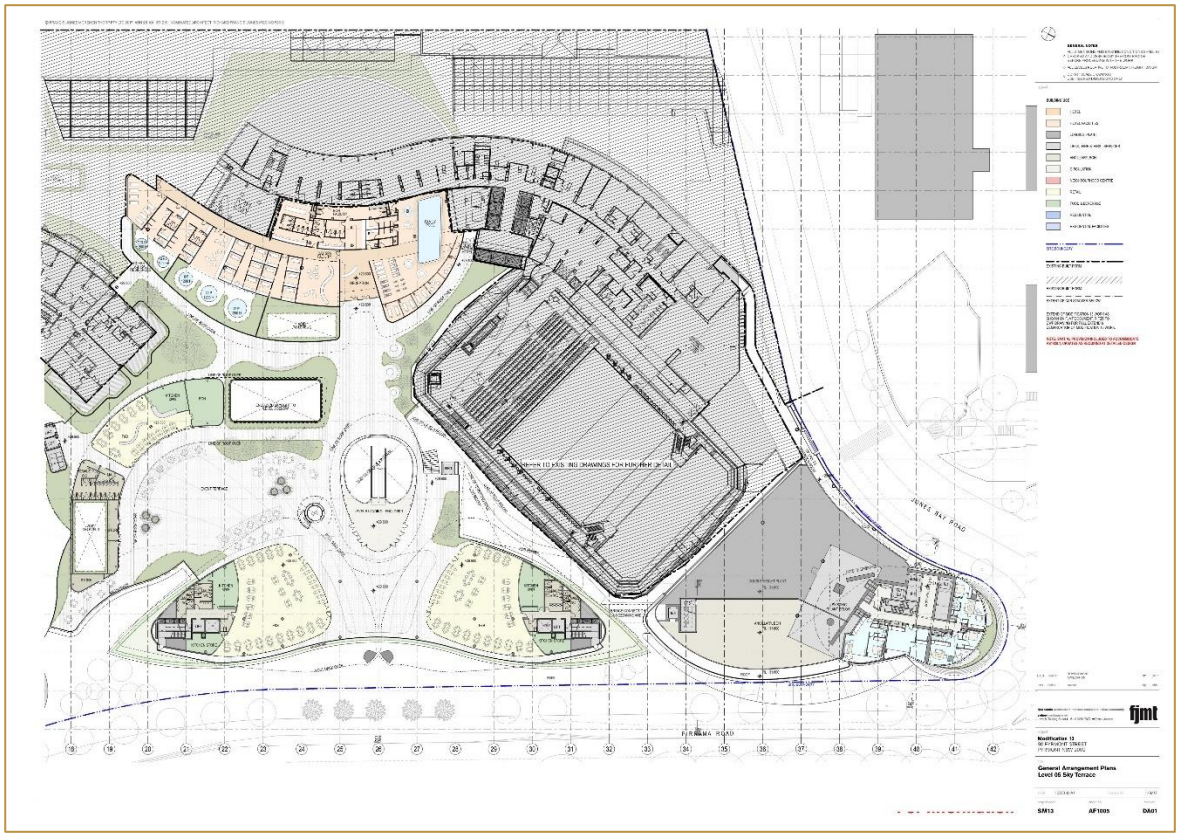

FIGURE 2-3 - PROPOSED LEVEL 05

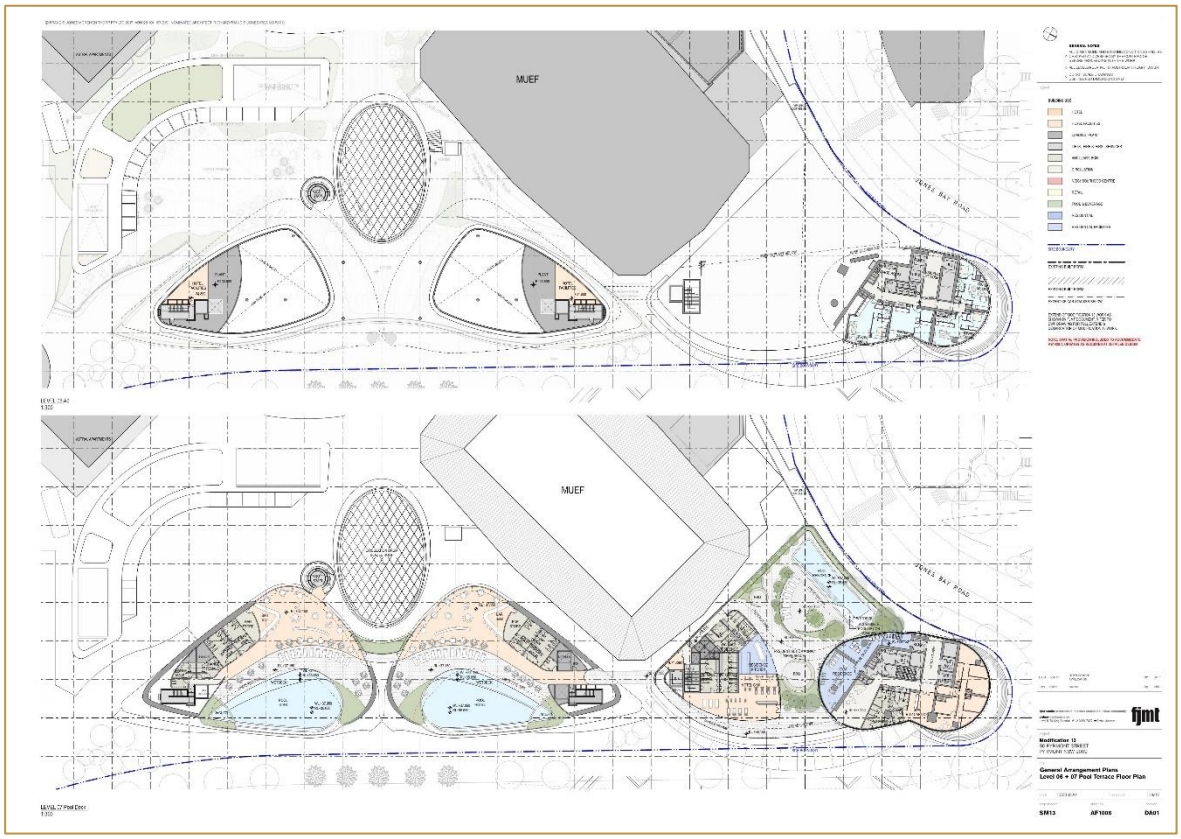

FIGURE 2-4 - PROPOSED LEVEL 07

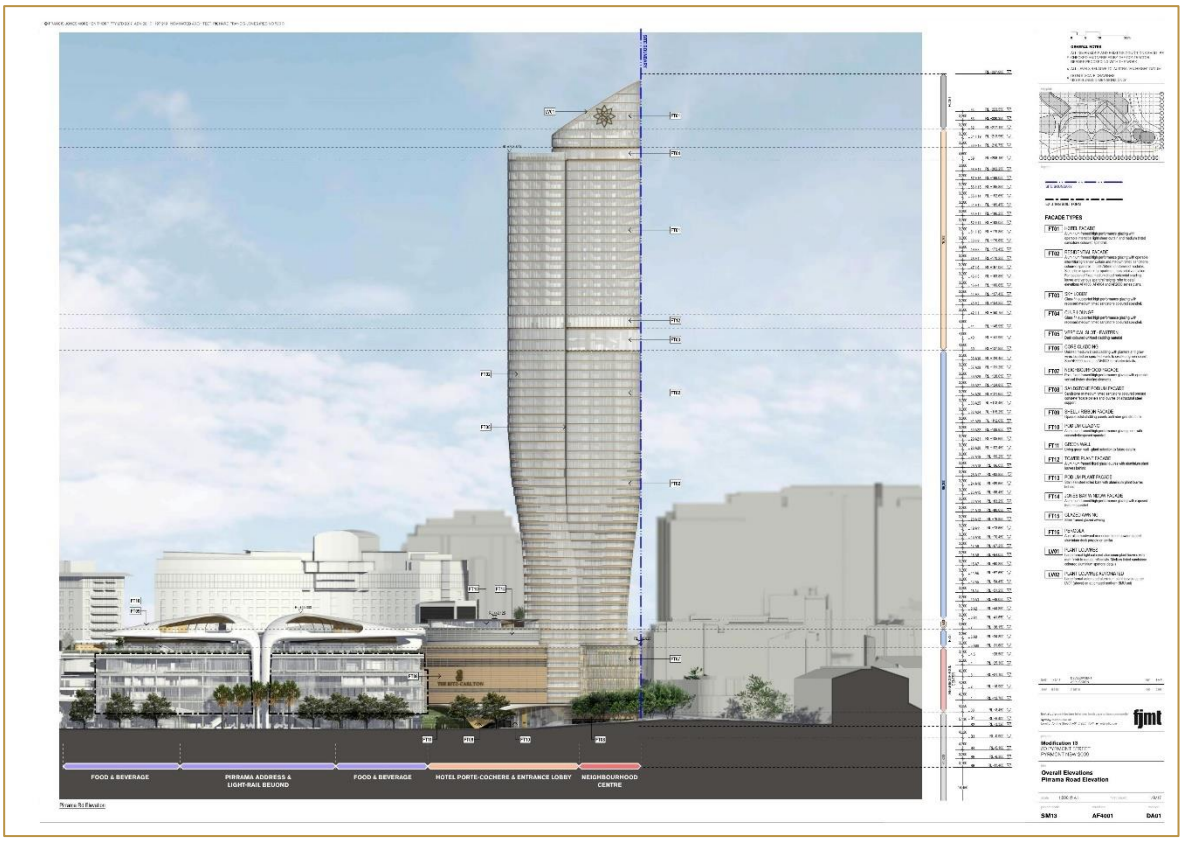

FIGURE 2-5 – EASTERN AND PIRRAMA ROAD ELEVATION

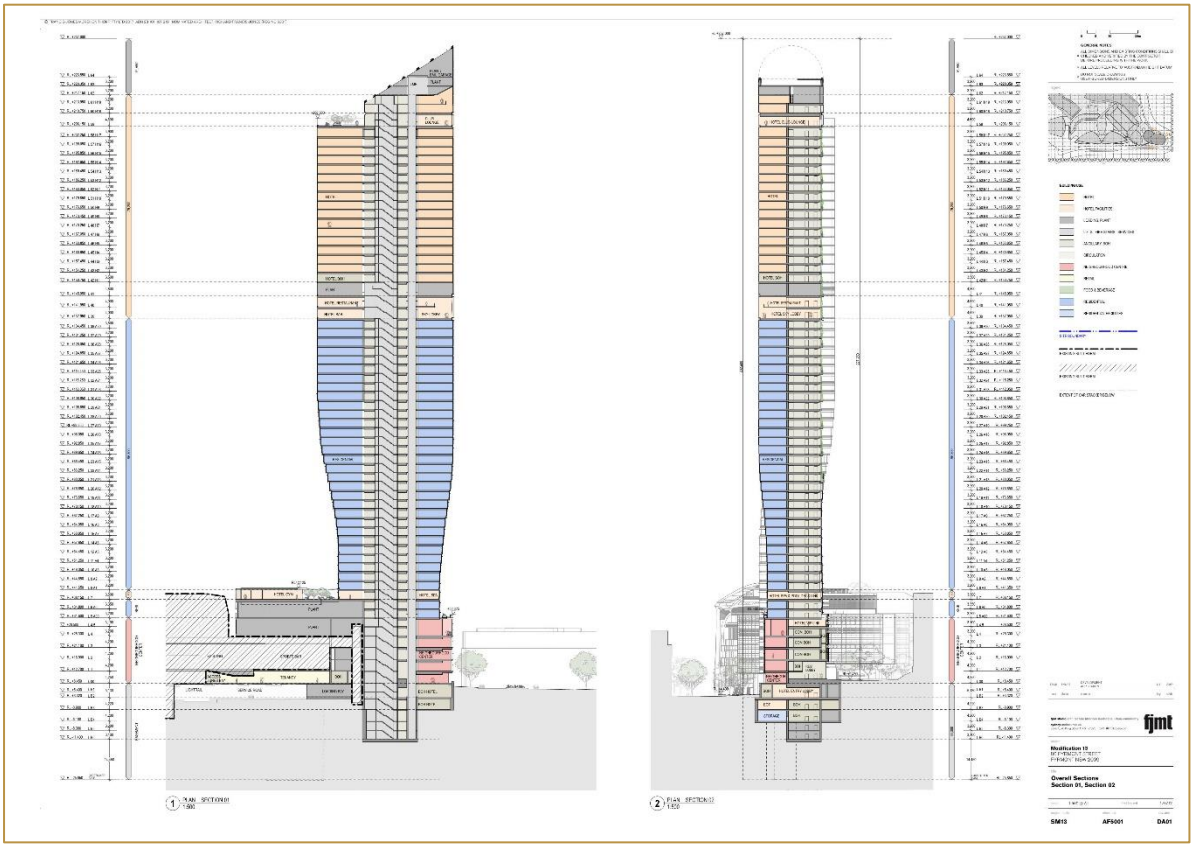

FIGURE 2-6 – TOWER CROSS SECTION

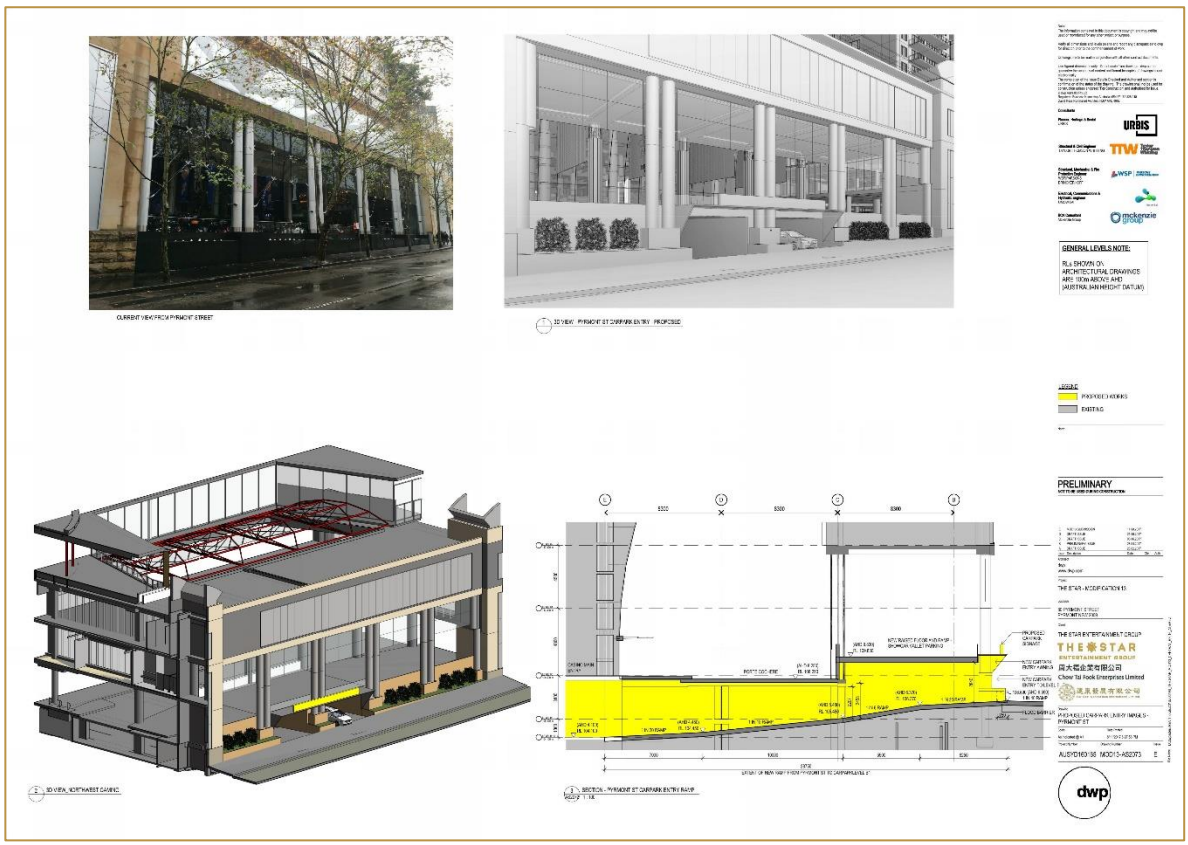

FIGURE 2-7 - PROPOSED NEW PYRMONT ROAD CAR PARK ENTRANCE

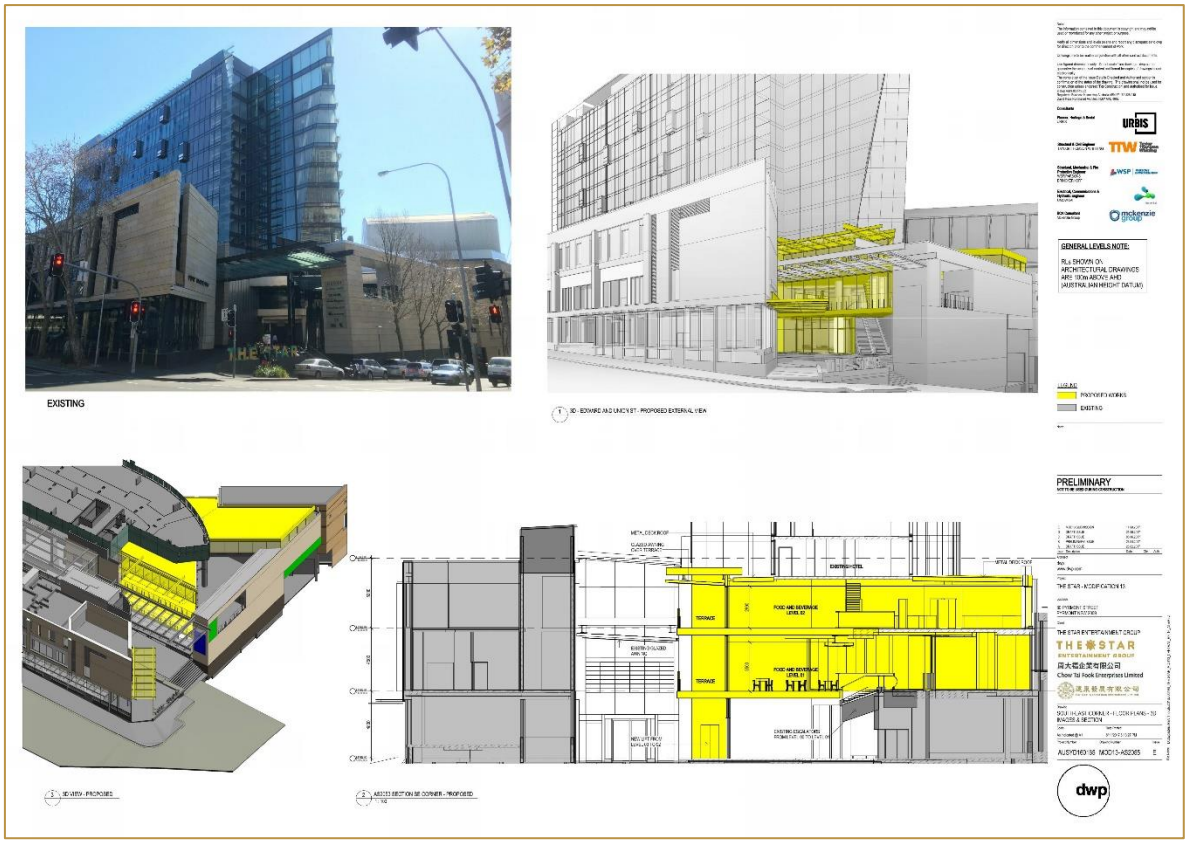

FIGURE 2-8 - PROPOSED NEW UNION STREET FOOD AND BEVERAGE PREMISES

THE STAR

INTRODUCTION

3 INTRODUCTION

WSP has been commissioned to provide acoustic consultancy services for proposed modification at The Star, in Pyrmont, New South Wales.

The purpose of this report is to provide a noise impact assessment as part of the Modification 13 proposal to the Department of Planning and Environment for the proposed works at the site as summarised in Section 2n.

This noise impact assessment addresses the following acoustic items:

- Noise egress from the operation of licenced areas within the development. Entertainment noise is the overall contribution from both patron noise sources and music noise sources defined as follows:
  - Patron noise – noise sources of people and associated activities including people's voices (unamplified) and noise from gaming machines
  - Music noise – noise sources from sound systems including amplified music, amplified speech, and music performance related noise such as musical instruments
- Noise egress from the operation of the development from mechanical plant and equipment noise. Mechanical plant and equipment noise is the overall contribution from stationary plant on site.
- Noise egress from the operation of the other areas except licenced areas such as porte cocheres and vehicle sources on the service road located within The Star's site boundary.
- Noise ingress on the development;
- Traffic noise assessment;
- Light rail noise and vibration;
- Internal acoustic requirements; and
- Construction noise and vibration.

This noise impact assessment has been conducted based on the architectural submission package for The Star – Modification 13 by DWP Suters Architects (dated 11 August 2017) and the tower and ribbon design by FJMT Architects (dated 1 September 2017).

THE STAR

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

4 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The Department of Planning and Environment (DPE) issued the Secretary's Environmental Assessment Requirements (SEARs) for MP08_0098 Modification 13 on 9 May 2016. The SEARs contain the requirements for the assessment of the proposal and have specific requirements for noise and vibration.

KEY ISSUE 1: RELEVANT EPIS, STRATEGIES, PLANS AND GUIDELINES

- *'Address the provisions of state environmental planning policies, strategies, plans and guidelines that would apply as if those provisions applied to the carrying out of the project.'*
- *'Demonstrate that the proposal has limited environmental impacts beyond those already assessed for project approval MP 08_0098 and any subsequent modifications to that approval.'*

KEY ISSUE 11. AIR, NOISE AND ODOUR.

- *'Address potential air quality, noise and odour impacts, in particular during the construction and operation of the development and appropriate mitigation measures.'*

To address Key Issue 11 and the first dot point of Key Issue 1, numerical assessment has been undertaken for all noise producing operational and construction activities. This is to show compliance with the current conditions of consent and the applicable policies and guidelines required in the SEARs, and to inform any necessary mitigation measures.

In respect of the second dot point of Key Issue 1, the currently approved Modification 14 represents the most recent modification to MP 08_0098. An assessment of environmental noise impacts beyond those already assessed is undertaken by comparing environmental noise impacts associated with the project up to Modification 14 when complying with its conditions of consent with those predicted under this current proposal Modification 13 (Section 16).

4.1 SITE-WIDE CUMULATIVE APPROACH

MP08_0098 conditions of consent detail cumulative noise levels that are to be met at receivers outside the site boundary emitted from various noise sources. A site-wide approach to noise emission limits applies because multiple noise sources may contribute to the overall noise level at a receiver location. However, verification of compliance with noise limits is problematic at sensitive receivers surrounding the site because of the dynamic characteristic of the urban noise climate and because it is often difficult to access premises to undertake compliance testing. Therefore, a Verification Noise Plan (VNP) is recommended in this report (being a combination of measurement and computation) to resolve this difficulty. Use of the VNP allows the level of noise emitted from the various individual noise sources within The Star to be set so that cumulatively they will comply with the conditions of consent and in addition provides a rapid validation of and response to any complaints should they occur.

As part of Modification 13, several City of Sydney Consents will be surrendered and the applicable areas brought under approval MP08_0098. This will strengthen this cumulative noise approach included in the existing MP08_0098 conditions by removing any noise sources on site that are not controlled by this approval. Some areas however will not be brought under this approval and the City of Sydney consents will remain. These areas are however, all internal to the development and will therefore not have any substantive influence over the external noise emissions from the site. Therefore, these consents will not contradict the purpose of the site-wide cumulative approach.

These outstanding consents are:

- D/2011/708 (Modify the approved uses of several tenancies of the approved food and retail court)
- D/2011/685 (Fit-out and use of F&B tenancy 13 as a Malaysian style restaurant)
- D/2011/894 (refurbishment and internal configuration of hotel suits located on Level 15/16 of the Astral Tower)
- D/2012/287 (Internal refurbishment of the existing licensed bar area in the Sydney Lyric Theatre)
- D/2014/355 (The Star Buffet)
- D/2015/1187 (Conversion of hotel suites on Level 05 as a business centre/VIP check in area)
- D/2016/1366 (Internal alternations to the Sydney Lyric Theatre)
- D/2016/1478 (Increase in number of seating by 19 seats – Gojima)

THE STAR

EXISTING ENVIRONMENT

5 EXISTING ENVIRONMENT

The existing environment has been determined though noise measurements and traffic counting. The assessment criteria are derived from background noise levels at the nearest sensitive receivers. Therefore, the background noise level has been measured at locations representative of the sensitive receivers.

To understand how any additional traffic from The Star might affect traffic noise, the existing traffic volumes have been measured for roads adjacent to The Star.

5.1 NEARBY NOISE SENSITIVE RECEIVERS

The Star development is surrounded by residential and commercial receivers. The locations of the closest surrounding noise sensitive receivers are illustrated in Figure 5-1.

Table 5-1 summarises the nearest noise sensitive receivers presenting the addresses, current uses, and proximity to the redevelopment.

TABLE 5-1 – NEAREST NOISE SENSITIVE RECEIVERS

Receiver	Description	Receiver type	Approximate number of building levels above ground	Approximate distance to nearest redevelopment area (m)	Representative BG grouping
1	77-89 Pyrmont Street	Commercial	5	70	BG5
2	94-136 Harris Street	Commercial	7	50	BG2
3	39-43 Pyrmont Street	Residential and Place of worship	2	60	BG1
4	88 John Street	Residential	8	90	BG3
5	135 Point Street	Residential	10	110	BG3
6	18 Pyrmont Street	Residential	2	25	BG2
7	2 Jones Bay Road	Residential	9	28	BG2
8	26 Point Street	Residential	7	90	BG2
9	48 Pirrama Road	Commercial	5	22	BG7
10	56-56A Pirrama Road	Residential	5	200	BG7
11	52 Pirrama Road	Commercial	3	103	BG7
12	99 Pyrmont Street	Commercial	2	20	BG5
13	91 and 93 Pyrmont Street	Residential	2	20	BG5
14	Pyrmont Street Residences	Residential	2	40	BG5
15	13A-29 Union Street Pyrmont	Commercial	2	20	BG6
16	31 Union Street	Residential	2	20	BG6
17	33-35 Union Street	Commercial	2	20	BG6
18	37-69 Union Street	Commercial	2	20	BG6
19	60 Union Street	Commercial	5	35	BG6
20	8 Jones Bay Road	Commercial	4	20	BG2
21	63 Edward Street	Residential	2	30	BG6
22	65 Edward Street	Residential	4	35	BG6
23	27-37 Pyrmont Street	Commercial	2	70	BG1
24	9 Union Street	Commercial	2	30	BG5

FIGURE 5-1 – LOCATION MAP OF RECEIVERS

5.1 UNATTENDED NOISE MEASUREMENTS

5.1.1 METHOD

To assess the noise environment at the nearest noise sensitive receivers to the proposed works, noise monitoring was conducted at locations representative to the nearest sensitive receivers to The Star.

Measurement locations are indicated in Figure 5-1. Details of the noise surveys are presented in Table 5-2.

All noise survey data are taken from recent long-term noise logging conducted at locations representative of nearby receivers conducted within two years. The noise measurements were carried out with reference to AS 1055 Description and measurement of environmental noise and the NSW Noise Policy for Industry.

TABLE 5-2 – NOISE SURVEY DETAILS

Equipment type	Location ID	Location	Reflection conditions	Manufacturer and Type No.	Serial No.	Start date	Finish date
Unattended monitor	BG1[1]	33-43 Pyrmont Street	Free-field	Svantek 955	28808	10/12/2015	17/12/2015
Unattended monitor	BG2 [1]	2 Jones Bay Road	Free-field	Svantek 958	28808	22/07/2016	1/08/2016
Unattended monitor	BG3 [1]	88 John St	Facade	Svantek 958	21094	25/07/2016	2/08/2016
Unattended monitor	BG4 [1]	67 Harris St	Free-field	Svantek 958	35873	22/07/2016	1/08/2016
Unattended monitor	BG5 [1]	103 Pyrmont St	Free-field	Svantek 958	27552	25/07/2016	2/08/2016
Unattended monitor	BG6 [1]	37-69 Union St	Free-field	Svantek 958	23294	22/07/2016	1/08/2016
Unattended monitor	BG7 [2]	Wharf 9, Pyrmont	Free-field	N/A	N/A	03/02/2016	04/03/2016
Calibrator	-	-	-	Pulsar 105	64928	-	-

Note 1: Daily ABL of noise monitoring for locations BG1 to BG6 are presented in Appendix C.
Note 2: Noise monitoring used from Renzo Tonin and Associates report TG004-13F05 (r2) L1 UGA Report dated 08/05/2014.

5.1.2 VERIFICATION OF BACKGROUND NOISE LEVELS

Observations made on site both at day and night during the background monitoring period indicated that noise sources from The Star were not a significant influence on the background noise environment for the measurement locations. To verify that the unattended noise measurements were not significantly influenced by noise sources from The Star, noise contributions from the existing Star operation at the logging locations were predicted using the SoundPLAN noise model of The Star and surrounding Pyrmont area (see Section 11 for details on the 3D computer noise model).

The verification model included existing operational noise sources on site which may have been in operations during the noise logging periods. The existing noise sources include mechanical plant, unenclosed gaming areas, external sound systems, and the porte cochere area.

The modelling results indicate that noise contribution from The Star's existing operations at noise logging locations are at least 10 dB lower than the measured RBLs. A comparison of the modelling results with the measured background levels

is given in Table 5-3. Therefore, the noise logging results are considered to be without significant influence from the existing operations of The Star.

TABLE 5-3 – COMPARISON OF PREDICTED AND MEASURED NOISE LEVELS, EXISTING SITE

Receiver	Predicted from Site, dBA L_{eq} (15 minute)	RBL (Rating Background Level), dBA			Difference, dBA (RBL minus Predicted from Site)		
		Day	Evening	Night	Day	Evening	Night
BG1	39	55	54	50	16	15	11
BG2	39	54	53	51	16	15	13
BG3	25	50	49	45	25	24	20
BG4	26	49	47	44	23	21	18
BG5	41	56	56	52	15	15	11
BG6	36	54	53	49	18	17	13
BG7	36	54	52	48	18	16	12

5.1.3 UNATTENDED NOISE MEASUREMENT RESULTS

A summary of the measured noise levels at the survey locations are presented in Table 5-4. Results have been presented in accordance with NSW Noise Policy for Industry time period classifications and include a description of the dominant noise sources at each location.

TABLE 5-4 – SUMMARY OF MEASURED NOISE LEVELS

Survey location	Ambient noise level, dBA L_{eq} (15 minute)			RBL (Rating Background Level), dBA			Dominant noise sources
	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am	
BG1	63	61	60	55	54	50	Traffic on Pyrmont St and urban hum
BG2	64	63	60	54	53	51	Mechanical plant (not The Star) and urban hum
BG3	61	58	55	48	47	42	Traffic and urban hum
BG4	58	55	51	49	47	44	Occasional traffic and urban hum
BG5	66	66	64	56	56	52	Traffic on Pyrmont St and urban hum
BG6	61	61	61	54	53	49	Local traffic, distant traffic and urban hum
BG7	57	55	52	54	52	48	Traffic on Pirrama Rd and urban hum

A summary of the measured background (L_{90}) octave band noise levels for **7am-to-midnight** and **midnight-to-7am** is presented in Table 5-5. These time periods accord with Condition F5 in the Major Approval MP08-0098 for entertainment noise.

TABLE 5-5 – L_{90} OCTAVE BAND NOISE LEVELS AT MEASUREMENT POSITIONS

Survey location	Time period[1]	Background noise level, L_{90} dB at 1/1 Octave band centre frequency (Hz)								
		31.5	63	125	250	500	1k	2k	4k	8k
BG1	7am-Midnight	61	59	57	54	51	51	48	40	31
	Midnight-7am	58	55	54	51	48	47	43	36	25
BG2	7am-Midnight	62	62	58	54	51	49	47	39	30
	Midnight-7am	62	62	58	54	51	49	47	39	30
BG3	7am-Midnight	52	55	51	47	44	43	40	31	20
	Midnight-7am	57	60	56	52	49	48	45	36	25
BG4	7am-Midnight	55	56	55	47	45	45	41	33	23
	Midnight-7am	60	61	60	52	50	50	46	38	28
BG5	7am-Midnight	67	65	58	55	53	52	48	41	31
	Midnight-7am	65	64	57	54	52	51	47	40	30
BG6	7am-Midnight	61	59	56	49	49	51	45	39	34
	Midnight-7am	65	63	60	53	53	55	49	43	38
BG7	7am-Midnight	57	54	52	51	50	46	40	29	20
	Midnight-7am	55	52	50	48	44	41	35	27	17

Note 1: Time periods defined in accordance with Condition F5 in the Major Approval MP08-0098. This differs from the time periods in accordance with the NSW Noise Policy for Industry presented in Table 5-4.

Table 5-6 presents the measured ambient noise levels in terms of the EPA's Road Noise Policy descriptors for the Day (7am to 10pm) and Night (10pm to 7am) periods.

TABLE 5-6 – MEASURED TRAFFIC NOISE LEVELS

Survey location	Road Noise Policy Descriptors			
	Day (7am to 10pm)		Night (10pm to 7am)	
	$L_{eq(15hr)}$ dBA	$L_{eq(1hr)}$ dBA	$L_{eq(9hr)}$ dBA	$L_{eq(1hr)}$ dBA
BG1	66	68	63	64
BG2	66	69	63	64
BG3	62	64	57	59
BG4	59	61	54	56
BG5	68	73	66	67
BG6	64	67	63	65

Note 1: All noise levels are presented as façade reflected noise levels.
Note 2:$L_{eq(1hr)}$ noise level presented using the worst 10th percentile method as decribed in the RNP.

5.2 ATTENDED MEASUREMENTS

5.2.1 METHOD

To supplement the unattended noise monitoring, operator-attended noise measurements were conducted at the logging locations. The measurement times were generally selected to investigate whether The Star contributes to the noise environment during busier operating times, as well as at times when other sources (such as local traffic) may be less pronounced.

The noise measurements were carried out with reference to AS 1055 Description and measurement of environmental noise and the NSW Noise Policy for Industry. Measurements were conducted using a Fast time weighting and recorded A-weighted statistical levels. Sound level meters used for the measurements were within NATA calibration and field calibrated before and after the measurement. No significant drift (± 1.0 dBA) was noted.

5.2.2 ATTENDED NOISE MEASUREMENT RESULTS

The attended measurements are summarised in Table 5-7. Comments regarding the identified noise sources are provided, alongside the measured background ($L_{90\ 15min}$) and ambient ($L_{eq\ 15min}$) levels.

TABLE 5-7 – ATTENDED NOISE MEASUREMENT RESULTS

Location	Date	Start time	Noise measurements results dBA		Comments
			$L_{eq(15\ minute)}$	$L_{90(15\ minute)}$	
BG1	17/12/15	3:48pm	62	56	Traffic noise on Pyrmont St and general urban hum dominant. Aircraft and pedestrians briefly audible. Sources from The Star inaudible.
BG1	28/7/16	9.15pm	65	55	Traffic noise on Pyrmont St dominant, general urban hum also audible. A fountain at The Star was barely audible in absence of traffic and not measurable. No other sources from The Star audible.
BG2	23/8/16	7.10pm	62	53	Mechanical plant source not identified to be from The Star at 53-55 dBA. General urban hum and traffic movements dominant. Sources from The Star inaudible.
BG2	29/7/16	12.05am	58	52	Taxis idling on both sides of road, about 8-10 present at a given time, 54 dBA when no traffic flowing. Light traffic on Jones Bay Road. Sources from The Star inaudible.
BG3	23/8/16	5.33pm	65	53	Traffic noise and urban hum dominant with light to medium traffic. Sources from The Star inaudible.
BG3	28/7/16	11.25pm	58	49	Light to no traffic on John St, some patron noise emanating from nearby Pyrmont Point Hotel. General urban hum dominant. Sources from The Star inaudible.
BG4	23/8/16	5.50pm	68	55	Traffic noise on Harris St dominant, intermittent bird calls. Aircraft overhead, up to 58 dBA. The Star inaudible.
BG4	28/7/16	10.45pm	62	49	Light traffic on Harris St, with occasional pedestrian walking past. General urban hum at other times. Sources from The Star inaudible.
BG5	23/8/16	6.13pm	65	56	Traffic noise dominant on Pyrmont St and urban hum. Idling cars 56 dBA, pedestrian crossing 'green light' 57 dBA. Sources from The Star inaudible.
BG5	29/7/16	12.50am	62	51	Light traffic on Pyrmont St, mainly coming from Union St. General urban hum dominates in absence of traffic, but some mechanical plant not identified to be from The Star also audible. Sources from The Star inaudible.
BG6	23/8/16	7:30pm	60	54	Urban hum and traffic noise dominant with light to medium traffic. Sources from The Star inaudible.
BG6	28/7/16	10.00pm	60	54	Light traffic on Union St, pedestrian crossing audible in absence of traffic. Measured 55 dBA in absence of traffic. Occasional groups of people talking while walking along Union St, not believed to have come from The Star. Sources from The Star inaudible.
BG7	23/8/16	6.50pm	53	50	General urban hum and traffic noise on Pirrama Rd. Occasional bell from Lyric Theatre just audible and not measurable. Laughing from bus stop, three instances of 52-54 dBA for 1-2 seconds. No other The Star sources audible.

Location	Date	Start time	Noise measurements results dBA		Comments
			$L_{eq(15\ minute)}$	$L_{90(15\ minute)}$	
BG7	29/7/16	1.15am	49	47	General urban hum. Occasional people talking on Pirrama Rd just audible, estimated 38-40 dBA. No other The Star sources audible.

5.3 TRAFFIC COUNTS

Traffic counts were carried out at six locations on the roads surrounding The Star to characterise existing traffic conditions, volumes and mix of heavy and light vehicles. Traffic counting was carried out at the same time as the noise monitoring (22 July to 2 August 2016) and during periods of typical traffic flow (outside of school holidays and special events).

Table 5-8 presents measured traffic counts, percentage heavy vehicles and the 85th percentile speeds used to validate the noise model for existing conditions.

TABLE 5-8 – MEASURED TRAFFIC VOLUMES, COMPOSITION AND SPEED FOR ROADS SURROUNDING THE STAR

Location	Day (7am to 10pm)			Night (10pm to 7am)		
	Total	%Heavy vehicles	85th speed (km/h)	Total	%Heavy vehicles	85th speed (km/h)
Jones Bay Road	6377	5.1	33.9	2603	3.3	29.6
Pirrama Rd near Light Rail	8219	4.7	39.9	3098	2.8	31.5
Pirrama Rd near Accenture	5813	5.6	42.0	2029	1.7	37.5
Pyrmont St 50m south of Jones Bay Road	6821	4.8	40.2	2435	3.2	33.2
Harris St 20m south of Jones Bay Road	6627	5.1	36.9	1243	3.5	35.0
Union St 20m east of Edward St	2058	4.8	31.6	810	2.3	26.3

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THE STAR

ENVIRONMENTAL NOISE CRITERIA

6 ENVIRONMENTAL NOISE CRITERIA

This section presents the criteria used to assess the potential acoustic impact of Modification 13 in accordance with the SEARs.

6.1 ASSESSMENT APPROACH

There are three types of noise sources emanating from The Star; mechanical plant and equipment, entertainment noise from licensed areas, and other operational noise sources. Currently, existing approval noise conditions controlling these noise sources are Conditions E1 and F4 (mechanical plant) and Condition F5 (entertainment noise).

Assessments of previous modifications have included 'other operational noise' sources (as defined in Section 3) under Conditions E1 and F4. However, 'other operational noise' sources includes, for example, noise from vehicular traffic in the Porte Cochere which is not 'mechanical plant'. Therefore, it is proposed in this report that 'other operational noise sources' be regulated under a separate condition so as to avoid this confusion.

The project's SEARs require the proposal to not only demonstrate compliance with the project approval conditions, but also, to demonstrate limited environmental impact beyond that already assessed for the approval.

The current approval, MP 08_0098 (Modification 14), was assessed against the policies, guidelines and approval conditions detailed within this section. The currently approved conditions in MP08_0098 (Modification 14) are based on a simplified and cumulative site-wide approach. To determine if the proposed Modification 13 works can be built to have limited environmental impact beyond that already approved, a comparison is made between noise impacts associated with the project operating under Modification 14 and that predicted under Modification 13 (Section 16).

6.2 CONDITIONS E1 AND F4 – PLANT AND MACHINERY

Table 6-1 presents the numerical criteria applicable to mechanical plant and machinery as per Conditions E1 and F4 of the project approval at each of the representative measurement locations. The background noise measurements described in Section 5 have been used to establish the assessment criteria.

These criteria apply to the overall environmental noise emissions from all mechanical plant associated with operation of The Star. Plant and machinery noise emission criteria are applicable at the nearest residence outside the proposed development site.

TABLE 6-1 – SUMMARY OF PLANT NOISE EMISSION CRITERIA IN ACCORDANCE WITH CONDITIONS E1 AND F4

Survey Location	Time Period	Rating Background Level (RBL), dBA	Plant Noise Criteria (L_{90} + 5), dBA $L_{eq\ (15\ minute)}$
BG1	Daytime 7am - 6pm	55	60
	Evening 6pm - 10pm	54	59
	Night 10pm - 7am	50	55
BG2	Daytime 7am - 6pm	54	59
	Evening 6pm - 10pm	53	58
	Night 10pm - 7am	51	56
BG3	Daytime 7am - 6pm	48	53
	Evening 6pm - 10pm	47	52
	Night 10pm - 7am	42	47
BG4	Daytime 7am - 6pm	49	54
	Evening 6pm - 10pm	47	52
	Night 10pm - 7am	44	49
BG5	Daytime 7am - 6pm	56	61
	Evening 6pm - 10pm	56	61

Survey Location	Time Period	Rating Background Level (RBL), dBA	Plant Noise Criteria (L_{90} + 5), dBA $L_{eq\ (15\ minute)}$
	Night 10pm - 7am	52	57
BG6	Daytime 7am - 6pm	54	59
	Evening 6pm - 10pm	53	58
	Night 10pm - 7am	49	54
BG7	Daytime 7am - 6pm	54	59
	Evening 6pm - 10pm	52	57
	Night 10pm - 7am	48	53

6.3 CONDITION F5 – LICENSED PREMISES – MUSIC AND PATRON NOISE

Table 6-2 presents the assessment criteria at the representative measurement locations for noise from music and patron (entertainment noise) related activities. Background noise measurements described in Section 5 have been used to determine the assessment criteria.

The internal noise levels within commercial receivers will vary principally according to the level of mechanical plant noise within the tenancy and may vary from hour to hour depending upon the type of plant used and the external temperature. Therefore, it is not feasible to evaluate existing internal noise levels within commercial tenancies.

Instead, an assumption is made that, where the external noise levels from The Star comply with their respective residential criteria at nearby residential receivers, the internal commercial criteria are complied with at the commercial tenancies. As a result, commercial receivers have not been considered further.

TABLE 6-2 – CONDITION F5 OCTAVE BAND NOISE CRITERIA FOR RESIDENTIAL RECEIVERS NEAR NOISE MONITORING LOCATIONS

Representative Location	Time Period	Entertainment venue noise criteria, dB $L_{10\ (15\ minute)}$ at 1/1 Octave band centre frequency, Hz								
		31.5	63	125	250	500	1k	2k	4k	8k
BG1	7am-Midnight	66	64	62	59	56	56	53	45	36
	Midnight-7am	58	55	54	51	48	47	43	36	25
BG2	7am-Midnight	67	67	63	59	56	54	52	44	35
	Midnight-7am	60	60	55	50	49	46	43	36	26
BG3	7am-Midnight	54	60	56	52	49	48	45	36	25
	Midnight-7am	49	49	47	44	42	40	36	27	16
BG4	7am-Midnight	60	61	60	52	50	50	46	38	28
	Midnight-7am	51	51	48	43	41	39	35	25	13
BG5	7am-Midnight	72	70	63	60	58	57	53	46	36
	Midnight-7am	62	59	56	52	49	48	43	35	25
BG6	7am-Midnight	66	64	61	54	54	56	50	44	39
	Midnight-7am	58	55	52	47	46	45	40	32	22
BG7	7am-Midnight	62	59	57	56	55	51	45	34	25
	Midnight-7am	55	52	50	48	44	41	35	27	17

THE STAR

INTERNAL ACOUSTIC DESIGN CRITERIA

7 INTERNAL ACOUSTIC DESIGN CRITERIA

Internal noise levels can have significant impacts on the intended use of a built space; from privacy issues through to protecting the amenity of the occupant. This section presents design criteria applicable to the new tower residential and hotel accommodation proposed in Modification 13.

7.1 INTERNAL AMBIENT NOISE

The City of Sydney's Development Control Plan 2012 (DCP) contains acoustic controls for proposed residential developments. The DCP sets out internal noise criteria for residential developments inside bedrooms and main living areas. The building must be designed so that noise received inside a sensitive development from external sources is controlled within the limits allowed by the DCP.

The applicable DCP requirements are outlined in: S*ection 4 - Development Types*;

(7) The repeatable maximum $L_{Aeq\ (1\ hour)}$ for residential buildings and serviced apartments must not exceed the following levels:
- *(a) for closed windows and doors:*
  - *(i) 35dB for bedrooms (10pm-7am); and*
  - *(ii) 45dB for main living areas (24 hours).*
- *(b) for open windows and doors:*
  - *(i) 45dB for bedrooms (10pm-7am); and*
  - *(ii) 55dB for main living areas (24 hours).*

(8) Where natural ventilation of a room cannot be achieved, the repeatable maximum $L_{Aeq\ (1hour)}$ level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:
- *(a) 38dB for bedrooms (10pm-7am); and*
- *(b) 48dB for main living areas (24 hours).*

(9) These levels are to include the combined measured level of noise from both external sources and the ventilation system operating normally.

(10) To limit the transmission of noise to and between dwellings, all foors are to have a weighted standardised impact sound level ($L'_{nT,w}$) less than or equal to 55 where the foor separates a habitable room and another habitable room, bathroom, toilet, laundry, kitchen, plant room, stairway, public corridor, hallway and the like.

7.1.1 BUILDING CODE OF AUSTRALIA

The Hotel and Residential components of the proposed development are classified as Class 3 and 2 respectively under the Building Code of Australia (BCA). Class 2 and 3 developments must achieve the acoustic performance requirements outlined in Part F5 of the BCA.

Table 7-1 presents the relevant acoustic requirements for Class 2 and 3 developments.

TABLE 7-1 – BCA ACOUSTIC REQUIREMENTS

Building Element	Description	Impact Noise Requirements	Airborne Noise Requirements
Walls	Separating sole occupancy units	—	$R_w + C_{tr} \geq 50$
	Separating a habitable room of a sole occupancy unit from a bathroom, sanitary compartment, laundry or kitchen in an adjacent sole occupancy unit	Discontinuous construction	$R_w + C_{tr} \geq 50$
	Separating a sole occupancy unit and a stairway, public corridor, public lobby or the like	—	$R_w \geq 50$
	Separating a sole occupancy unit and a plant room and lift shaft	Discontinuous construction	$R_w \geq 50$
	A door between a sole occupancy unit and a stairway, public corridor, lobby or the like.	—	$R_w \geq 30$

Building Element	Description	Impact Noise Requirements	Airborne Noise Requirements
Floors	Separating sole-occupancy units and separating sole-occupancy units and a plant room, lift shaft, stairway, public corridor, public lobby or the like.	$L_{n,w} \leq 62$	$R_w + C_{tr} \geq 50$
Services	A duct, soil, waste, water supply pipe and stormwater pipe located in a wall or floor cavity, serves or passes through more than one sole occupancy unit if the adjacent room is a habitable room (other than a kitchen)	—	$R_w + C_{tr} \geq 40$
	A duct, soil, waste, water supply pipe and stormwater pipe located in a wall or floor cavity, serves or passes through more than one sole occupancy unit if the adjacent room is a kitchen or any other non-habitable room.	—	$R_w + C_{tr} \geq 25$
Pumps	The point of connection between the service pipes in a building and any circulating or other pump.	A flexible coupling at the connection	—

Note 1: Discontinuous constructions must have a minimum 20 mm gap between separate leaves. Cavity masonry walls are to have resilient wall ties or no wall ties.

7.2 VIBRATION

Vibration generated within the development shall be designed such that the resultant vibration does not exceed the criteria detailed in the EPA's Assessing Vibration: A Technial Guideline. The guideline provides vibration limits for human comfort for the different usages in the development. The recommended multiplying factors for this development are shown in Table 7-2.

TABLE 7-2 - MULTIPLYING FACTORS USED TO SPECIFY SATISFACTORY MAGNITUDES OF BUILDING VIBRATION WITH RESPECT TO HUMAN RESPONSE (ASSESSING VIBRATION: A TECHNICAL GUIDELINE, EPA, 2006)

Usage	Time	Multiplying factors	
		Continuous vibration	Impulsive vibration
Residences	Day	2-4	60-90
	Night	1.4	20
Offices	Day	4	128
	Night	4	128

THE STAR

CONSTRUCTION NOISE AND VIBRATION CRITERIA

8 CONSTRUCTION NOISE AND VIBRATION CRITERIA

To demonstrate compliance with the SEARs Key issue 1 and 11, construction noise and vibration must be be assessed and managed according to the Interim Construction Noise Guideline (ICNG) (DECC, 2009), and undertaken in line with hours of work for specified in Condition D11 of the project approval.

8.1 PROJECT APPROVAL REQUIREMENTS

Condition D11 from the project approval relates to construction activities as follows:

Condition D11 Hours of Work

1. The hours of construction, including the delivery of materials to and from the site, shall be restricted as follows:

a) *between 7:00 am and 5.30 pm, Mondays to Fridays inclusive;*

b) *between 8:00 am and 3.00 pm, Saturdays;*

c) *between 9:00 am and 3.30 pm, Mondays to Fridays for mechanical rock blasting;*

d) *no work on Sundays and public holidays.*

2. Works may be undertaken outside these hours where:

a) *the delivery of materials is required outside these hours by the Police or other authorities;*

b) *it is required in an emergency to avoid the loss of life, damage to property and/or to prevent environmental harm; and*

c) *residents likely to be affected by the works are notified of the timing and duration of these works at least 48 hours prior to the commencement of the works; and*

d) *the work is approved by the Director-General or their nominee.*

3. Notwithstanding conditions 1 and 2 above minor internal works to the existing building, including but not limited to demolition of light weight partitions, construction of new partitions, installation of ceilings, finishing of floors, engineering services installations, carpet installation, lighting programming, painting, may be undertaken outside these hours in accordance with the submitted Construction Noise and Vibration Management Plan required by condition B 21B.

Should noise complaints be received by Council or other State government agencies from a place of different occupancy (including commercial premises) and the complaint being substantiated by a Council Officer or representative of the relevant State agency, the construction works occurring during the approved extended construction hours must cease operation until 'attenuation works' are carried out. Extended construction hours must not commence until compliance with the relevant noise conditions can be achieved.

All heavy demolition and construction works shall be restricted to between the hours of 9:00am – 4:00pm Mondays to Saturdays.

8.2 INTERIM CONSTRUCTION NOISE GUIDELINES

In accordance with the SEARs, construction noise from the development should be managed and assessed in accordance with the ICNG.

Noise management levels (NMLs) have been defined for each representative noise monitoring location with reference to the ICNG. Table 8-1 presents the definition of NMLs and how they are applied.

TABLE 8-1 - CONSTRUCTION NOISE MANAGEMENT LEVELS FOR RESIDENTIAL RECEIVERS

Time of day	NML $L_{Aeq\ (15\ minute)}$	How to apply
Recommended standard hours: **Monday to Friday** **7.00 am to 6.00 pm** **Saturday** **8.00 am to 3.00 pm[1]** **No work on Sundays or public holidays**	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority(consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Note 1: Recommended standard hours in the ICNG for Saturday is between 8.00am and 1.00pm. However, the existing approved construction hours in Condition D11 for Saturday of 8.00am to 3.00pm have been maintained for this development.

8.2.1 NOISE MANAGEMENT LEVELS

Table 8-2 presents the established construction noise management levels at the nearest residential receivers based on the background noise monitoring described in Section 5. The predominant non-residential land use in Pyrmont close to The Star is commercial. The ICNG construction noise management level for offices and retail outlets is 70 dBA $L_{eq(15\ minute)}$.

TABLE 8-2 – CONSTRUCTION NOISE MANAGEMENT TRIGGER LEVELS AT RESIDENCES

Representative location	Construction noise management levels dBA $L_{eq\ (15\ minute)}$			
	Standard hours	Outside of standard hours		
		Day	Evening	Night
BG1	65	60	59	55
BG2	64	59	58	56
BG3	58	53	52	47
BG4	59	54	52	49
BG5	66	61	61	57
BG6	64	59	58	54
BG7	64	59	57	53

Note 1: Standard hours are defined as Monday to Friday 7am to 6pm and Saturdays 8am to 3pm
Outside of standard hours (day) defined as Saturdays 3pm to 6pm and 7am to 6pm Sundays and Public Holidays
Outside of standard hours (evening) defined as Monday to Sunday 6pm to 10pm
Outside of standard hours (night) defined as all remaining periods.

8.2.2 GROUND BORNE NOISE

As no blasting is proposed for this site, the ground borne noise criteria in the ICNG is applicable for the proposed works. This criteria limits noise at nearby residences caused by vibration transmitted through the ground into a structure. This criteria targets noise between the hours of 6pm and 7am on any day of the week. Table 8-3 presents the ground-borne noise limits at nearby residential receivers.

TABLE 8-3 – ICNG GROUND BORNE NOISE LIMITS AT RESIDENTIAL RECEIVERS

Time of Day	Internal Noise Limit, dBA $L_{eq\ (15\ minute)}$
Evening (6pm to 10pm)	40
Night-time (10pm to 7am)	35

8.3 GROUND VIBRATION

Excessive vibration from construction activities can lead to:

- Cosmetic and structural building damage; and
- Loss of amenity due to perceptible vibration, termed human comfort.

Importantly, cosmetic damage is regarded as minor in nature; it is readily repairable and does not affect a building's structural integrity. Damage of this nature is typically described as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks, and separation of partitions or intermediate walls from load bearing walls. If there is no significant risk of cosmetic damage then structural damage is not considered a significant risk and is not further assessed.

8.3.1 COSMETIC BUILDING DAMAGE

There is currently no guidance in NSW specifically addressing cosmetic damage to buildings from vibration. Two international standards are typically referenced for the assessment of cosmetic damage in buildings; British Standard BS 7385-2: 1993 Evaluation and measurement for vibration in buildings and German Standard DIN 4150-3: 1999 Structural Vibration - Part 3: Effects of vibration on structure. Table 8-4 presents a summary of the vibration limits for cosmetic damage from BS 7385-2.

These peak vibration limits are set so that the risk of 'cosmetic' damage in residential or commercial buildings is minimal. They have been set at the lowest level above which damage has been credibly demonstrated. The limits also assume that the equipment causing the vibration is only used intermittently, however if the equipment is used continuously, then the limits may need to be reduced by up to 50 per cent. For 'minor' or 'major' vibrational damage to occur, the standard states that vibration need to be two times and four times (respectively for group 1 and group 2) the values shown in Table 8-4.

TABLE 8-4 - BS7385 COSMETIC DAMAGE CRITERIA, PEAK COMPONENT PARTICLE VELOCITY, (MM/S 1)

Group	Type of structure	4–15 Hz	15–40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial or heavy commercial buildings		50	
2	Un-reinforced or light framed structures Residential or light commercial buildings	15 - 20[2]	20 - 50	50

Note 1: Values referred to are at the base of the building, on the side of the building facing the source of vibration (where feasible).
Note 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

Guidance in BS 7385 also suggests that unless structurally unsound, heritage items should not be considered to be more sensitive than dwellings for the purposes of assessment.

8.3.2 HUMAN COMFORT (AMENITY)

Limits for vibration impacts relating to human comfort are detailied in Assessing Vibration: A Technical Guideline (DEC, 2006). For short term work, such as construction work, the guideline states the following:

When short-term works such as piling, demolition and construction give rise to impulsive vibrations, undue restriction on vibration values may signifcantly prolong these operations and result in greater annoyance. Short-term works are works that occur for a duration of approximately one week.

In circumstances where work is short term, feasible and reasonable mitigation measures have been applied, and the project has a demonstrated high level of social worth and broad community benefits, then higher vibration values (above the maximum) may apply. In such cases, best management practices should be used to reduce values as far as practicable, and a comprehensive community consultation program should be instituted.

THE STAR

ROAD NOISE POLICY REQUIREMENTS

9 ROAD NOISE POLICY REQUIREMENTS

The Road Noise Policy (EPA, 2011) (RNP) provides criteria and guidance for the assessment of impacts from road traffic noise on sensitive receivers.

One of the aims of the RNP is to limit noise impacts from road traffic from land use developments that generate additional traffic on public roads. The RNP has been used in this assessment to address noise associated with potential traffic increases on the surrounding road network as a result of changes at The Star.

Table 9-1 presents the criteria for the relevant road categories associated with the project. Road categories were determined in consultation with the project's traffic consultant and the definitions in the RNP. Roads surrounding The Star have been categorised as local roads and collector roads (the latter which is included in the RNP's definition of sub-arterial roads). The applicable noise assessment criteria are shown in the following table.

TABLE 9-1 – EXTRACT FROM RNP SECTION 2.3.1- NOISE ASSESSMENT CRITERIA - RESIDENTIAL LAND USES

Project Type/Land Use	**Assessment Criteria dBA[1]**	
	Day (7am-10pm)	Night (10pm-7am)
Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{eq\ (1\ hour)}$ 55 (external)	$L_{eq\ (1\ hour)}$ 50 (external)
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use development	$L_{eq\ (15\ hour)}$ 60 (external)	$L_{eq\ (9\ hour)}$ 55 (external)

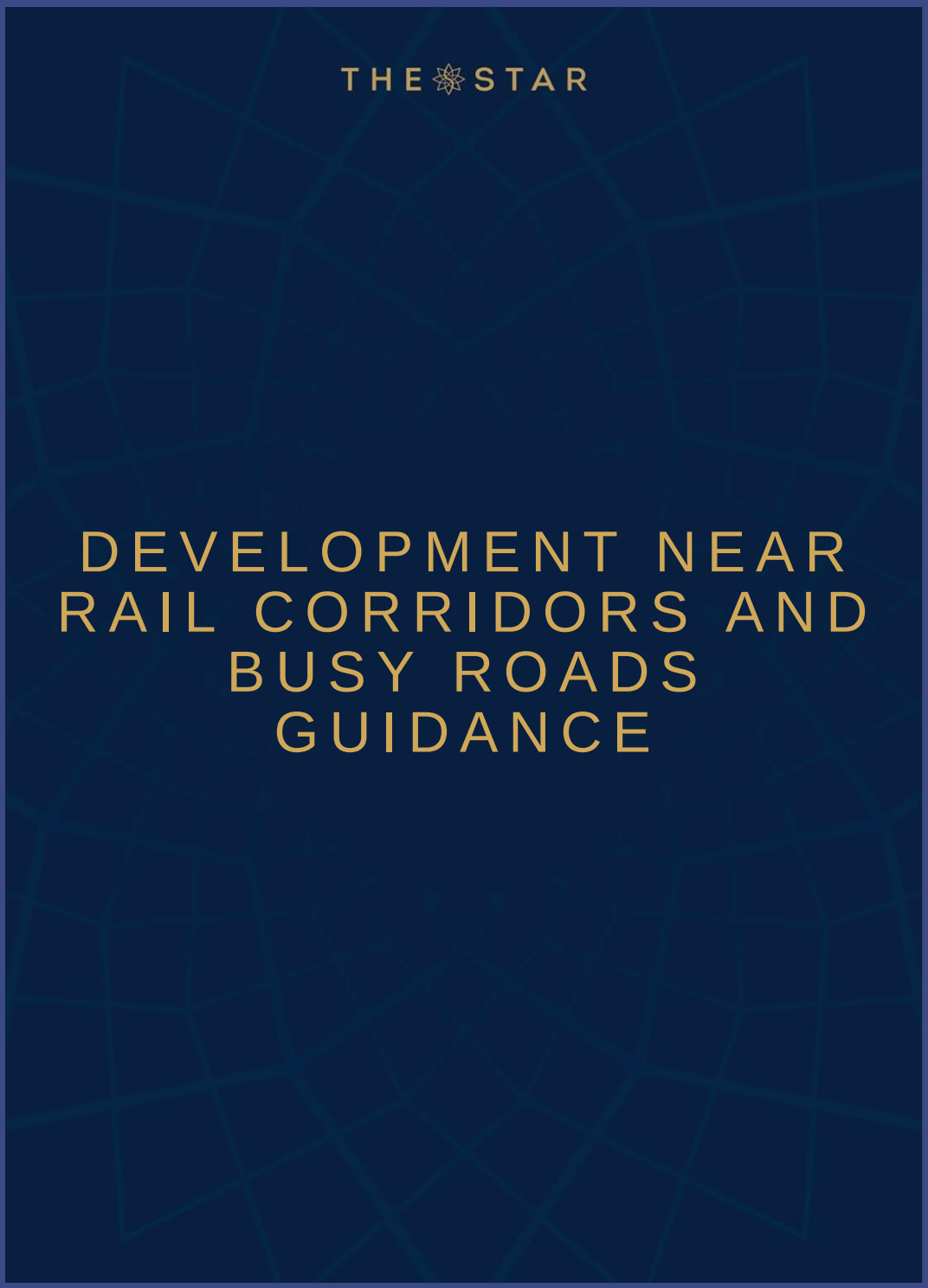
Note 1: Façade corrected noise levels.

Noise monitoring indicates that existing noise levels from current traffic exceed the RNP assessment criteria. In this case, the RNP Application Notes (EPA, 2013) state that where traffic noise increases as a result of a land use development by more than 2 dBA and existing noise levels are above the assessment criteria, mitigation should be considered. According to the RNP, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. Therefore, as existing levels without the development are already above the RNP criteria, any increases in road traffic noise levels as a result of the development should be limited to no more than 2 dBA above the existing traffic noise level.

Specifically for land use developments, the RNP considers a development that has multiple approvals which all incrementally increase road traffic noise levels is to be assessed cumulatively as one development, unless the development affects separate areas and cumulative impacts at receivers from multiple approvals do not exceed the RNP criteria.

The Star was approved in 2008 and has since had 13 modifications approved. Determining the cumulative impact of all modifications with precision is not possible because traffic volumes in the area have changed from other local developments not associated with The Star. Nevetheless, an appreciation of changes in traffic volumes and traffic noise attributable to The Star can be made by examining the various traffic and noise reports prepared for each modification.

The assessment of the development's impact on the off-site road traffic is detailed in Section 12.


THE STAR
DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS GUIDANCE

10 DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS GUIDANCE

The DPE Development near Rail Corridors and Busy Roads Interim Guideline (2008) provides guidance on the acoustic requirements for developments which are located in or adjacent to rail corridors or busy roads. The guideline details the requirements and implementation of the relevant provisions in the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP).

The proposed development is above the existing Sydney Light Rail line and therefore potential impacts are required to be addressed.

10.1 ROAD

The guideline specifies that any development adjacent to a major road, defined as a road which carries an annual average daily traffic (AADT) of more than 40,000 vehicles is also subject to Infrastructure SEPP requirements. The nearest road that has an AADT of more than 40,000 vehicles is the Western Distributor which is at least 500 metres from the proposed development. As this road is not considered adjacent, the busy roads criteria in the guideline will not apply to this development.

10.2 RAIL

The guideline is applicable to the proposed development as the proposed tower containing residential uses is within the Sydney Light Rail corridor.

The guideline specifies noise limits for residential uses from rail movements as follows:

- In any bedroom in the building: 35dB(A) at any time 10pm–7am; and
- Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.

As the Light Rail line is underground or enclosed within the vicinity of the proposed residential tower and there is no line of sight, the noise emissions from the Light Rail line are not considered significant and no further assessment has been undertaken.

The Light Rail is on Level B2 and the lowest residential apartment is on level L5 which is a separation of eight building levels. Whilst it is unlikely that vibration and ground borne noise from the Light Rail will be felt or audible in any residential apartment, an assessment has been carried out in Section 14.

THE STAR

OPERATIONAL NOISE EMISSIONS ASSESSMENT

11 OPERATIONAL NOISE EMISSIONS ASSESSMENT

The following are the operational noise emission assessments of Modification 13 using the applicable noise criteria presented in Section 6. Noise emission assessments presented in this section address areas of Modification 13 works which have been identified to potentially have noise impacts on nearby receivers.

The assumptions of the operational noise emission are presented in the following sections for each category. These assumptions have been made based on worst case scenario and our understanding of the site and conditions.

The internal modification works are not considered to impact external receivers and have not been included.

11.1 ASSESSMENT METHODOLOGY

To assess operational noise emissions, a three-dimensional noise model was developed using the methodology outlined in the following sections and the sound power levels for existing sources detailed in Appendix B. The model was developed in SoundPLAN (Version 7.4) using the parameters presented in Table 11-1. The following sections outline the methodology and assumptions that have been used in the modelling and assessment.

TABLE 11-1 – THE STAR NOISE MODEL PARAMETERS

Item	Description
Noise model	SoundPLAN Version 7.4
Calculation method	ISO 9613-2
Ground topography	0.5 metre spaced ground contours from AAM 2013 LiDAR Data set.
Surrounding Buildings	LiDAR building footprints and heights from AAM 2013 LiDAR Data set.
The Star building information	High resolution 2013 AAM LiDAR Data set with modifications for any modifications taken place between 2013 and 2016 using latest drawings available (December 2016).
Ground absorption	Water, roads and concrete areas, absorption coefficient set to 0 Grassed areas, absorption coefficient set to 0.75.
The Star existing noise sources	From measurements taken on site or derived from similar sources as detailed in Appendix B.

An image of the noise model is presented in Figure 11-1.

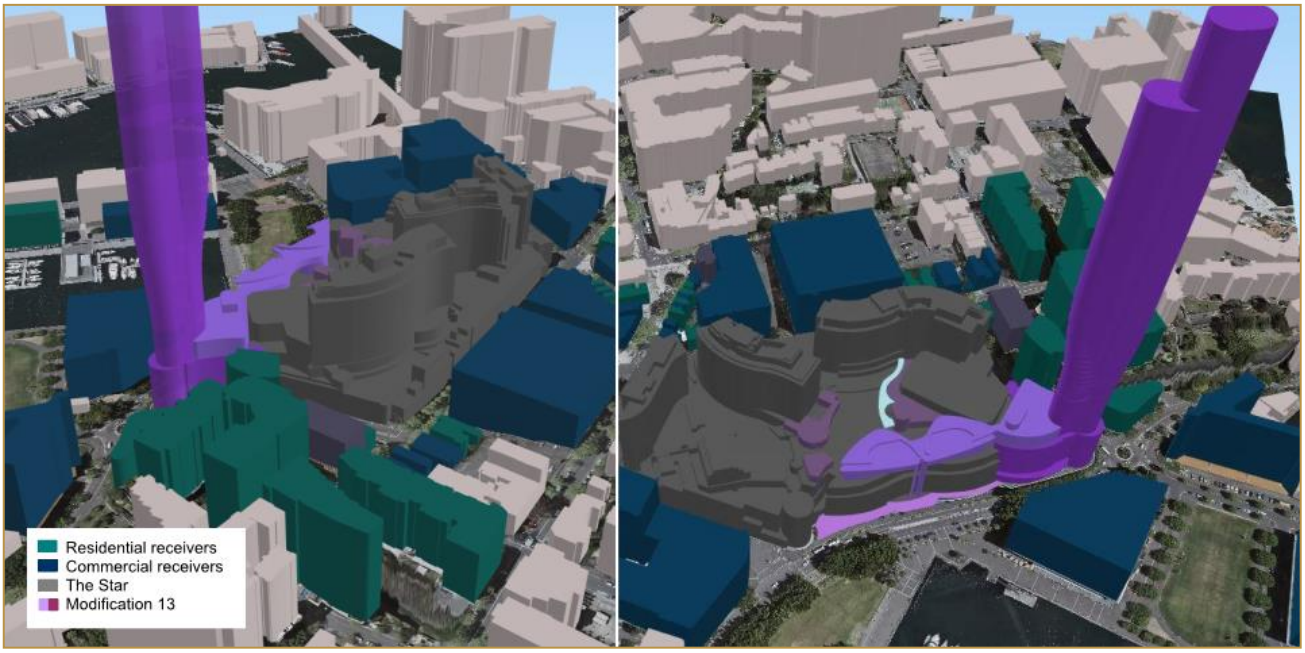


FIGURE 11-1 - THE STAR AND SURROUNDING AREA NOISE MODEL

11.2 MECHANICAL AND OPERATIONAL NOISE

The following sections provide an assessment of the proposed mechanical and operational noise emissions from The Star at the surrounding sensitive receivers excluding entertainment noise from licensed premises.

The conditions addressed in this section are:

- Conditions E1 and F4 – Mechanical Plant and Equipment
- Other operational noise except entertainment noise from licenced areas

Of the changes proposed in Section 2, the items with the potential to impact the acoustic impact of the site are as follows:

- Addition of mechanical plant associated with
  - New Ritz Carlton hotel
  - New Tower residential apartments
  - New Level B2 and Level 00 retail and food and beverage premises
  - New food and beverage premises on Level 05
  - New Level 05 and 07 pools and gyms
  - New Capstone tri-generation plant
- Relocation of existing mechanical plant
  - MUEF cooling towers
  - Emergency diesel generator flues
- New operational noise sources including
  - Reconfiguration of transportation hub
  - Change in Pirrama Road transportation hub facade
  - Activation of service road for taxi exit from transportation hub
  - Use of service road to store coaches

- New Porte Cochere for Ritz Carlton hotel
- New car park entry on Pyrmont Street

11.2.1 MECHANICAL PLANT

The proposed upgrades and changes to The Star will include additional mechanical plant to service the tower, ribbon and use changes across the site in addition to the relocation of existing plant to accommodate the physical changes across the site.

New mechanical plant is expected to be required as per the following:

- Restaurants, bars, toilets entertainment areas associated with the proposed tower and Level 07.
  - Each new restaurant has been assumed to have one Kitchen Exhaust Fan and each toilet has a Toilet Exhaust Fan located above the area of use.
  - An additional 5 kitchen exhaust fans have been modelled at the Ribbon façade on Level 07, as well as an additional 3 kitchen exhaust fans at the Ritz Carlton façade near the Ribbon on Level 07.
  - One exhaust fan has been modelled for the Food and Beverage facing Edward Street
- Proposed new pools on the Level 05 and Level 07.
  - The pumps and associated mechanical plant are to be housed in acoustically treated enclosures and are expected to be controlled to within allowable limits. As such they have not been included in the calculation.
- Six Capstone tri-generation units are expected to be added as follows:
  - Four units are within the new Level 03 plant room, located at the foot of the Astral Residences
    - Level 03 plant room has one exhaust flue in addition to breakout noise from a ventilation opening.
  - Two units are located within the plant room located on Level 05 of the Ribbon.
    - The two units are exhausted with one exhaust stack each.
  - The noise levels used for the assessment are detailed in Table 11-3.
- As is expected at this stage of design, the details of all the plant room equipment have not been finalised. Plant areas that are located internally, have therefore not been included in the calculation. These are considered to have minimal noise contribution and are acceptable for this assessment, as equipment likely to be installed, can be effectively attenuated through use of typical noise controls; enclosed rooms, in-duct attenuators, acoustic louvres and selection of low-noise equipment. These internal plant rooms are:
  - Proposed food and beverage premises at the corner of Union and Edward Street;
  - New and upgraded site-wide retail premises;
  - Community and food outlet usage space at base of tower; and
  - Plant rooms for the hotel and ribbon located internally within the Ribbon, Level 42 and the roof of the tower.

In addition to the new mechanical plant, the relocation of existing plant is also expected to occur to accommodate physical changes associated with the following:

- Relocation of the emergency diesel generator exhaust stacks. It is proposed that the four existing flues and their associated mufflers within the generator room will be retained. The four flues will be rerouted into a new manifold and consolidated into a single flue. A new double width, double inlet (DWDI) fan and attenuator in discharge will be introduced. The flue will then be mounted on the wall of the existing MUEF plant room and discharge above the height of the new cooling tower extension.
  - Table 11-2 shows the sound pressure data received from Exhaust Control for the diesel generators
  - Noise emission of breakout from the exhaust stack walls has not been modelled as the lagging of the flues is required for thermal insulation and appropriate acoustic attenuation will be achieved by the design.

- The noise emission from the stack tip has been limited and the limit stated in this report will be achieved by the exhaust stack designers.
- The detailed design of the attenuators and duct paths for the diesel stack shall be designed to not emit excessive low frequency noise or tonal noise as defined in the EPA's Noise Policy for Industry (**NPfI**). According to the NPfI's definition of the excessive low frequency, the dBC noise level from the new diesel exhaust flue must not exceed the dBA level by more than 15 dB when assessed at the receiver.
- Based on preliminary calculation of the re-routed diesel generator exhaust stack design, the generator has the potential to result in excessive low frequency in accordance with NPfI's definition of the dBC noise level exceeding the dBA level by more than 15 dB. This is due to the physical properties of attenuators or lined ducts which attenuate mid and high frequencies more than low frequencies. Therefore, acoustic treatment to reduce the overall diesel generator stack noise emission will result in widening the level difference between the dBC and the dBA noise levels.
- It is reconised that any formal penalty under the NPfI should be applied when the sound level at the receiver has a low frequency characterstic. For simplicity, a 5 dB penalty has been applied to the dBA noise limit for the stack emission. Based on the dBA noise limit, a dBC noise limit is also established and presented in Table 11-3.

TABLE 11-2 - EXISTING GENERATOR SETS SOUND PRESSURE LEVELS

Generator set	Sound Pressure Level, dB * 1/1 Octave band centre frequencies (Hz)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
TCD 2020 V12 1750 kVA (3 sets)	115	121	119	115	110	103	100	99
TCD 2020 V16 2700 kVA (1 set)	121	125	118	112	109	105	96	93

* measured at 1m from the generator sets

- Cooling towers adjacent to the MUEF to be moved from current location on Jones Bay Road to make way for the tower. They are expected to be relocated in the 345 plantroom adjacent to the Astral Hotel along the Jones Bay Road façade.
  - The assessment has been based on preliminary selections for the cooling towers as eight BAC VXT-1050 XC units. Mitigation has been included in the calculations as follows:
    - XC type attenuators fitted to all units
    - Half of the units are orientated to have the fan end orientated away from the Jones Bay Road residences.
    - 345 Plantroom to have solid block walls facing the Jones Bay Road residences of minimum height equal to the full height of the cooling tower units
- The sound power levels used for the proposed mechanical plant and operations are presented in Section 11.2.3.

11.2.2 OTHER OPERATIONAL NOISE SOURCES

In addition to mechanical plant changes, other non-licensed areas operational activities associated with the tower and site-wide upgrades have been included in the operational noise assessment as detailed in the following sections.

EXISTING PORTE COCHERE

The existing Porte Cochere has been included in the noise model for operational noise, based on ten idling vehicles inside.

RITZ-CARLTON HOTEL PORTE COCHERE

The new Ritz Carlton Porte Cochere has been included in the operational noise model. A worst-case 15 minute period has been assumed. While talking is expected to take place, it is assumed that noise associated with vehicles will be dominant. The following sources for a 15 minute period were included:

- Two idling cars;
- Three car movements into the Porte Cochere; and
- Three car movements out of the Porte Cochere.

LOADING DOCKS

Loading docks are located within the premises and are not considered a significant noise emission source, therefore they have not been included in the noise model.

PIRRAMA ROAD FAÇADE AND PUBLIC TRANSPORT HUB CHANGES

The changes to Pirrama Road façade at ground level have the potential to increase ambient noise levels at the receivers from noise breaking out of the public transportation area underneath The Star. The noise model has accounted for an open façade in the area under the entrance escalators and assuming a reverberant sound pressure level based the reverberant noise level inside the existing transportation hub measured during peak activity and included five light rail movements, mechanical plant and vehicle movements.

Additional vehicle movements will be present in the transportation hub as a result of the public transportation access to The Star. The peak additional taxi movements in the transportation hub were derived from the existing Porte Cochere movements which will be diverted to the transportation hub during the day, and evening/night periods. The addition of the hotel and Tower residential car park vehicle movements was also considered. The model assumed the following based on the forecast movements in the Traffic Impact Assessment:

- 22 (day) and 56 (night) taxi entry and exit movements in a 15 minute period
- One door slam per taxi movement
- Each taxi moves at 20 km/h
- 22 idling taxis in a 15 minute period
- 19 (day) and 11 (night) movement associated with the Tower residential and hotel car park in a 15 minute period

This noise level was added to the measured level to generate a reverberant noise level inside the transportation hub and associated breakout noise on the Pirrama Road façade during the day and night periods.

SERVICE ROAD

The use of the service road (north of the Jones Bay Road intersection) is expected to change as a result of the transportation hub changes. Taxis are expected to exit the transportation hub on the service road. In addition, during the day period, coaches are also expected to be stored on the service road.

Based on the number of existing taxi movements accessing the site and the predicted car park usage from the Traffic Impact Assessment, the model has assumed a worst case 15 minute period for 13 taxis and 7 light vehicle movements on the service road during the day. Coaches must not stand with their engines on or idling and must be shut off when waiting on the service road at all times.

During the evening and night, 26 taxis and 4 light vehicle exit movements and no coaches have been assumed in a worst case 15 minute period.

ADDITIONAL CAR PARK ENTRY ON PYRMONT STREET

The additional car park entry on Pyrmont Street has been assessed for the impact from re-routing cars towards the new entrance on Pyrmont Street. The traffic noise assessment in line with the NSW Road Noise Policy (Section 9) is presented in Section 12.

11.2.3 SOUND POWER LEVELS OF PROPOSED PLANT AND OPERATIONAL SOURCES

Table 11-3 presents the sound power levels associated with the proposed mechanical plant. Appendix B presents the location of the proposed plant and operational noise sources.

The noise emission of the plant and operational sources was screened to identify potential annoying characteristics in accordance with the NSW Noise Policy for Industry. The diesel generator flue was identified with potential to generate low frequency and tonal noise. As a result, a 5 dB penalty was applied to account for these characteristics.

TABLE 11-3 - PROPOSED MECHANICAL PLANT AND OPERATIONAL SOUND POWER LEVELS

Item [1, 2]	Level dBA	Unit	Notes
Capstone exhaust stacks	79 (per unit)	Sound power level per unit	Level 03 plant room has one stack for 4 Capstone units. Other Capstones near Astral Hotel (Level 05 plantroom) have one exhaust each.
Level 03 Capstone plant room	85	Internal plant room reverberant sound pressure level	Breakout from plant room calculated assuming 6 Capstones inside and a ventilation opening.
345 Plantroom cooling tower	84	Sound power level per unit	8 units in 345 plantroom
Diesel generator flue[3]	66 (81 dBC)	One metre from the flue tip on axis	Directional source based on 1300mm x 650mm exhaust flue dimension. One new flue in the one stack.
Transportation hub exposed facade	79	Daytime internal reverberant sound pressure level	Includes 5 light rail movements, 22 taxi movements and 66 taxis idling, 22 door slams,14 car park vehicle movements and mechanical plant
	80	Evening/Night internal reverberant sound pressure level	Includes 5 light rail movements, 56 taxi movements and 22 taxis idling, 56 door slams, 11 car park vehicle movements and mechanical plant
Ritz Carlton Porte Cochere – taxi movements	69	Sound power level, 15 minute	Includes 3 vehicle movements lasting 0.5 minutes in total. Assumed each taxi is moving 15 km/h along a 45m path into and out of the porte cochere.
The Star VIP Porte Cochere	74	Sound power level	Includes 10 vehicles idling
Toilet exhaust fans	81	Sound power level per unit	Located above each new toilet on Level 05
Kitchen exhaust fans	81	Sound power level per unit	Located on Level 07 facing Pirrama Road; 5 units located at Ribbon, 3 units located at Ritz Carlton. 1 unit located at F&B facing Edward Street.
Light vehicle (idle)	67	Sound power level per unit	Vehicle idling.
Light vehicle (moving)	90	Sound power level per unit	Vehicle moving at slow speed
Light vehicle door slam	100	Sound power level per unit	One second duration

Note 1: Other mechanical plant sources that have not yet been defined cannot be included in the model (as described above). Their contribution to The Star's noise emission will be controlled to within the noise emission limits, as detailed in Section 11.3.4.
Note 2: Appendix B details existing mechanical plant noise sources and their locations.
Note 3: The diesel generator was identified to have potential for tonal and low frequency character. A 5 dB penalty has been added to the noise level to account for these characteristics.

11.2.4 ASSESSMENT SCENARIOS

For mechanical plant and equipment noise emission, the worst-case scenario of all mechanical plant in operation has been assessed for all periods

Table 11-4 presents the assessment scenarios for the operation of non-licensed areas. The operational configuration of these non-licensed areas for evening is the same as the night period, therefore to present a more conservative assessment operation in these periods has been assessed against the more onerous night criteria.

TABLE 11-4 - OPERATIONAL NOISE ASSESSMENT SCENARIOS

Assessment scenario	Description
Day	♦ Existing Porte Cochere ♦ Ritz-Carlton Porte Cochere ♦ Day period transportation hub open façade daytime noise level ♦ Day period taxis movements and coaches on service road
Evening/Night	♦ Existing Porte Cochere ♦ Ritz-Carlton Porte Cochere ♦ Evening/Night period Transportation hub open façade daytime noise level ♦ Evening/night period taxi movements on service road

11.2.5 RESULTS

Cumulative noise emission from mechanical plant and equipment and other operational noise from The Star must be controlled to achieve the noise criteria specified in Conditions E1 and F4, as detailed in Section 6.2. Table 11-5 presents the predicted cumulative noise level from mechanical plant and other operational noise at each receiver.

For multi-storey residential receivers, where noise impacts may differ floor by floor, predicted noise levels for the ground, mid, and top floors are presented to demonstrate the range of noise levels for the building. The predicted noise levels include several controls and provisions which are detailed in Sections 11.2.1, 11.2.2 and 11.3.4 that must be implemented to achieve compliance at the residential receivers.

TABLE 11-5 – CUMULATIVE PREDICTED NOISE LEVELS FOR MECHANICAL PLANT AND EQUIPMENT PLUS OTHER OPERATIONAL NOISE

Rec ID	Residential Receiver	Assessment Criteria $L_{eq(15min)}$ dBA			Mech plant and equipment Predicted Noise Level $L_{eq(15min)}$ dBA		Other operational noise Predicted Noise Level $L_{eq(15min)}$ dBA		Cumulative Predicted Noise Level $L_{eq(15min)}$ dBA		Compliance
		D	E	N	D	E/N	D	E/N	D	E/N	
3	39-43 Pyrmont Street	60	59	55	31	32	37	37	**38**	**38**	Yes
4	88 John Street	53	52	47	GF - 29 3F - 32 5F - 33	GF - 32 3F - 35 5F - 35	GF - 30 3F - 30 5F - 31	GF - 30 3F - 31 5F - 31	**35**	**37**	Yes
5	135 Point Street	53	52	47	31	33	28	28	**33**	**34**	Yes
6	18 Pyrmont Street	59	58	56	37	39	42	42	**43**	**44**	Yes
7	2 Jones Bay Road	59	58	56	GF - 44 5F - 47 9F - 48	GF - 45 5F - 47 9F - 48	GF - 34 5F - 34 9F - 33	GF - 34 5F - 34 9F - 33	**48**	**48**	Yes
8	26 Point Street	59	58	56	GF - 32 5F - 34 9F - 38	GF - 36 5F - 37 9F - 40	GF - 26 5F - 28 9F - 30	GF - 27 5F - 28 9F - 30	**43**	**41**	Yes
10	56-56A Pirrama Road	59	57	53	41	37	37	38	**43**	**41**	Yes
13	91 and 93 Pyrmont Street	61	61	57	41	41	39	39	**43**	**43**	Yes
14	Pyrmont Street Residences	61	61	57	44	44	30	30	**44**	**44**	Yes

Rec ID	Residential Receiver	Assessment Criteria $L_{eq(15min)}$ dBA			Mech plant and equipment Predicted Noise Level $L_{eq(15min)}$ dBA		Other operational noise Predicted Noise Level $L_{eq(15min)}$ dBA		Cumulative Predicted Noise Level $L_{eq(15min)}$ dBA		Compliance
		D	E	N	D	E/N	D	E/N	D	E/N	
16	31 Union Street	59	58	54	42	42	18	19	**42**	**42**	Yes
21	63 Edward Street	59	58	54	42	42	19	20	**42**	**42**	Yes
22	65 Edward Street	59	58	54	42	42	16	16	**42**	**42**	Yes

11.2.6 ASSESSMENT

The results in Table 11-5 shows that the predicted noise levels of the assessed mechanical plant and other operational noise sources comply with the assessment criteria and would by implication demonstrate limited environmental impact as defined in Section 4. However, a comparative assessment is nevertheless undertaken as described in Section 16.

The noise levels are similar during the day and the night for the majority of receivers as mechanical plant operation is the primary noise source. As The Star is a 24 hour operation, the mechanical plant is required to operate for the whole period and therefore noise levels do not necessarily reduce during the night period. Receiver 8 overlooks the service road and the noise level at this receiver is influenced by day and night vehicle movements on the service road.

It is noted in Sections 11.2.1 and 11.2.2 that some of the noise sources could not be defined at this stage as the design is not sufficiently developed to allow for this analysis. During detailed design when these sources are defined, the noise emission will be controlled to meet the noise emission criteria set out in this report.

During the detailed design process, consideration must be made for the selection and design of all mechanical equipment that emits noise. If selected equipment is in excess of these criteria or the noise levels vary from those detailed in this report, additional assessment shall be carried out and acoustic mitigation measures shall be provided. These measures may include, but are not limited to:

- Siting and location of plant rooms and equipment;
- Attenuators;
- Noise barriers;
- Acoustic louvres; and
- Acoustic absorption to plant rooms.

11.3 LICENSED PREMISES – ENTERTAINMENT NOISE

The following sections outline the assessment of entertainment (patron and music) noise from the changed outdoor licensed areas proposed as part of Modification 13 in accordance with Condition F5 of the Major Project Approval MP-0098. The following additional outdoor areas with potential to increase noise impacts are:

- Two outdoor terraces (Level B2 and Level B1) associated with the new food and beverage on corner of Edward and Union Street. The terraces also include an openable façade on each of the terraces.
- Level 05 areas including:
  - Level 05 outdoor event space with amplified music
  - Level 05 undercover event space with amplified music
- One additional external area on the Pirrama Road façade on Level 03.
- Level 07 areas including:

  - Two swimming pools
  - Two bar areas with amplified music
- New swimming pool for the Astral Hotel guests.
- New swimming pool on Jones Bay Road side for Tower residents.
- External space on Level 05 of the neighbourhood centre and an outdoor eating area at the café at ground level of the neighbourhood centre.
- Outdoor seating area for the Club Lounge on Level 59 of the hotel tower.
- One new food and beverage outlet with outdoor seating on Level B2 Pirrama Road façade, north of the water feature.
- Refurbished food and beverage outlet with outdoor seating on Level B2 Pirrama Road façade, south of the water feature.

11.3.1 METHODOLOGY

The assessment has considered significant sources of patron noise and outdoor music noise associated with outdoor areas including those associated with restaurants, bars, cafes, community areas and pools. The inputs and parameters that have been used to determine the sound power levels of the entertainment noise sources are as follows:

- It has been assumed that all the outdoor food and beverage areas, the hotel and residential pools and flex event space, existing and proposed, will close prior to 12.00am (midnight). All UGA and smoking terraces will remain active 24 hours a day.
- The Marquee smoking terrace is to be covered by the Level 05 terrace area and is no longer considered an external noise source.
- The number of patrons in each outdoor food and beverage area has been taken from the latest available drawings and assumes a capacity of two patrons per square metre. The number of patrons in each area are detailed in Table 11-6 and the sound power level of a single raised male voice is given in Table 11-8.
- Sound power levels for each area were calculated assuming every one in two people are talking with a raised voice.
- Loudspeaker sound power levels and source directivities were derived from WSP measurements of Sky Terrace loudspeakers conducted on 13 July 2016. The sound pressure levels of the units were measured on-axis at a distance of 2 metres. The sound power level of each loudspeaker was determined to be 105 dBA. This level was adopted for the units on the level 3 pool deck. Each loudspeaker was assigned the same directivity as the Sky Terrace loudspeakers and directed inwards towards The Star. Amplified music systems are not in operation during the night period.
- For the Level 07 pool deck bar loudspeakers, the noise emission is limited to the spectrum shown in Table 11-7 and uses the same directivity pattern as the Sky Terrace loudspeakers. The units will not be in operation between midnight and 7am.
- The Level 05 outdoor and undercover event areas, loudspeaker noise levels were reduced to comply with the noise emission criteria at the nearest receivers. The assumed spectrum is shown in Table 11-7. The units are not to be in operation between midnight and 7am
- Appendix B presents the noise levels assumed for the existing outdoor patron and music noise sources at The Star. The existing noise sources are determined based on either noise measurements or assumptions consistent with those made above, as detailed in Appendix B. The existing sources are as follows:
  - Astral Hotel smoking terrace;
  - Level 01 smoking terrace (Jones Bay Road façade);
  - Level 03 pool deck patrons and music;
  - Pirrama Road Unenclosed Gaming Area Level 01; and
  - Sovereign Unenclosed Gaming Area;

- Commercial receivers are assumed to have a closed façade providing a 20 dB outside to inside reduction and operate between 7am and midnight only. Table 11-6 provides a summary of the proposed outdoor areas and the number of patrons and speakers for each area.

TABLE 11-6 – SUMMARY OF PROPOSED OUTDOOR AREAS INCLUDED IN THE ASSESSMENT

Period	Location	Occupied area	Number of Patrons Talking	Number of External Loudsp-eakers	Source location used in modelling
7am to midnight	Edward and Union Street corner food and beverage outdoor eating area (lower floor)	One area of 20 m^2 with 2 patrons/m^2 One façade opening with breakout from 130 patrons, 1 in 2 talking with raised voices	20 outside 65 inside	-	Patrons located on balcony facing corner of Edward and Union Street. Façade openings face south toward Edward Street.
7am to midnight	Edward and Union Street corner food and beverage outdoor eating area (upper floor)	One area of 20 m^2 with 2 patrons/m^2 One façade opening with breakout from 374 patrons, 1 in 2 talking with raised voices	20 outside 187 inside	-	Patrons located on balcony facing corner of Edward and Union Street. Façade openings face south toward Edward Street.
7am to midnight	New Pirrama Road facade Level 03 external area	One area each 20m^2 with 2 patrons/m^2	20	-	Patrons located on the façade boundary facing Pirrama Road.
7am to midnight	Level 05 Outdoor event space	Two areas each 100 m^2 with 2 patrons/m^2	200	8	Patrons located in outdoor venue space at minimum 30 m from Pirrama Road façade boundary line. Loudspeakers are directional as per existing Sky Terrace approval conditions. 8 loudspeakers distributed across venue at minimum 26 m from Pirrama Road façade boundary line.
7am to midnight	Level 05 Undercover event space	Three areas each 100 m^2 with 2 patrons/m^2	300	8	Patrons located in outdoor venue space at minimum 1 m from Pirrama Road façade boundary line. Loudspeakers are directional as per existing Sky Terrace approval conditions. 4 loudspeakers distributed along Pirrama Road façade boundary line with setback of approximately 5 m.
7am to midnight	Level 07 pool deck (1)	One area each 20m^2 with 2 patrons/m^2	20	-	Patrons location in middle of deck approximately 13 m from Pirrama Road façade boundary line.
7am to midnight	Level 07 pool bar (1)	One area each 186m^2 with 2 patrons/m^2	186	4	Patrons location in middle of deck minimum 15 m from Pirrama Road façade boundary line. Loudspeakers distributed through the bar at minimum 17 m from Pirrama Road façade boundary line. Loudspeakers are directional and do not operate at night.
7am to midnight	Level 07 pool deck (2)	One area each 20m^2 with 2 patrons/m^2	20	-	Patrons location in middle of deck approximately 13 m from Pirrama Road façade boundary line.

Period	Location	Occupied area	Number of Patrons Talking	Number of External Loudsp-eakers	Source location used in modelling
7am to midnight	Level 07 pool bar (2)	One area each 180m^2 with 2 patrons/m^2	180	4	Patrons location in middle of deck minimum 15 m from Pirrama Road façade boundary line. Loudspeakers distributed through the bar at minimum 17 m from Pirrama Road façade boundary line. Loudspeakers are directional and do not operate at night.
7am to midnight	Tower residential pool deck	Two areas each 20m^2 with 2 patrons/m^2	20	-	Patrons located approximately 12m from Jones Bay Road façade boundary line.
7am to midnight	Jones Bay Road outdoor eating areas	One area each 55m^2 with 2 patrons/m^2	55	-	Patrons located at foot of new tower, at minimum 19m from 2 Jones Bay Road.
7am to midnight	Neighbourhood centre outdoor area	One area each 115 m^2 with 2 patrons/m^2	115	-	Located on Level 05 of neighbourhood centre, patrons located on façade boundary line.
7am to midnight	Level B2 outdoor eating area	One area with occupancy for 250 patrons	125	-	Patrons located on Pirrama Road façade boundary line. Level based on measurements of existing outdoor eating area (Pizzaperta)
Midnight to 7am	Level 05 Outdoor event space (night period)	One area each 100 m^2 with 2 patrons/m^2	100	-	Patrons located in outdoor venue space at minimum 30 m from Pirrama Road façade boundary line. Loudspeakers are directional as per existing Sky Terrace approval conditions. 8 loudspeakers distributed across venue at minimum 26 m from Pirrama Road façade boundary line.
Midnight to 7am	Level 05 Undercover event space (night period)	Two areas each 100 m^2 with 2 patrons/m^2	200	-	Patrons located in outdoor venue space at minimum 1 m from Pirrama Road façade boundary line. Loudspeakers are directional as per existing Sky Terrace approval conditions. 4 loudspeakers distributed along Pirrama Road façade boundary line with setback of approximately 5 m.
Midnight to 7am	Level 07 pool deck (1)	One area each 20m^2 with 2 patrons/m^2	20	-	Patrons location in middle of deck approximately 13 m from Pirrama Road façade boundary line.
Midnight to 7am	Level 07 pool bar (1)	One area each 186m^2 with 2 patrons/m^2	186	-	Patrons location in middle of deck minimum 15 m from Pirrama Road façade boundary line. Loudspeakers distributed through the bar at minimum 17 m from Pirrama Road façade boundary line. Loudspeakers are directional and do not operate at night.

Period	Location	Occupied area	Number of Patrons Talking	Number of External Loudsp-eakers	Source location used in modelling
Midnight to 7am	Level 07 pool deck (2)	One area each 20m^2 with 2 patrons/m^2	20	-	Patrons location in middle of deck approximately 13 m from Pirrama Road façade boundary line.
Midnight to 7am	Level 07 pool bar (2)	One area each 180m^2 with 2 patrons/m^2	180	-	Patrons location in middle of deck minimum 15 m from Pirrama Road façade boundary line. Loudspeakers distributed through the bar at minimum 17 m from Pirrama Road façade boundary line. Loudspeakers are directional and do not operate at night.

TABLE 11-7 - LOUDSPEAKER NOISE LEVELS

Source name	Sound pressure level at 2m at 1/1 Octave band centre frequency (Hz) dB									
	31.5	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Level 07 pool bar loudspeaker (per unit)	62	85	76	80	78	77	73	69	65	81
Level 05 loudspeaker (per unit)	67	90	81	85	83	82	78	74	70	86
Level 3 pool deck loudspeakers (per unit)	72	95	86	90	88	87	83	79	75	93

TABLE 11-8 – PATRON NOISE LEVEL, SOURCE FROM ANSI 3-5-1997

Source name	Sound power level 1/1 Octave band centre frequency (Hz) dB						
	250	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Male raised voice	69	74	70	65	59	51	75

11.3.2 ASSESSMENT SCENARIOS

Table 11-9 presents the patron and music scenarios that have been assessed during the 7am to midnight and midnight to 7am periods.

TABLE 11-9 – PATRON AND MUSIC NOISE ASSESSMENT SCENARIOS

Assessment scenario	Description
7am to midnight	♦ All UGAs and smoking terraces ♦ 2x Level B2 outdoor eating areas patrons ♦ Jones Bay Road outdoor eating area patrons ♦ Neighbourhood centre outdoor deck ♦ Level 03 Pool deck patrons and music (existing) ♦ 2x Level 07 Pool Bars patrons and music ♦ Tower residents pool patrons ♦ Level 05 Outdoor and Undercover event space day period operation patrons and music ♦ 2x Level 05 Sky Terrace licensed areas patrons ♦ 2x Food and Beverage outdoor eating area patrons
Midnight to 7am	♦ All UGAs and smoking terraces ♦ Level 05 Outdoor and Undercover event space night period operation patrons ♦ 2x Level 07 Pool Bars patrons

11.3.3 RESULTS

Using the assumptions and methodology outlined in this section, the noise levels from the entertainment noise were predicted at the nearest sensitive receivers and compared with the assessment criteria in Section 6. Patron and music noise have been assessed cumulatively at each receiver.

Table 11-10 and Table 11-11 provides a summary of the predicted entertainment noise levels at the nearest residential receivers and the applicable assessment criteria during the 7am to midnight and midnight to 7am periods respectively. For residential tower receivers where noise impacts may differ floor by floor, predicted noise levels for the ground, mid, and top floors are presented to demonstrate the range of noise levels for the towers.

TABLE 11-10 - PREDICTED ENTERTAINMENT NOISE AT RESIDENTIAL RECEIVERS (7AM TO MIDNIGHT)

ID	Address	Noise level	Sound pressure level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
3	39-43 Pyrmont Street	Criteria	66	64	62	59	56	56	53	45	36
		Predicted	29	48	36	37	38	37	32	23	<15
		Difference	-37	-16	-26	-22	-18	-19	-21	-22	-
4	88 John Street - GF	Criteria	54	60	56	52	49	48	45	36	25
		Predicted	29	49	35	36	35	33	26	17	< 15
		Difference	-25	-11	-21	-16	-14	-15	-19	-19	-
	88 John Street – 3F	Criteria	54	60	56	52	49	48	45	36	25
		Predicted	31	51	37	39	37	33	26	16	< 15
		Difference	-23	-9	-19	-13	-12	-15	-19	-20	-
	88 John Street – 5F	Criteria	54	60	56	52	49	48	45	36	25
		Predicted	33	53	39	42	39	36	29	18	< 15
		Difference	-21	-7	-17	-10	-10	-12	-16	-18	-
5	135 Point Street	Criteria	54	60	56	52	49	48	45	36	25
		Predicted	33	54	41	43	41	38	31	22	<15
		Difference	-21	-6	-15	-9	-8	-10	-14	-14	-
6	18 Pyrmont Street	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	29	49	40	41	42	41	37	29	<15
		Difference	-38	-18	-23	-18	-14	-13	-15	-15	-
7	2 Jones Bay Road – GF	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	31	49	34	45	52	51	46	40	29
		Difference	-36	-18	-29	-14	-4	-3	-6	-4	-6
	2 Jones Bay Road – 5F	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	35	55	41	47	50	50	45	38	27
		Difference	-32	-12	-22	-12	-6	-4	-7	-6	-8
	2 Jones Bay Road – 9F	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	39	60	48	53	54	52	47	40	27
		Difference	-28	-7	-15	-6	-2	-2	-5	-4	-8
8	26 Point Street – GF	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	28	46	32	36	42	42	36	29	< 15
		Difference	-39	-21	-31	-23	-14	-12	-16	-15	-
	26 Point Street – 5F	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	34	55	41	44	43	40	35	27	< 15

		Difference	-33	-12	-22	-15	-13	-14	-17	-17	-
	26 Point Street – 9F	Criteria	67	67	63	59	56	54	52	44	35
		Predicted	37	58	46	50	50	48	43	35	18
		Difference	-30	-9	-17	-9	-6	-6	-9	-9	-17
10	56-56A Pirrama Road	Criteria	62	59	57	56	55	51	45	34	25
		Predicted	41	59	48	52	51	49	44	34	<15
		Difference	-21	0	-9	-4	-4	-2	-1	0	-
13	91 and 93 Pyrmont Street	Criteria	72	70	63	60	58	57	53	46	36
		Predicted	40	56	43	46	44	41	36	28	16
		Difference	-32	-14	-20	-14	-14	-16	-17	-18	-20
14	Pyrmont Street Residences	Criteria	72	70	63	60	58	57	53	46	36
		Predicted	33	50	34	38	37	35	30	23	<15
		Difference	-39	-20	-29	-22	-21	-22	-23	-23	-
16	31-33 Union Street	Criteria	66	64	61	54	54	56	50	44	39
		Predicted	36	55	40	44	44	41	35	29	16
		Difference	-30	-9	-21	-10	-10	-15	-15	-15	-23
21	63 Edward Street	Criteria	66	64	61	54	54	56	50	44	39
		Predicted	37	57	41	52	56	53	47	41	23
		Difference	-29	-7	-20	-2	2*	-3	-3	-3	-16
22	65 Edward Street	Criteria	66	64	61	54	54	56	50	44	39
		Predicted	35	54	39	47	50	46	40	34	17
		Difference	-31	-10	-22	-7	-4	-10	-10	-10	-22

* Marginal compliance with the target level, as the predicted level is no more than 2 dB above the target.

TABLE 11-11 - PREDICTED ENTERTAINMENT NOISE AT RESIDENTIAL RECEIVERS (MIDNIGHT TO 7AM)

ID	Address	Noise level	Entertainment noise level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
3	39-43 Pyrmont Street	Criteria	58	55	54	51	48	47	43	36	25
		Predicted	18	36	34	30	32	27	23	<15	<15
		Difference	-40	-19	-20	-21	-16	-20	-20	-	-
4	88 John Street - GF	Criteria	49	49	47	44	42	40	36	27	16
		Predicted	17	30	28	27	32	28	20	< 15	< 15
		Difference	-32	-19	-19	-17	-10	-12	-16	-	-
	88 John Street – 3F	Criteria	49	49	47	44	42	40	36	27	16
		Predicted	18	32	31	31	32	27	21	< 15	< 15
		Difference	-31	-17	-16	-13	-10	-13	-15	-	-
	88 John Street – 5F	Criteria	49	49	47	44	42	40	36	27	16
		Predicted	18	32	32	33	35	29	22	< 15	< 15
		Difference	-31	-17	-15	-11	-7	-11	-14	-	-
5	135 Point Street	Criteria	49	49	47	44	42	40	36	27	16
		Predicted	<15	28	29	34	37	33	26	15	<15
		Difference	-	-21	-18	-10	-5	-7	-10	-12	-
6	18 Pyrmont Street	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	<15	39	38	34	34	29	25	<15	<15

ID	Address	Noise level	Entertainment noise level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
		Difference	-	-21	-17	-16	-15	-17	-18	-	-
7	2 Jones Bay Road – GF	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	< 15	30	30	31	33	28	21	< 15	< 15
		Difference	-	-30	-25	-19	-16	-18	-22	-	-
	2 Jones Bay Road – 5F	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	< 15	32	30	36	39	34	26	15	< 15
		Difference	-	-28	-25	-14	-10	-12	-17	-21	-
	2 Jones Bay Road – 9F	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	< 15	32	30	43	48	45	39	30	< 15
		Difference	-	-28	-25	-7	-1	-1	-4	-6	-
8	26 Point Street – GF	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	< 15	26	22	24	26	21	15	< 15	< 15
		Difference	-	-34	-33	-26	-23	-25	-28	-	-
	26 Point Street – 5F	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	15	32	31	34	37	32	25	16	< 15
		Difference	-45	-28	-24	-16	-12	-14	-18	-20	-
	26 Point Street – 9F	Criteria	60	60	55	50	49	46	43	36	26
		Predicted	< 15	30	28	38	44	43	36	27	< 15
		Difference	-	-30	-27	-12	-5	-3	-7	-9	-
10	56-56A Pirrama Road	Criteria	55	52	50	48	44	41	35	27	17
		Predicted	18	19	15	39	44	41	34	23	<15
		Difference	-37	-33	-35	-9	0	0	-1	-4	-
13	91 and 93 Pyrmont Street	Criteria	62	59	56	52	49	48	43	35	25
		Predicted	39	40	34	37	39	37	32	24	15
		Difference	-23	-19	-22	-15	-10	-11	-11	-11	-10
14	Pyrmont Street Residences	Criteria	62	59	56	52	49	48	43	35	25
		Predicted	29	31	26	28	29	27	22	<15	<15
		Difference	-33	-28	-30	-24	-20	-21	-21	-	-
16	31-33 Union Street	Criteria	58	55	52	47	46	45	40	32	22
		Predicted	18	15	<15	25	27	21	<15	<15	<15
		Difference	-40	-40	-	-22	-19	-24	-	-	-
21	63 Edward Street	Criteria	58	55	52	47	46	45	40	32	22
		Predicted	16	<15	<15	27	28	23	<15	<15	<15
		Difference	-42	-	-	-20	-18	-22	-	-	-
22	65 Edward Street	Criteria	58	55	52	47	46	45	40	32	22
		Predicted	<15	<15	<15	29	31	25	16	<15	<15
		Difference	-	-	-	-18	-15	-20	-24	-	-

11.3.4 INAUDIBILITY

To determine for inaudibility for the midnight to 7am period, WSP has adopted an external design criterion of 10 dB below the background noise level in each octave band for intermittent noise sources. This is a typically accepted approach and has been used on previous assessment of The Star.

Based on the predicted results in Table 11-11, noise emission from licensed premises areas have the potential to be audible within habitable spaces of nearby residential receivers. Although the predicted entertainment noise levels comply with the numerical noise criteria for midnight to 7am, several of the predicted entertainment noise levels are within 10 dB of the background noise levels in certain octave band frequencies.

To minimise the risk of entertainment noise from licensed premises from being audible within habitable spaces of nearby residential receivers, the following operational noise management strategies are recommended:

- Patrons are to be restricted from accessing the following licensed areas between midnight and 7am:
  - Level 5 undercover bar areas fronting Pirrama Road
  - Ribbon pool bars

Implementation of the recommended management strategies above will ensure entertainment noise emission from The Star achieves the external design criterion of 10 dB below the background noise level in each octave band. This minimises the risk of entertainment noise being audible within habitable spaces of nearby residential receivers as indicated by the results in Table 11-12.

TABLE 11-12 - PREDICTED ENTERTAINMENT NOISE AT RESIDENTIAL RECEIVERS WITH RECOMMENDED MANAGEMENT STRATEGIES IMPLEMENTED TO ACHIEVE INAUDIBILITY (MIDNIGHT TO 7AM)

ID	Address	Noise level	Entertainment noise level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
3	39-43 Pyrmont Street	Inaudibility target	48	45	44	41	38	37	33	26	15
		Predicted	18	36	34	30	31	26	23	<15	<15
		Difference	-30	-9	-10	-11	-7	-11	-10	-	-
4	88 John Street - GF	Inaudibility target	39	39	37	34	32	30	26	17	6
		Predicted	18	32	32	31	32	26	20	<15	<15
		Difference	-21	-7	-5	-3	0	-4	-6	-	-
5	135 Point Street	Inaudibility target	39	39	37	34	32	30	26	17	6
		Predicted	<15	28	29	29	31	26	19	<15	<15
		Difference	-	-11	-8	-5	-1	-4	-7	-	-
6	18 Pyrmont Street	Inaudibility target	50	50	45	40	39	36	33	26	16
		Predicted	<15	39	38	32	32	27	25	<15	<15
		Difference	-	-11	-7	-8	-7	-9	-8	-	-
7	2 Jones Bay Road – GF	Inaudibility target	50	50	45	40	39	36	33	26	16
		Predicted	<15	32	30	33	39	35	29	20	<15
		Difference	-	-18	-15	-7	0	-1	-4	-6	-
8	26 Point Street – GF	Inaudibility target	50	50	45	40	39	36	33	26	16
		Predicted	15	35	34	33	35	31	25	15	<15
		Difference	-35	-15	-11	-7	-4	-5	-8	-11	-

ID	Address	Noise level	Entertainment noise level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
10	56-56A Pirrama Road	Inaudibility target	45	42	40	38	34	31	25	17	7
		Predicted	18	19	15	31	35	32	25	<15	<15
		Difference	-27	-23	-25	-7	1*	1*	0	-	-
13	91 and 93 Pyrmont Street	Inaudibility target	52	49	46	42	39	38	33	25	15
		Predicted	39	40	34	36	38	36	32	24	15
		Difference	-13	-9	-12	-6	-1	-2	-1	-1	0
14	Pyrmont Street Residences	Inaudibility target	52	49	46	42	39	38	33	25	15
		Predicted	29	31	26	27	29	27	22	<15	<15
		Difference	-23	-18	-20	-15	-10	-11	-11	-	-
16	31-33 Union Street	Inaudibility target	48	55	52	47	46	45	40	32	22
		Predicted	18	15	<15	18	19	<15	<15	<15	<15
		Difference	-30	-40	-	-29	-27	-	-	-	-
21	63 Edward Street	Inaudibility target	48	55	52	47	46	45	40	32	22
		Predicted	17	15	<15	19	20	15	<15	<15	<15
		Difference	-31	-40	-	-28	-26	-30	-	-	-
22	65 Edward Street	Inaudibility target	48	55	52	47	46	45	40	32	22
		Predicted	<15	<15	<15	22	24	18	<15	<15	<15
		Difference	-	-	-	-25	-22	-27	-	-	-

* Marginal compliance with the target level, as the predicted level is no more than 2 dB above the target.

11.3.5 ASSESSMENT

The predicted cumulative noise levels from patrons and music at residential receivers from all existing, approved and proposed sources on the development indicate that compliance can be achieved with the assessment criteria during the 7am to midnight and midnight to 7am periods. The predicted noise levels include several controls and provisions which are detailed in Section 11.3.1 and 11.3.4 that must be followed in order to achieve compliance at the residential receivers. Therefore, the proposed Modification 13 can be built and operated to have limited environmental impact as defined in Section 4.

The assessment criteria are cumulative criteria for music and patron noise across the whole site. Therefore, alternative noise controls and management strategies other than those defined in this report may be developed which also meet the cumulative criteria, once operational strategies have been defined. For example, the noise level controls on the Ribbon pool bar speakers and the Sky Terrace may be replaced by an alternative management strategy, for example where only one is used at any one time. The strategies can be incorporated into The Star's operational noise management plan required as part of Condition B5, and can be developed further as part of detailed design.

11.4 OPERATIONAL NOISE MANAGEMENT

The proposed changes for Modification 13 have been assessed as able to meet the requirements of the SEARs. Nevertheless, to minimise the risk of impacts above those predicted caused by unexpected events, it is recommended that The Star incorporate best practice operational noise management measures into its Operational Noise Management Plan (ONMP) as required in condition B5 to account for the changes associated with Modification 13.

These include:

- Ensuring all plant and other noise generating equipment, including sound system devices, are operating in their intended manner.
- Carrying out noise measurements to verify predicted noise emissions or in response to complaints.
- All plant and other noise generating equipment, including sound system devices, to be maintained according to manufacturer's specifications.
- All plant and other noise generating equipment, including sound system devices, do not exceed the sound power levels and sound pressure levels in this report and the project approval.
- Mitigation and management measures outlined in this report are included as part of the further design development process including:
  - Limiting exhaust stack emissions from the diesel generators and capstone units to those noise level specified in the report
  - Providing attenuation on the diesel generators and capstones that eliminate low frequency noise as defined in the NPfI.
  - Providing acoustic louvres or other attenuated ventilation for the new plant rooms including plant rooms for Capstones and diesel generators.
  - Cooling tower noise attenuation or attenuation of equivalent acoustic performance as presented in this report.
  - Controls for amplified music in outdoor external areas.
- All noise mitigation measures are to be maintained so that they function in their intended manner. This includes but is not limited to:
  - acoustic louvres, acoustic absorbing panels and treatments, acoustic screens, acoustic seals on doors and windows, plant rooms and enclosures, noise level limits and limiters, speaker systems etc.
- Patrons are managed so that they do not behave in a way which intensifies noise from outdoor areas.
- All outdoor areas are to be managed so that they meet the cumulative entertainment (patrons and music) noise criteria at the nominated residential receivers presented in this report.
- Patrons are to be restricted from accessing the following licensed areas between midnight and 7am:
  - Level 5 undercover bar areas fronting Pirrama Road
  - Ribbon pool bars
- All service providers, suppliers and staff that access or drive on the site to be managed so that they do not cause their vehicles to emit excessive noise, including but not limited to:
  - Minimisation of the use of any reversing beepers.
  - Shutting off idling engines when not in use on the service road, roads immediately adjacent to The Star and within Porte Cocheres
  - Standing vehicles in areas away from residential receivers.
  - Driving in a manner which does not generate excessive vehicle noise, such as avoiding aggressive acceleration and truck engine brakes.
- Coaches are not permitted to stand with their engines on or idling on the services road at any time of day or night.

Through providing an updated ONMP, The Star will further limit environmental impact from the proposed modification. Details of items to be included in the ONMP are provided in Section 17.1.

THE STAR

ROAD TRAFFIC NOISE ASSESSMENT

12 ROAD TRAFFIC NOISE ASSESSMENT

The following sections present an assessment of the proposal's impact on off-site road traffic noise using the assessment criteria set out in Section 9.

12.1 ASSESSMENT METHODOLOGY

The RNP's criteria for traffic generating developments are assessed according to the criteria noise levels and also by limiting any increase in noise caused by a development generating additional traffic on public roads.

The assessment firstly involves the calculation of traffic noise levels with the proposed development (termed the 'build' scenario) and comparing it with the RNP criteria. Where the development causes the criteria to be exceeded, all reasonable and feasible mitigation should be applied to reduce noise levels. Any noise level increase should be limited to 2 dB or less above the 'no build' scenario.

For this project, definition of the no build scenario is problematic because since 2008, when The Star was approved, there have been changes in traffic arising from building development in the local area. This is discussed further in the next section.

The RNP does not allow multiple uses of the 2 dB increase by staging a development. In respect of The Star, the 2 dB allowance applies to the cumulative change in traffic noise levels between the no build scenario and all subsequent modifications.

The public roads which have been assessed include; Pyrmont Street, Pirrama Road, Jones Bay Road, Union Street and Edward Street as the residential receivers on these streets have the potential to be impacted by additional vehicle movements generated Modification 13. Table 12-1 provides the road category of the assessed roads according to the definitions in the RNP. The roads are administrated by City of Sydney Council, with the exception of Pyrmont Bridge Road which is a designated state road.

TABLE **12-1** ASSESSED ROAD CATEGORIES

Road	RNP Road category	Description
Pyrmont Street	Collector (Sub-arterial)[1]	Provides access to local roads within Pyrmont and links to arterial road (Pyrmont Bridge Rd) and carries through traffic to rest of Pyrmont
Pirrama Road	Collector (Sub-arterial)	Provides access to local roads within Pyrmont and links to arterial road (Pyrmont Bridge Rd) and carries through traffic to rest of Pyrmont
Jones Bay Road	Collector (Sub-arterial)	Provides link between collector roads (Pirrama Rd and Pyrmont St) that carries through traffic to rest of Pyrmont
Union Street	Collector (Sub-arterial)	Provides links to Pyrmont St and local roads, and links to arterial road (Pyrmont Bridge Rd). Serves traffic generating developments; The Star and commercial property on Edward and Union St.
Edward Street (north of Union Street)	Local	Provides access to The Star and commercial properties on Edward St. There are no residential receivers located on this section.
Edward Street (south of Union Street)	Collector (Sub-arterial)	Provides links to arterial road (Pyrmont Bridge Rd), and links to other collector roads. Serves traffic generating developments.

Note 1: The RNP includes collector roads in the sub-arterial road category

Note 2: Road category definitions are consistent with the project approval and Modification 7.

As there are no residential receivers in Edward Street (north of Union Street), this section of road is not considered further.

The noise monitoring carried out for Modification 13 presented in Table 5-6 shows that existing road traffic noise levels without Modification 13 are already above the 15 hour and 9 hour RNP criteria for Pyrmont Street (BG1 and BG5), Jones

Bay Road (BG2) and Union Street (BG6). It is assumed that traffic noise levels in Edward Street (south of Union Street) are also above the RNP criteria.

It is noted that the road traffic noise levels reported in the 2008 Project Approval acoustic assessment (Sydney Harbour Casino Properties Pty Ltd, Project Star, Sydney Acoustic Assessment Report Arup Acoustics ref: AAc/205395/R01 Rev A September 2008) were also above the criteria.

Since The Star's original project approval in 2008, thirteen modifications have been approved. A review of the previous modifications has been undertaken to identify previously defined impacts to compare with the changes in traffic predicted to occur for Modification 13.

Therefore, in accordance with the RNP, feasible and reasonable measures should be applied to reduce noise levels. Land use developments, however, usually have limited capacity to reduce noise at the source and so any increase in traffic noise as a result of the proposal should be limited to 2 dB or less.

In consideration of the above, the assessment was conducted as follows:

- Review and identify impacts and changes in traffic noise from previous modifications compared with the 'no build' option;
- Identify changes in traffic due to Modification 13; and,
- Identify cumulative traffic changes in traffic noise compared with the no build scenario including Modification 13 and compare with 2dB allowance.

12.2 PREVIOUS MODIFICATIONS

The previous modifications of The Star where road traffic noise has been assessed are as follows:

- Approved project (2008), Project Approval Acoustic Assessment (Project Star, Sydney Acoustic Assessment Report, Arup ref: AAC/205395/R01 Rev A 4 August 2008)
- Modification 4 (2009), Modification 4 Acoustic Assessment (Project Star – Pirrama Road Façade Alternative Design Proposal – Section 75w Submission, Acoustic Logic Consultancy ref: 2006520/1408A/R0/VF 14 August 2009)
- Modification 7 (2010), Modification 7 Acoustic Assessment (Star City Multi Use Entertainment Facility Project Application Acoustic Assessment AECOM ref: 60047996-LA006.RPT.03, 7 October 2010)
- Modification 12 (2014), Modification 12 Response to Submissions (THE STAR, MP08_0098 MOD 12 – Request For Response To Submissions Report, Pure Projects 3 September 2014)
- Modification 14 (2017), Modification 14 Acoustic Assessment (Modification 14 Planning Submission Engineering Advice – Noise Impact Assessment, WSP ref: 2304290PA Rev06 16 September 2016)

A summary of assessment of road traffic noise from previous modifications is present in Table 12-2.

Reviewing the outcomes of the project approval and previous modifications assessment of road traffic noise, there has been approximately a 1dB increase in traffic noise levels compared to the 'no build' scenario on roads surrounding The Star. The exception was for Modification 7 where a 3dB increase was predicted at the residential terrace and apartment building on Edward Street south of Union Street (Receivers 21-22). The assessment for Modification 7 did not consider the exceedance significant and no mitigation measures were recommended. It is noted that the calculation for this road did not take into account noise from existing traffic on Union Street not associated with The Star. If that contribution were taken into account, it may result in an increase which is less than the 3dB reported.

TABLE 12-2 - SUMMARY OF TRAFFIC NOISE ASSESSMENTS IN PREVIOUS MODIFICATIONS

Assessment	Year approved	Existing conditions	Roads affected	Predicted impacts	Mitigation
Project Approval	2008	Pirrama Rd, Jones Bay Rd and union St already over criteria. Pirrama Rd within 2 dB of criteria.	Pyrmont Rd, Jones Bay Rd, Pirrama Rd and Union St	1 dB increase on all named roads.	None required
Modification 4	2009	Not stated	None identified as affected	No predicted impacts	None required
Modification 7	2010	Project Approval data used. Assume same existing conditions as Project Approval.	Edward St, Union St, Murray St	Up to 1 dB and 3 dB increase in PM and late peak period on Edward St (south of Union St). Up to 1 dB increase on Union St and Murray St during late peak period. Impacts only when MUEF in use.	No mitigation considered necessary at time of approval
Modification 12	2014	Not stated	None identified as affected	No predicted impacts	None required
Modification 14	2017	Not stated	Edward Street, Pirrama Road	0.1 dB increase	None required

12.3 TRAFFIC VOLUMES FOR MODIFICATION 13

The Modification 13 project includes changes to the gross floor area of The Star, the new car park entry on Pyrmont Street and the changes to taxi movements from the existing Porte Cochere to the transportation hub and the addition of the car park movements from the Hotel and residential tower.

Changes to traffic volumes for roads were provided by Mott Macdonald, the project's traffic consultant. The changes primarily involve an increase in movements and changes to which roads are used to access The Star, with the new car park entrance on Pyrmont Street.

The RNP criteria assess sub-arterial (collector) road category over a 15 hour period during the day (7am to 10pm) and a 9 hour period during the night (10pm to 7am). Forecast total traffic volume changes were not available for project related roads, and so the forecast peak relative increases have been used to indicate the impact of Modification 13. By using the peak hour traffic changes, it represents the worst case traffic noise impacts for collector roads.

Table 12-3 present the percentage change in traffic impacts due to Modification 13 from the Traffic Impact Statement. Reviewing the changes in traffic volumes in Table 12-3, the largest increase in traffic is forecast on Pyrmont Street. Decreases are forecast on other roads including Jones Bay Road, Pirrama Road, Union Street and Murray Street.

TABLE 12-3 – MODIFICATION 13 PERCENTAGE FORECAST CHANGES IN TRAFFIC VOLUME

Section	Traffic volume percentage increase by period		
	AM peak	PM peak	Late peak
Jones Bay Rd	12%	-2%	-10%
Pyrmont St (Immediately South of Jones Bay Rd)	11%	4%	-3%
Pyrmont St (Immediately north of Union Street)	35%	47%	25%
Pyrmont St (South of Union St)	36%	48%	30%
Pyrmont Bridge Rd (West of Pyrmont St)	11%	17%	3%
Pirrama Rd (South of Jones Bay Rd)	1%	7%	-10%
Edward St (North of Union St)	-11%	3%	13%
Pirrama Road (South of Star Car Park Entry)	11%	-9%	-22%
Pyrmont Bridge Rd (East of Edward Street)	18%	-8%	-1%

Note: Time periods defined as AM 8am to 9am, PM 5.30pm to 6.30pm and Late peak 10.30pm to 11.30pm

12.4 ASSESSMENT

The assessment has considered the cumulative increase in noise level from Modification 7, 12, 14 and 13. Increases from the original project approval have not been included when assessing the cumulative increase.

The project approval was based on noise levels and traffic volumes measured in 2008. Modification 13 will not be operational until after 2018. Since the original project approval, there has been significant development within Pyrmont including multiple high density residential projects and new commercial premises which will have increased traffic volumes on the roads surrounding The Star. Therefore, it is considered that the increases associated with The Star assessed in the project approval do not represent an appropriate 'no build' scenario. Instead, traffic conditions prior to Modification 7, as outlined in the Modification 7 acoustic report, have been selected as the 'no build' scenario.

Changes in traffic noise were calculated based on the percentage change in total traffic volume. As advised by the project traffic engineer, heavy vehicle percentage is assumed to remain unchanged. The calculations have been based on the available information for traffic volume changes, which assume that the peak hour impacts for the am, pm and late peaks are the worst case 1 hour period, 15 hour day and 9 hour night periods.

Table 12-4 presents the percentage traffic volume and noise level increase from modifications prior to Modification 13, changes associated with Modification 13 and the cumulative increase in noise level.

TABLE 12-4 PREDICTED PEAK HOUR TRAFFIC VOLUME AND NOISE LEVEL CHANGES

Road	Section	Modifications prior to Modification 13[1,2]		Modification 13		Total
		% increase	Change (dB)	% increase	Change (dB)	Change (dB)
AM Peak[3]						
Pyrmont St	North of Union St	0	0.0	35	1.3	1.3
	South of Union St	1	0.0	36	1.3	1.3
	North of PBR[4]	1	0.0	36	1.3	1.3
Edward St	North of Union St[5]	3	0.1	-11	-0.5	-0.4
	South of Union St	4	0.2	-22	-1.1	-0.9
Murray St/Pirrama Rd	North of Union St	2	0.1	11	0.5	0.6
Union St	West Edward St	1	0.0	-2	-0.1	-0.1
Darling Dr	East of Murray St	1	0.0	18	0.7	0.7
Pyrmont Bridge Rd	West of Pyrmont St	1	0.0	11	0.5	0.5
	East of Pyrmont St	1	0.0	18	0.7	0.7
	West of Union St	1	0.0	18	0.7	0.7
Jones Bay Rd	All	-	0.0	12	0.5	0.5
PM Peak						
Pyrmont St	North of Union St	1	0.0	47	1.7	1.7
	South of Union St	2	0.1	48	1.7	1.7
	North of PBR[4]	2	0.1	48	1.7	1.7
Edward St	North of Union St	3	0.1	3	0.1	0.2
	South of Union St	19	0.8	-12	-0.6	0.1
Murray St/Pirrama Rd	North of Union St	9	0.4	-9	-0.4	0.0
Union St	West Edward St	7	0.3	5	0.2	0.5
Darling Dr	East of Murray St	4	0.2	-8	-0.4	-0.2
Pyrmont Bridge Rd	West of Pyrmont St	2	0.1	17	0.7	0.8
	East of Pyrmont St	2	0.1	-8	-0.4	-0.3

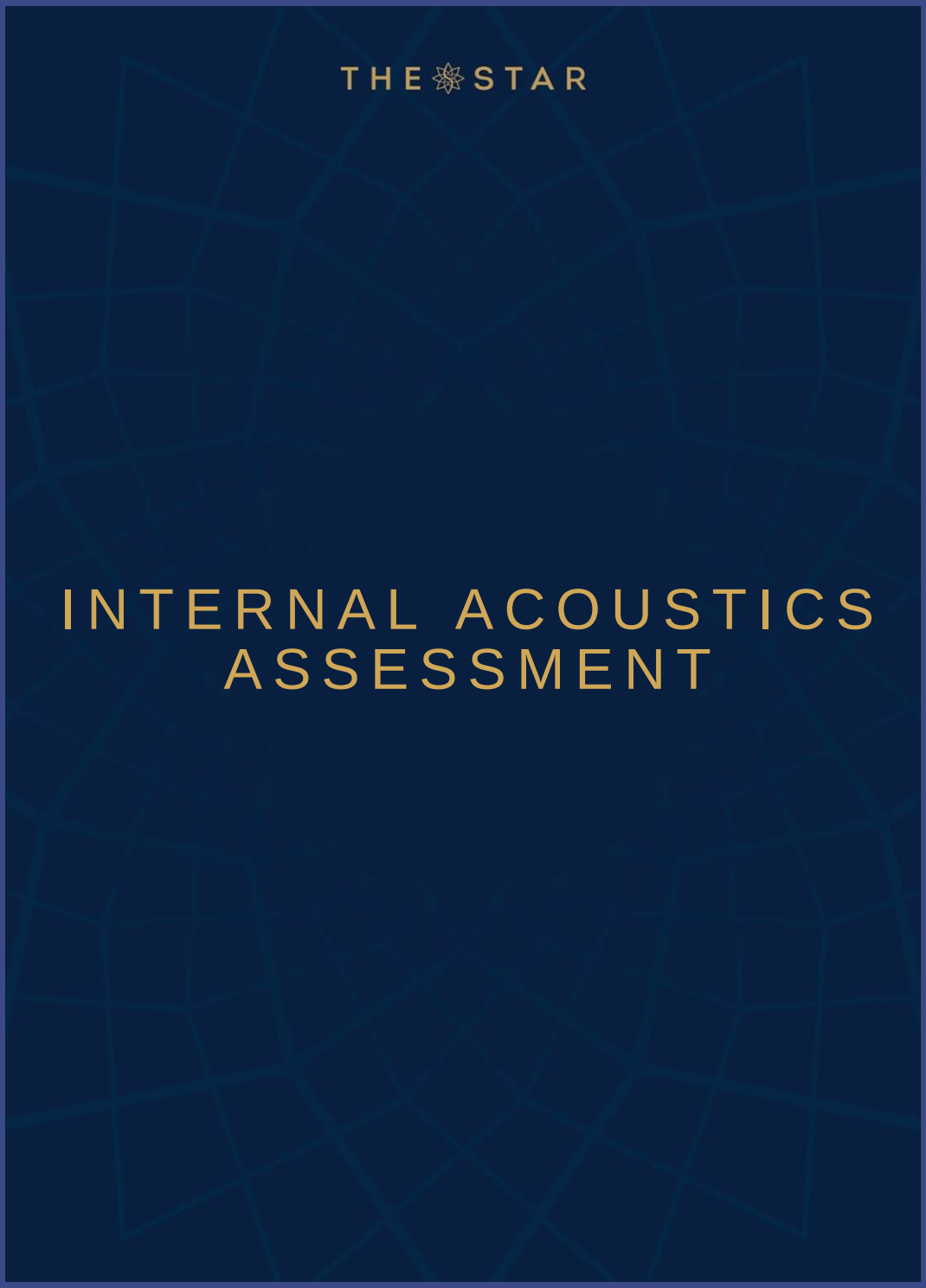
	West of Union St	5	0.2	-8	-0.4	-0.2
Jones Bay Rd	All	-	0.0	-2	0.0	0.0
			Late Peak			
Pyrmont St	North of Union St	5	0.2	25	1.0	1.2
	South of Union St	5	0.2	30	1.1	1.3
	North of PBR[4]	4	0.2	30	1.1	1.2
Edward St	North of Union St	58	2.0	13	0.5	2.5
	South of Union St	90	2.8	-8	-0.4	2.4
Murray St/Pirrama Rd	North of Union St	24	0.9	-22	-1.1	-0.1
Union St	West Edward St	26	1.0	-1	0.0	1.0
Darling Dr	East of Murray St	14	0.6	-1	0.0	0.6
Pyrmont Bridge Rd	West of Pyrmont St	3	0.1	3	0.1	0.2
	East of Pyrmont St	2	0.1	-1	0.0	0.1
	West of Union St	13	0.5	-1	0.0	0.6
Jones Bay Rd	All	-	0.0	-10	0.0	0.0

Note 1: Dashes indicate the road section was not assessed in traffic impact statement and assumes no significant impacts will occur.
Note 2: Increases prior to Modification 13 include Modification 7 and 14.
Note 3: Time periods defined as AM peak 8am to 9am, PM peak 5.30pm to 6.30pm and Late peak 10.30pm to 11.30pm
Note 4: PBR stands for Pyrmont Bridge Road.
Note 5: Edward Street North of Union does not have any residential receivers on it and therefore is not assessed for road noise increases. It has been included for information only.

A review of Table 12-4 shows that all assessed road sections are predicted to either increase noise levels by less than 2 dB or decrease noise levels, with the exception of Edward Street (South of Union St) during the late peak. As previously indicated, Edward Street (North of Union Street) does not have residential receivers.

Edward Street, south of Union Street, is shown to have a cumulative increase of 2.8 dB during the late peak for all assessed modifications, including Modification 13. Modification 13 is predicted to cause a decrease 0.4 dB on this section of road. As Modification 13 is reducing impacts on this road, additional mitigation measures are not required.

In consideration of the above, it can be said that the impact on road traffic noise due to Modification 13 is predicted to satisfy the requirements of the RNP and represents a limited environmental impact compared with the previously assessed impacts.


THE STAR
INTERNAL ACOUSTICS ASSESSMENT

13 INTERNAL ACOUSTIC AMENITY ASSESSMENT

Criteria for the acoustic amenity for internal spaces within the development have been outlined in Section 7. These relate to the noise ingress from external noise sources, and sound insulation performance between residential apartments or hotel guest rooms.

13.1 SOUND INSULATION

The residential apartments and hotel guest rooms will be designed to have sound insulation that meets the performance requirements of the BCA for a Class 2 and 3 buildings, as outlined in Section 7.1.1. These items to be developed as part of the detailed design include walls, floors, floor finishes, ceilings and junction detailing.

13.2 NOISE INGRESS ASSESSMENT

Noise from sources external to The Star and The Star's own noise sources have potential to impact on internal residential and hotel areas in the proposed tower. As outlined in Section 7.1, there is a requirement to control noise levels in internal areas from external noise ingress.

Environmental ambient noise sources in the area are generally dominated by road traffic noise from the immediately surrounding roads but also from distance sources including the M1/Western Distributor and other major CBD roads as observed on site. The residential and hotel accommodation amenity may also be impacted by noise sources on the roof of The Star.

13.2.1 ASSUMPTIONS

The noise modelling for the noise ingress calculation included all potential noise sources from The Star and surrounding significant roads. This includes the noise sources from The Star as described in Section 11 in addition to the surrounding roads described in Section 5.2 and includes the Western Distributor.

The Star configuration is as predicted for Modification 13 for all mechanical plant, operational, patron and music noise sources detailed in Sections 11.1 and 11.3.

As discussed in Section 11.4, an Operational Noise Management Plan (ONMP) shall be developed for the site. The noise management measures introduced to ensure compliance for external receivers will also benefit the onsite residential and hotel receivers.

13.2.2 MODELLING METHODOLOGY

The noise model developed for The Star includes major noise sources associated with The Star such as mechanical plant and outdoor entertainment areas in addition to major road traffic noise sources on the surrounding roads. The noise modelling parameters used to calculate the noise levels at the façade of the Tower are presented in Table 13-1.

TABLE 13-1 - NOISE MODELLING PARAMETERS

Item	Description
Noise model	SoundPLAN Version 7.4
Calculation method	ISO 9613-2 (industrial, operational, entertainment and patron), CRTN (road)
Ground topography	0.5 metre spaced ground contours from AAM 2013 LiDAR Data set.
Surrounding Buildings	LiDAR building footprints from AAM 2013 LiDAR Data set.
The Star building information	High resolution 2013 AAM LiDAR Data set with modifications for any modifications taken place between 2013 and 2016 using drawings available.
Ground absorption	Water, roads and concrete areas coefficient set to 0

Item	Description
	Grassed areas coefficient set to 0.75.
Traffic volumes and speeds	Posted speeds used and traffic volumes described Section 12 and the Western Distributor.
The Star noise sources	Includes all existing and proposed noise sources. Including measurements taken on site as detailed in Appendix B and proposed noise sources described in Sections 11.1 and 11.3.

13.2.3 ASSESSMENT

Table 13-2 presents the calculated facade noise levels at each level from all external noise sources.

TABLE 13-2 – CALCULATED TOWER FACADE NOISE LEVELS

Level	Floor RL (m)	Room use	Highest façade noise level, dBA L_{eq} (15 minute)	
			Day	Night
0	8.5	Common usage area	65	65
1	13.3	Common usage area	68	68
2	17.8	Common usage area	66	66
3	22.8	Common usage area	65	65
5	29.8	Common usage area	65	63
7	35.5	Ribbon function and business centre	63	62
9	42.7	Residential gym and hotel change facilities	62	61
10-18	46.8	Residential apartments Level 10-18	62	61
18-27	68.9	Residential apartments Level 18-27	60	59
27-38	100.4	Residential apartments	60	58
39	138.2	Hotel and back of house	61	58
40	143.0	Sky Lobby and Bar	60	58
41	147.0	Restaurant	60	58
42	151.0	Plant	60	58
43-58	155.8	Hotel rooms	60	58
59	207.0	Club Lounge	53	53
60	211.8	Hotel Suites	49	48
61	215.0	Hotel Suites	49	48

The noise levels inside habitable spaces such as bedrooms are required to be controlled to meet the internal noise levels specified in Section 7 by designing a façade with suitable performance.

Using the available floor plans at this stage, an indicative glazing performance has been developed for the hotel and residential sleeping areas. Table 13-3 presents a summary of the usage, level and indicative glazing specifications assuming the worst-case façade noise level. Further detailed analysis using the developed design may allow a reduced glazing specification to be determined at the detail design stage.

The calculations indicated that the internal noise levels would not be able to be met with windows open for the residential units. Therefore, mechanical ventilation must be provided to the residential units so that the windows can be closed whist providing adequate ventilation. Winter Gardens are not considered an internal space and therefore have no internal noise limits.

The hotel rooms are understood to have a closed façade, as such the glazing specification would meet the internal noise requirements.

The layouts of hotel suites on Levels 60 and 61 and the intended usage of areas defined as common usage areas at the base of the tower has not yet been defined and as such an indicative glazing specification cannot be determined.

Where facades are closed, or operable windows are required to be closed to meet internal noise limits, ventilation requirements will be met though mechanical ventilation solutions and attenuated natural ventilation paths. This will be done through a combination of ducted façade louvres and trickle vents in the spandrel which will include appropriate acoustic treatment as detailed in the Mechanical Services report and Architectural drawings.

TABLE 13-3 - INDICATIVE GLAZING SPECIFICATION

Room use and location	Facade noise level dBA	Indicative glazing specification
Residential apartment bedrooms below level 27 with windows directly on façade.	61-63	DGU consisting of 12.8mm glazing 12mm air gap 13.5mm glazing or equivalent performing DGU.
Residential apartment bedrooms Levels 27 and above with windows directly on façade.	60	12mm sealed glazing Or DGU consisting of ♦ 8mm glazing ♦ 12mm air gap ♦ 10mm glazing or equivalent performing DGU.
Hotel room type A	61-60	12mm sealed glazing
Hotel type B	61-60	12mm sealed glazing
Hotel type C	61-60	12mm sealed glazing
Hotel type D	61-60	12mm sealed glazing

13.2.4 RESIDENTIAL AMENITY SUMMARY

Assessment of noise ingress to the proposed residential apartments and hotel rooms has been undertaken considering noise from sources external to The Star and The Star's own noise sources (industrial sources and entertainment sources). This assessment has shown that the internal amenity criteria as set out by the City of Sydney DCP (detailed in Section 7.1), can be met internally through use of appropriately selected glazing and attenuated natural ventilation paths.

As discussed in Section 11.4, an Operational Noise Management Plan (ONMP) shall be developed for the site. The noise management measures introduced to ensure compliance for external receivers will also benefit the onsite residential and hotel receivers.

THE STAR

RAIL VIBRATION ASSESSMENT

14 RAIL VIBRATION ASSESSMENT

As required by the busy roads and rail corridors (Section 10), the potential for vibration impacts to occur at residential properties proposed within the rail corridor should be assessed against the criteria detailed in Section 7.

To provide an indication of the existing level of vibration from the light rail, vibration measurements were carried out at The Star and used to evaluate the following:

- Structure-borne noise radiated into residences assessed against internal ambient noise criteria detailed in Section 7.1.
- Vibration within tower assessed against human comfort levels detailed in Section 7.2.

14.1 MEASUREMENT

To provide an indication of the existing level of vibration from the light rail, vibration measurements were carried out at The Star on Thursday 16 November 2017 between 12:40pm and 1:45pm. The measurement location shown in Figure 14-1 was selected as it was the closest accessible point to the proposed tower's footing and is representative of a worst-case vibration level directly into the proposed structure.

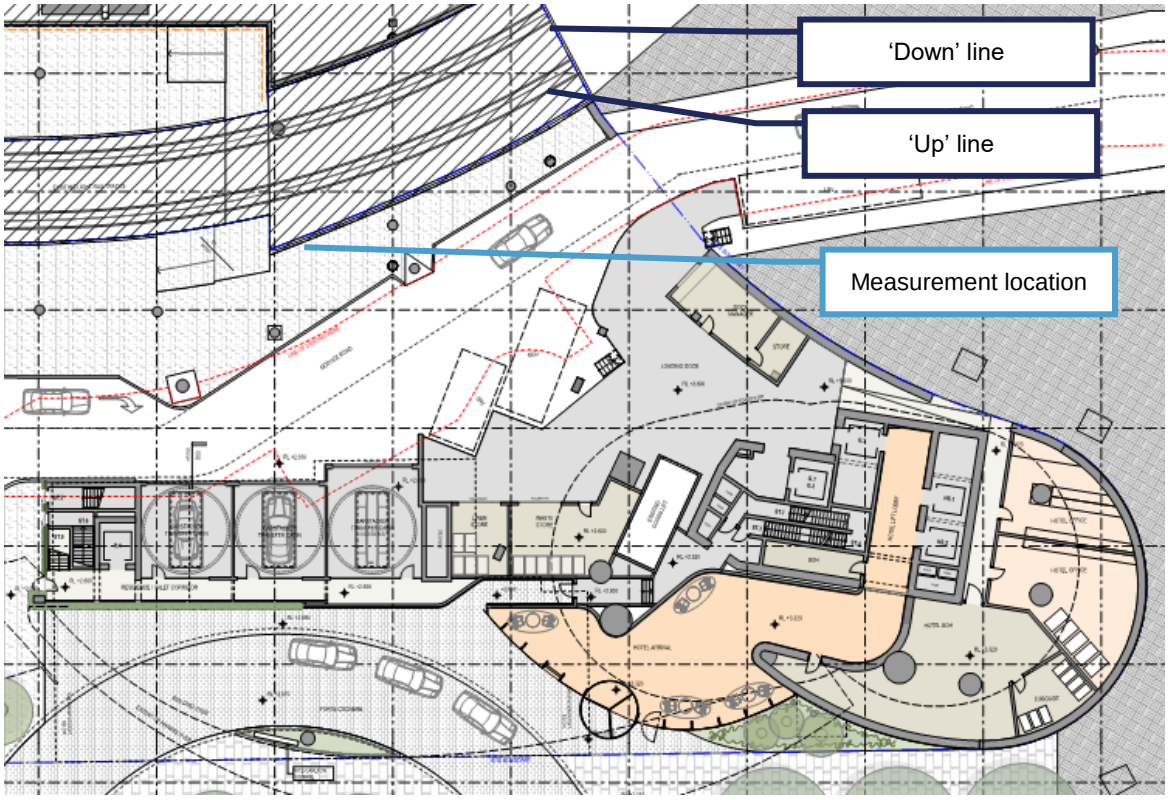


FIGURE 14-1 – MEASUREMENT LOCATION

A Svan 958A three-axis vibration level meter was used in conjunction with a Svan SV84 accelerometer. The meter was set to record root-mean-squared (rms) vibration levels in one-third octave bands, in one second intervals. The accelerometer was fixed to the ground near the building footing using epoxy resin.

14.1.1 RESULTS

Eleven light rail vehicles were measured during the survey. Summaries of the vibration measurements for arrivals and departures are given in Table 14-1. The values presented are the maximum rms velocity level recorded during the time the tram was either entering or departing the station. To provide a worst-case analysis, the highest vibration level in each octave band has been obtained and is used for the structure-borne noise calculation.

TABLE 14-1 – MEASURED VIBRATION, HIGHEST LEVELS

	Measured rms velocity levels, dB rel $1x10^{-9}$ m/s 1/1 Octave bands, Hz										
	1	**2**	**4**	**8**	**16**	**31.5**	**63**	**125**	**250**	**500**	**1000**
Arrival	75	68	62	69	79	72	77	68	59	56	47
Departure	75	69	62	66	73	69	73	67	59	58	41

14.2 ASSESSMENT

14.2.1 STRUCTURE-BORNE NOISE

Using the measured light rail pass-by vibration levels, structure-borne noise within the nearest residential room was calculated. To ensure the calculation demonstrated the worst-case scenario, the following assumptions were adopted:

- The highest measured vibration level in each octave band has been used as the basis for the calculation
- All vibration from light- rail measurement at platform transmitted to building structure - no additional attenuation due to isolation or de-coupling
- Nearest residence is 8 floors above the light rail line
- Building structure is concrete
- Residences will have a concrete floor and ceiling

Based on these worst-case assumptions, the structure-borne noise within the residence due to tram movements is predicted at 6-8 dBA. As per internal ambient noise criteria set out in Section 7.1, noise within the residence will be designed to no greater than 35 dBA. At 8dBA, structure-borne noise due to light rail movements will not be perceptible over this level.

14.2.2 VIBRATION – HUMAN COMFORT

Using the highest rms vibration levels from the measurements (Table 14-1), an estimated vibration dose value (eVDV) may be calculated for assessment of human comfort. While direct measurement of the VDV is preferred, the eVDV has been used in this case to determine the levels when the highest recorded rms vibration level is sustained for the duration of a tram movement. Table 14-2 summarises the calculated eVDV levels. Note that these levels are at the building footing, and as a result should be considered conservative.

To determine the impact of intermittent events, the number of such events is required. A review of the light rail timetable was conducted on 21 November 2017 to evaluate the number of light rail movements through The Star station on a weekday. These are presented in Table 14-2.

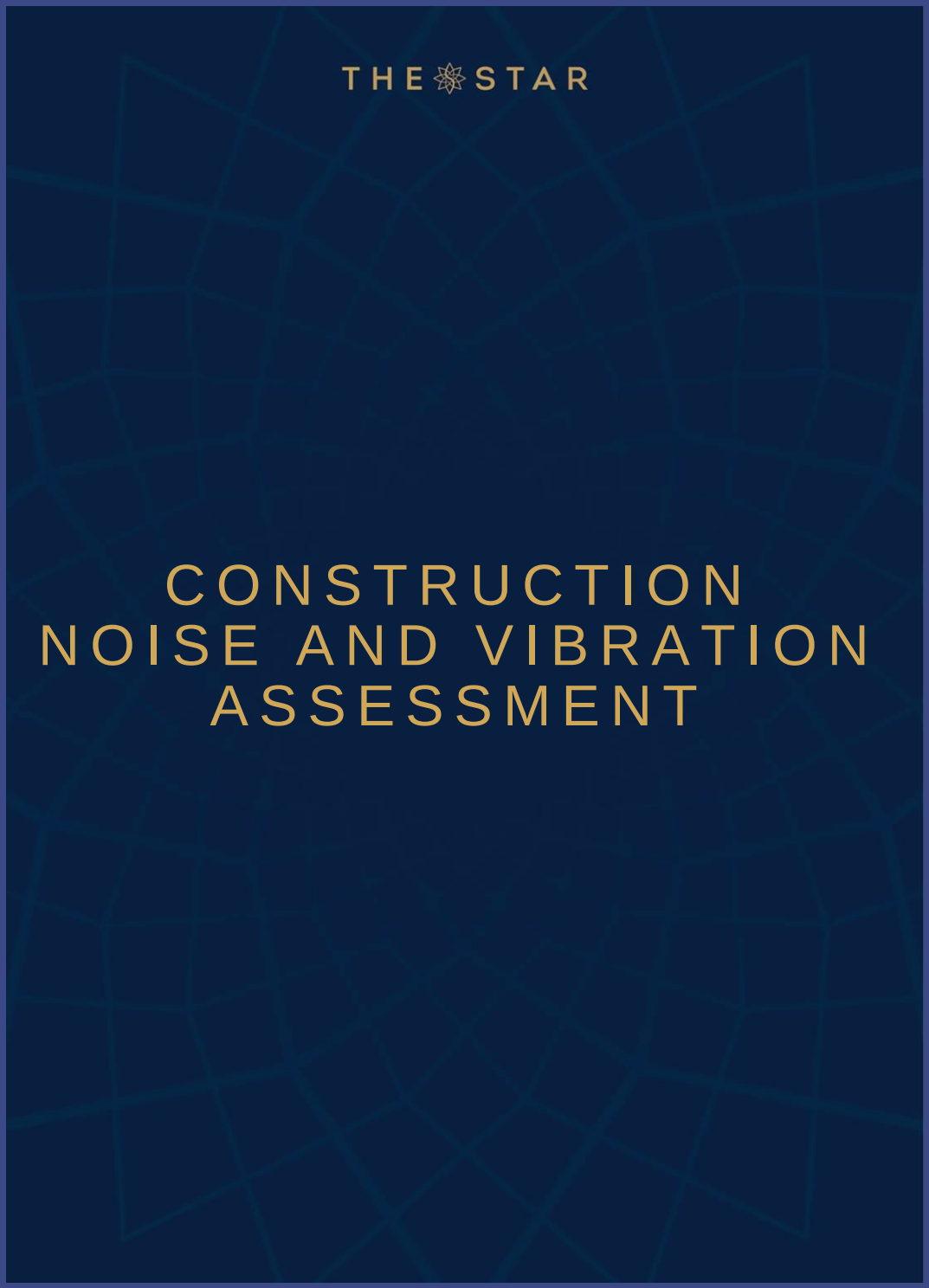
TABLE 14-2 – EVDV LEVELS FOR TRAM MOVEMENTS

	Track	**eVDV based on highest rms levels, $m/s^{1.75}$**		**Tram movements**	**Vibration dose, $m/s^{1.75}$**
		Arrival	Departure		
7am and 10pm	Up	$3.7x10^{-6}$	$3.4 x10^{-6}$	86	$1.5x10^{-5}$
	Down	$3.6 x10^{-6}$	$3.1 x10^{-6}$	88	
10pm and 7am	Up	$3.7x10^{-6}$	$3.4 x10^{-6}$	26	$1.1x10^{-5}$
	Down	$3.6 x10^{-6}$	$3.1 x10^{-6}$	29	

Vibration dose levels the at the building footing given in Table 14-2 are well below the recommended levels of 0.2 $m/s^{1.75}$ and 0.13 $m/s^{1.75}$ for human comfort.

14.2.3 SUMMARY

Existing vibration levels from tram movements were measured and found to be low. It is expected that structure-borne noise and vibration from light rail movements will have a negligible impact on the residences within the tower.


THE STAR
CONSTRUCTION
NOISE AND VIBRATION
ASSESSMENT

15 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Construction noise and vibration activities of the development will be subject to the criteria detailed in Section 8 developed from the approval conditions and Interim Construction Noise Guideline (ICNG).

15.1 ASSESSMENT

As the managing contractor has not yet been appointed, the following is a conceptual level assessment of construction noise and vibration based on typical construction equipment against the ICNG and vibration limits. Construction noise mitigation and management measures will be developed as part of a construction noise and vibration management plan developed by the main contractor leading up to and during the construction phase.

Typical construction scenarios and equipment provided are based on typical construction methodologies likely to apply on this project.

15.1.1 AIRBORNE NOISE

The noise management levels developed in Section 8 in line with the ICNG, represent management levels, above which there may be some adverse community reaction to noise.

To undertake a high-level assessment of construction, typical equipment for demolition, excavation and construction activities have been selected. The operation of the selected equipment at a receiver distance of 20m and assuming no mitigation measures, is presented in Table 15-1.

The noise levels and data are taken the Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites.

If construction activity noise is likely to exceed these management levels, then the ICNG requires the following actions:

- The proponent should apply all feasible and reasonable work practices to meet the noise affected level; and
- The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details for the project.

TABLE 15-1 - TYPICAL CONSTRUCTION EQUIPMENT AND RESULTANT NOISE LEVELS

Equipment	Sound Power Level, dBA	% Operation in 15 minute period	Distance, m	Predicted Level, dBA $L_{eq,15\ minute}$
Tower crane	105	100%	20	71
Excavator	107	100%	20	73
Forklift	106	100%	20	72
Bored Piling Rig	111	80%	20	76
Jackhammer	121	20%	20	80
Hand tools (pneumatic)	116	20%	20	75
Hand tools (electric)	102	20%	20	61

15.1.2 GROUND BORNE NOISE

Ground-borne noise is not considered an issue as the ICNG only specifies ground borne noise limits for outside of working hours and at this stage it is not anticipated that any works that generate ground borne noise would take place outside of standard construction hours.

15.1.3 GROUND VIBRATION

To provide a high level assessment of the ground vibration, indicative minimum working distances for typical vibration generating equipment are assessed for the most onerous criteria set out in Section 8.

The resultant indicative minimum working distances are presented in Table 15-2. The nearest receiver location to the proposed works is Receiver 13 at 20m, therefore the minimum working distances indicate that ground vibration due to the presented activities will meet vibration limits.

TABLE 15-2 - INDICATIVE MINIMUM WORKING DISTANCES FOR VIBRATION INTENSIVE EQUIPMENT

Equipment	Rating / description	Indicative minimum working distance, m*	
		Cosmetic damage	Human response **
Bored piling rig	≤ 800 mm	2 (nominal)	-
Jackhammer	Handheld	1 (nominal)	Avoid contact with structure

*Stricter conditions may apply to heritage or other sensitive structures.
**These values relate to continuous vibration. The majority of construction activities produce intermittent vibration, in which case higher vibration levels are allowable over a shorter period of time.
***Distances based on the values provided in Table 3 of the TfNSW Construction Noise Strategy (TfNSW 2016)

15.2 CONSTRUCTION TRAFFIC NOISE

The ICNG requires an assessment of construction traffic against the Road Noise Policy (EPA, 2011) (RNP) criteria. As discussed in section 9, the RNP states that any increase in road traffic noise as a result of a traffic generating development should be limited to no more than 2 dBA over the existing traffic noise levels.

The Modification 13 Traffic Impact Statement prepared by Mott Macdonald provides predicted increases to traffic in the area due to labourer transport and construction haulage. This information has been used to undertake an assessment of the impact of additional road traffic due to the construction.

The traffic report nominates a maximum number of 45 deliveries in a day along a route following the roads surrounding the site; Pyrmont Bridge Road, Pirrama Road, Jones Bay Road and Pyrmont Street, with all access to the route via Pyrmont Road. To provide a worst case scenario for assessment, it is assumed that up to 5 deliveries occur prior to the site opening at 7am.

The predicted number of workers per day in the traffic report peaks at 370 with a presumed 40% of workers travelling by car. This corresponds to 148 car trips before the site opens at 7am and again when the site closes. To provide a worst case scenario for assessment, it is assumed that all additional vehicles travel on all adjacent roads.

An assessment of increases to traffic has been undertaken using the traffic count information gathered as part of the survey detailed in Section 5.3. The predicted noise level changes have been calculated using the Calculation of Road Traffic Noise (CRTN) (UK Department of Transport 1988) method. Based on advice received from the project's traffic engineer heavy vehicle percentages will remain the same proportion of total traffic.

Table 15-3 shows that the proposal is not predicted to increase the total traffic noise level on the assessed roads by more than 2 dBA and are therefore considered compliant with the RNP.

TABLE 15-3 – MODIFICATION 13 PREDICTED ROAD TRAFFIC NOISE LEVEL CHANGES DUE TO CONSTRUCTION

Location	Day (7am to 10pm)			Night (10pm to 7am)		
	Additional cars	Additional heavy vehicles	Predicted increase in total noise level (dB)	Additional cars	Additional heavy vehicles	Predicted increase in total noise level (dB)
Jones Bay Road	148	40	0.3	148	5	0.2
Pirrama Rd near Light Rail	148	40	0.2	148	5	0.2
Pirrama Rd near Accenture	148	40	0.3	148	5	0.4
Pyrmont St 50m south of Jones Bay Road	148	40	0.3	148	5	0.3
Harris St 20m south of Jones Bay Road	148	0	0.1	148	0	0.3
Union St 20m east of Edward St	148	0	0.2	148	0	0.5

15.3 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

The Managing Contractor is key to the provision of a Construction Noise and Vibration Management Plan (CNVMP) as they will inform the construction processes to be assessed and ensure that all operational and physical noise and vibration mitigation measures will be integrated in to the project. As such, a detailed assessment shall be undertaken once a contractor is appointed and additional detailed construction methods are known. Based on the assessment, the managing contractor shall put in place a Construction Noise and Vibration Management Plan (CNVMP) to manage the risk associated with construction noise and vibration from the works.

Below are typical noise mitigation and management measures to be considered in the preparation of a CNVMP.

HOURS OF CONSTRUCTION WORKS

The hours of works for construction specified in Condition D11 of the Approval are primarily to control construction noise from adversely impacting nearby sensitive receivers and should be strictly adhered to.

SOURCE

The most effective form of mitigation is to eliminate or reduce the noise source where possible. This strategy should be adopted by changing the way work is carried out so that excessive noise is not produced.

All equipment should be regularly inspected and maintained (e.g. replacement of any worn-out parts) to reduce noise impacts at the source. All construction equipment should be operated in a quiet and efficient manner, by reducing throttle setting and turning off equipment when not in use.

PATH

Once all practical measures have been taken to minimise noise from the source, obstructing the path between the source and receiver is the next strategy to mitigate noise transmission. The transmission of noise between the construction works to residences and commercial receivers may be reduced by using temporary barriers.

Where installed, temporary noise barriers such as hoarding shall be constructed with solid panels such as plywood boards with minimum mass 10kg/m^2 with no gaps between the panels. Where practicable, localised noise barriers can be installed immediately surrounding noise intensive sources such as jackhammers.

RECEIVER

Where the first two mitigation strategies have been implemented or are not reasonable and feasible, the final phase of noise management is at the receiver. These mitigation management measures include letterbox drops, individual briefings, phone calls and a specific notification board with a hotline contact number. It is recommended that the

impacted receivers be notified of the proposed works and the expected duration of significant noise impacts well in advance. All potentially affected receivers should be informed of the following:

- The nature and duration of the works to be carried out (a schedule would be provided outlining each principal activity and what would be involved in that activity).
- The expected overall noise levels and the relative level of noise for the activities.
- Relevant contact details for site personnel.

The receivers to be included in the consultation process should at least include all identified residential receivers and adjacent commercial uses.

Additionally, receivers within The Star may be impacted by airborne and structure borne noise. It is in the interest of the operation of The Star that noise impacts are controlled for internal receivers. By internally managing noise impacts within The Star, it will also be beneficial to external receivers.

Measures for internal mitigation strategies include notification to patrons of the proposed works, scheduling of bookings to outside of construction periods, and a communication protocol in providing assistance to patrons with specific needs.

15.4 CONCLUSION

The appointed managing contractor shall put in place a Construction Noise and Vibration Management Plan (CNVMP) to manage the risk associated with construction noise and vibration from the works in line with the established criteria. In doing so, the environmental impact of the construction will be limited in line with the existing site approvals. This requirement is included in Condition B21.


THE STAR
ASSESSMENT OF LIMITED ENVIRONMENTAL IMPACT

16 ASSESSMENT OF LIMITED ENVIRONMENTAL IMPACTS

In addition to assessments in the previous sections which demonstrate the proposed Modification 13 works can comply with the relevant established noise criteria, WSP has conducted an assessment between the noise impact of those already assessed for the project and the predicted noise impact of Modification 13. This section assesses the potential changes in noise impacts due to the proposed Modification 13 operations.

16.1 MECHANICAL PLANT AND EQUIPMENT AND OTHER OPERATIONAL NOISE

For mechanical plant and equipment and other operational noise, differences of predicted noise levels at the nearest residential receiver locations are presented in Table 16-1. The predicted noise levels include the two following scenarios:

- L_A90 + contribution from already assessed operations
- L_A90 + contribution from Modification 13 operations

The reason for this approach is that changes in mechanical plant noise level between two scenarios cannot be assessed as only a contribution. For example, if the contributing noise levels for both scenarios are below the background noise level then they will both be inaudible and therefore the change in noise level is immaterial. For this reason, the background noise level is added to both scenarios so that a realistic impression of the audibility (and hence by inference noise impact) of the change can be properly assessed.

TABLE 16-1 – DIFFERENCES IN PREDICTED NOISE LEVELS BETWEEN ALREADY ASSESSED OPERATIONS AND MODIFICATION 13

Rec ID	Residential Receiver	Predicted Noise Level of already assessed operations (including L_A90) $L_{eq(15min)}$ dBA			Predicted Noise Level with contribution from Modification 13 (including L_A90) $L_{eq(15min)}$ dBA			Difference in predicted noise levels $L_{eq(15min)}$ dBA		
		D	E	N	D	E	N	D	E	N
3	39-43 Pyrmont Street	55	54	50	55	54	50	0	0	0
4	88 John Street	50	49	45	50	49	45	0	0	0
5	135 Point Street	50	49	45	50	49	45	0	0	0
6	18 Pyrmont Street	54	53	52	54	53	51	0	0	0
7	2 Jones Bay Road	54	53	51	55	54	53	1	1	2
8	26 Point Street	54	53	51	54	53	51	0	0	0
10	56-56A Pirrama Road	54	52	48	54	52	48	0	0	0
13	91 and 93 Pyrmont Street	56	56	52	56	56	52	0	0	0
14	Pyrmont Street Residences	56	56	52	56	56	53	0	0	0
16	31 Union Street	54	53	49	54	53	50	0	0	0
21	63 Edward Street	50	49	45	50	49	46	0	0	1
22	65 Edward Street	54	53	49	54	53	50	0	0	1

As presented in Table 16-1, there are minimal changes in the predicted noise levels between the already assessed operations and the Modification 13 proposal. A maximum relative increase of 2 dB is predicted at 2 Jones Bay Road

(Receiver 7) during the night-time period. However, in accordance with the Noise Policy for Industry, a 2 dB level difference is considered "negligible" as "the exceedances would not be discernable by the average listener".

Based on the above, noise impact due to mechanical plant and equipment and other operational noise constitutes limited environmental impact beyond what has previously been assessed.

16.2 LICENSED AREAS OPERATIONAL NOISE

For noise emission impact of the operations of licensed areas, comparison of predicted noise contributions from the following scenarios are provided.

- Already assessed operations including Sky Terrace
- Modification 13 operations.

Table 16-2 presents the 7am to midnight predicted noise contributions. Table 16-3 presents the midnight to 7am predicted noise contributions.

Where the predicted noise level for Modification 13 works is ≥5dB below the background noise level in octave bands for 7am to midnight, and ≥10dB below the background noise level in octave bands for midnight to 7am, the background noise will dominate, and these receiver locations are not shown this assessment.

TABLE 16-2 – COMPARISON OF PREDICTED ENTERTAINMENT NOISE CONTRIBUTIONS AT RESIDENTIAL RECEIVERS (7AM TO MIDNIGHT)

Rec ID	Address	Predicted Noise contribution	Sound pressure level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
7	2 Jones Bay Road – GF	Already assessed	41	63	49	51	47	44	37	28	<15
		Mod 13	39	60	48	53	54	52	47	40	27
		Difference	-2	-3	-1	2	7	8	10	12	-
8	26 Point Street – GF	Already assessed	39	61	47	50	46	44	36	26	<15
		Mod 13	38	59	47	51	51	49	44	36	18
		Difference	-1	-2	0	1	5	5	8	10	-
10	56-56A Pirrama Road	Already assessed	38	61	51	56	54	53	47	38	<15
		Mod 13	41	59	48	52	51	49	44	34	<15
		Difference	3	-2	-3	-4	-3	-4	-3	-4	-
21	63 Edward Street	Already assessed	35	56	40	43	40	39	34	28	16
		Mod 13	37	57	41	52	56	53	47	41	23
		Difference	2	1	1	9	16	14	13	13	7
22	65 Edward Street	Already assessed	35	56	40	42	38	37	32	25	<15
		Mod 13	35	54	39	47	50	46	40	34	17
		Difference	0	-2	-1	5	12	9	8	9	-

TABLE 16-3 - COMPARISON OF PREDICTED ENTERTAINMENT NOISE CONTRIBUTIONS AT RESIDENTIAL RECEIVERS (MIDNIGHT TO 7AM)

ID	Address	Predicted Noise contribution	Sound pressure level dB $L_{10\ (15min)}$ at 1/1 Octave band centre frequency (Hz)								
			31.5	63	125	250	500	1k	2k	4k	8k
10	56-56A Pirrama Road	Already assessed	36	35	36	38	42	40	33	21	<15
		Mod 13	18	19	15	31	35	32	25	<15	<15
		Difference	-18	-16	-21	-7	-7	-8	-8	-	-

Table 16-2 indicates that noise contribution from licensed areas operations between 7am and midnight will increase at some residential receivers as a result of the proposed Modification 13 operations. At receiver locations 21 and 22 along Edward Street, increases are to be expected due to new the new Food and Beverage licensed area on the corner of Edward and Union Streets.

Notwithstanding the relative increases shown in Table 16-2, it is noted that all the predicted noise contributions from proposed Modification 13 operations comply with conditions of consent as previously assessed for the existing approval (demonstrated in Section 11.3).

Table 16-3 indicates that noise levels to receiver 10 along Pirrama Road will see a decrease in noise contribution from licensed areas operations between midnight and 7am.

Based on the above, noise impact due to operation of the licensed areas, with implementation of management strategies, constitutes limited environmental impact beyond that which has previously been assessed.

16.3 TRAFFIC NOISE IMPACT

The road noise assessment in Section 12 presents the impact of previous modifications and the cumulative impacts including Modification 13.

The RNP states that an increase of 2 dB represents a minor impact that is considered barely perceptible to the average person. Therefore, for road traffic noise a difference of 2 dB between previous modifications and Modification 13 is considered to be a limited environmental impact.

Reviewing Table 12-4, the difference between Modification 13 and the previous modification's impacts, the difference is not more than 2 dB. Therefore, road traffic noise impact due to Modification 13 constitutes limited environmental impact beyond what has previously been assessed.

RECOMMENDED CONDITIONS OF APPROVAL

17 RECOMMENDED CONDITIONS OF APPROVAL

Appendix A details the existing approval conditions related to noise emission, noise management and controls. Updates to the conditions of consent are recommended to remove redundancy, ensure ongoing relevance to the site, and strengthen understanding of future obligations for The Star. Key changes proposed are discussed further in this section.

These alterations will not alter the quantitative criteria from the approved conditions for Modification 14 and the assessments undertaken in the preceding sections will still hold true.

17.1 CONDITION B5 – OPERATIONAL NOISE MANAGEMENT PLAN

Condition B5 requires that a Noise Management Plan be developed and submitted to the Department for approval prior to the issue of Construction Certificate. The wording of this condition is proposed to be updated to ensure the development of a holistic Operational Noise Management Plan (ONMP) to cover the operation of the whole site as part of the Modification 13 works.

The ONMP shall cover the following as a minimum:

- Document location of noise sensitive receivers
- Document noise emission criteria at noise sensitive receivers
- Identify potential noise emission sources - Identify any noise emission sources including but not limited to; patron behaviour, outdoor sound systems, unenclosed gaming area machine use, maintenance, mechanical plant and on site transportation.
- Document management strategies – Detail all strategies and procedures that are required to be implemented to meet noise emission criteria. This is to include identification of personel and responsibilities.
- Complaint handling procedures – Detail procedures to handle complaints should any arise. These may include; maintaining a complaint register, establishing a complaints hotline.
- Review and update procedure – Detail procedure for periodic review and update of the ONMP to maintain relevancy.

17.2 CONDITION B5A – NOISE VERIFICATION PLAN

It is proposed that an additional condition is included as part of Condition B5 to outline a methodology for ongoing verification of noise emissions from the licensed areas. In addition, the condition will require a detailed plan of ongoing verification of noise from these areas to be delivered as part of the Operational Noise Management Plan. The proposed wording for this is included within Appendix A.

17.3 INAUDIBILITY CRITERIA

Currently, Conditions E1 (Clause 3) and F5 (Clause 4) of the MP08-0098 MOD14 include “inaudibility” clauses which state that noise emission must not be audible within any habitable room in any residential property between the hours of 12.00 midnight and 7.00am.

Condition F5 refers to noise from the use, particularly noise from music and patrons in the licensed areas. The condition is one adopted in whole by the City of Sydney from the licensed premises standard criteria published by the Liquor and Gaming NSW (L&GNSW). The inaudibility clause included in this condition is taken from this original L&GNSW criteria as music and patron noise has the ability to be of an annoying characteristic. No change to this inaudibility criteria is proposed.

Condition E1 refers to noise emitted from plant and machinery on site. It is proposed that the inaudibility criteria is removed from this condition. The basis of this proposal is that the inaudibility clause on mechanical plant and equipment

holds no basis in state standards, guidelines or policy. Notably, the EPA has no requirement or assessment protocol for the inaudibility of industrial noise sources.

17.4 CONDITION F5 – NOISE CRITERIA

It is proposed that an additional condition is included as part of Condition F5 to capture noise sources that are otherwise not specifically conditioned in the approval. To do this, condition F5 is proposed to be renamed as Condition F5A – Noise (Licensed Premises) as the criteria replicates the L&GNSW entertainment noise criteria. The additional condition is named Condition F5B – Noise (Other Operational Noise) to capture noise sources such as on site transportation that do not have the same noise characteristic as entertainment noise.

THE STAR

SUMMARY

18 SUMMARY

An assessment of the noise and vibration impacts associated with changes proposed under Modification 13 to The Star has been conducted in accordance with the Secretary's Environmental Assessment Requirements (SEARs).

The SEARs contain two Key Issues relating to noise; Key Issues 1 and 11. Key Issue 11 and the first dot point of Key Issue 1 requires that the environmental assessment address noise impacts during the construction and operation of the development and appropriate mitigation measures. In addressing this SEAR throughout this report, we have also taken into account the second part of Key Issue 1 which requires a demonstration that the proposal (as a whole) has limited environmental impacts beyond those already assessed for MP 08_0098 and any subsequent modifications to that approval. The current approval, MP 08_0098 (Modification 14), was assessed against the relevant policies, guidelines and approval conditions. To determine if the proposed Modification 13 works can be built to have limited environmental impact beyond that already approved, these same acoustic criteria are used in combination with an investigation of the relative change between the approved project and the proposed Modification 13. It is considered that in assessing compliance with these criteria, the proposal will demonstrate limited environmental impact.

The assessment has been undertaken in accordance with this and considered; noise emissions from mechanical plant, patrons, amplified music and other operational noise sources, road traffic noise impacts and construction noise and vibration.

- The assessment determined that mechanical noise emissions from the existing and proposed development can meet the requirements of the SEARs with the requirements outlined in Section 11.1 implemented.
- For entertainment noise, the assessment determined the development can meet the SEARs with the requirements detailed in Section 11.3 implemented.
- The traffic noise assessment predicted that the operational phase of the development will be compliant with RNP criteria.

Having assessed noise emissions from mechanical plant, patrons, amplified music and other operational noise sources, and road traffic noise impacts, to comply with the relevant policies, guidelines and approval conditions, the proposed development can be built to have limited environmental impact.

Compliance with conditions for construction noise and vibration has been assessed and will be achieved through the development of a Construction Noise and Vibration Management Plan upon appointment of the Managing Contractor.

In addition to the SEARs assessment, evaluation has been undertaken of; internal acoustics including sound insulation, internal sound levels, reverberation time and vibration from pools and gyms, and rail vibration from the Sydney Light Rail. Recommendations to meet the internal acoustic requirements of the Sydney DCP and the BCA have been detailed in the report. In particular, internal amenity of residential apartments and hotel rooms onsite has been assessed considering noise from sources external to The Star and The Star's own noise sources (industrial sources and entertainment sources). This assessment has shown that the internal amenity criteria as set out by the City of Sydney DCP (detailed in Section 7.1), can be met internally through use of appropriately selected glazing and attenuated natural ventilation paths.

Based on the assessments presented in this document, it is determined that the development can be built to meet all noise limits imposed by the conditions of approval and all applicable policies and guidelines. Therefore, demonstrating compliance with the SEARs Key Issues 1 and 11.

The assessment also reviewed the change in noise level between the existing approved development and the proposed Modification 13 in combination with the criteria set out in the relevant policies, guidelines and conditions of consent. On the basis of this review, noise and vibration aspects of Modification 13 will have limited environmental impact as per the second dot point of SEAR Key Issue 1.

THE STAR

APPENDICES

APPENDIX A

PROJECT APPROVAL MP 08_0098 (MOD 13)- NOISE AND VIBRATION CONDITIONS.

Relevant Conditions of Approval - MP08_0098 (Mod 14)	Proposed Conditions of Approval	Reasoning
B5 NOISE MANAGEMENT PLAN A Noise Management Plan is to be prepared in consultation with the City of Sydney, addressing the following. 1. Further mitigation measures and treatments including additional acoustic -absorptive finishes and alternative perimeter treatments to the outdoor gaming and terrace areas. 2. The operation of all gaming and entertainment areas, including the external areas. The Noise Management Plan is to address the Mitigation Measures included in the letter from Bassett Consulting Engineers dated 3 December 2008. 3. In relation to the MUEF Project and the works shown on the drawings approved as part of Modification 7, a separate Noise Management Plan is to be prepared in consultation with the City of Sydney Council. The report shall detail how the noise mitigation measures recommended in the Acoustic Report prepared by AECOM dated 7th October 2010, will be implemented. The Plan is to be submitted to the Department for approval prior to the issue of a Construction Certificate for the MUEF works. The Noise Management Plan is to be submitted to the Department for approval prior to issue of a Construction Certificate for above ground works.	B5 NOISE MANAGEMENT PLAN ~~A Noise Management Plan is to be prepared in consultation with the City of Sydney, addressing the following.~~ ~~1. Further mitigation measures and treatments including additional acoustic -absorptive finishes and alternative perimeter treatments to the outdoor gaming and terrace areas.~~ ~~2. The operation of all gaming and entertainment areas, including the external areas. The Noise Management Plan is to address the Mitigation Measures included in the letter from Bassett Consulting Engineers dated 3 December 2008.~~ ~~3. In relation to the MUEF Project and the works shown on the drawings approved as part of Modification 7, a separate Noise Management Plan is to be prepared in consultation with the City of Sydney Council. The report shall detail how the noise mitigation measures recommended in the Acoustic Report prepared by AECOM dated 7th October 2010, will be implemented. The Plan is to be submitted to the Department for approval prior to the issue of a Construction Certificate for the MUEF works.~~ ~~The Noise Management Plan is to be submitted to the Department for approval prior to issue of a Construction Certificate for above ground works.~~ **An Operational Noise Management Plan (ONMP) is to be prepared for the site in consultation with the City of Sydney. The ONMP is to be submitted to the Department for approval prior to issue of a Construction Certificate for above-ground works associated with Modification 13 and is to incorporate the following:** ◆ **Document location of noise sensitive receivers** ◆ **Document noise emission criteria at noise sensitive receivers Document management strategies** ◆ **Performance verification protocols** ◆ **Complaint handling procedures**	Altered to ensure new ONMP is developed and put in place for the site.
	CONDITION B5A – NOISE VERIFICATION PLAN **A Noise Verification Plan (NVP) is to be prepared for the site. The NVP is to be submitted as part of the Operational Noise Management Plan as required by Condition B5.** **The NVP shall nominate Noise Control Points (NCP) on The Star site. The NCPs should be located where they will be representative of a sound source (or group of sound sources) contributing to the cumulative noise level controlled by Condition F5A at the most exposed off site noise sensitive receivers.** **The NVP will nominate an L_{10} octave band sound pressure level Noise Control Level (NCL) at each NCP such that where the sound level satisfies the NCL, it will also satisfy the relevant criteria of Condition F5A at the receiver it represents, taking into account the cumulative total from all relevant noise sources.**	New condition proposed to ensure ongoing monitoring of noise from licenced premises (Condition F5A).

		Condition F5A - Noise (Licenced Premises) is verified if the measured L10 octave band sound pressure levels at the NCP do not exceed the NCL **The NVP shall be prepared by an appropriately qualified Acoustic Consultant who has full membership of the Australian Acoustic Society or who is employed by a member firm of the Association of Australasian Acoustical Consultants**	
B21 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN A Construction Noise and Vibration Management Plan (CNVMP) is to be prepared detailing: a. specific activities to be carried out on the site and associated noise sources; b. identification of potentially affected sensitive receivers; c. construction noise and vibration criteria specified in the conditions of this approval; d. maximum noise levels for internal works to be carried out 24 hours a day; e. detailed assessment of the construction methods to be used for the works: f. mitigation treatments, management methods and procedures to be implemented during construction to control noise and vibration; g. measures to inform all potentially impacted residents of the nature of the works to be carried out, the expected noise levels and duration, as well as site contact details; h. noise and vibration monitoring, reporting and response procedures; i. measures to be implemented to manage complaint handling and reporting; and j. contingency plans to be implemented where non-compliances occur or noise complaints are received. The CNVMP must be prepared in accordance with the Interim Construction Noise Guideline and include feasible and reasonable work practices to meet the established construction noise limits. The construction hours must be in accordance with condition D11 of this approval. The CNVMP is to be submitted to the Certifying Authority for endorsement prior to the issue of a Construction Certificate. The Proponent shall also submit a copy of the final plan to the Department and the Council.	Retain – no changes	Retained as this forms the requirement for planning and designing of construction activities to limit impact on nearby receivers.
D 11 HOURS OF WORK 1. The hours of construction, including the delivery of materials to and from the site, shall be restricted as follows: a. Between 7:00 am and 5.30 pm, Mondays to Fridays inclusive; b. Between 8:00 am and 3.00 pm, Saturdays; c. Between 9:00 am and 3.30 pm, Mondays to Fridays for mechanical rock blasting; and d. No work on Sundays and public holidays. 2. Works may be undertaken outside these hours where: a. the delivery of materials is required outside these hours by the Police or other authorities; b. it is required in an emergency to avoid the loss of life, damage to property and/or to prevent environmental harm;	Retain – no changes	Retained as this forms the requirement for planning and designing of construction activities to limit impact on nearby receivers.

c. residents likely to be affected by the works are notified of the timing and duration of these works at least 48 hours prior to the commencement of the works; and d. the work is approved by the Director-General or their nominee. 3. Notwithstanding conditions 1 and 2 above minor internal works to the existing building, including but not limited to demolition of light weight partitions, construction of new partitions, installation of ceilings, finishing of floors, engineering services installations, carpet installation, lighting programming, painting, may be undertaken outside these hours in accordance with the submitted Construction Noise and Vibration Management Plan required by condition B 21. Should noise complaints be received by Council or other State government agencies from a place of different occupancy (including commercial premises) and the complaint being substantiated by a Council Officer or representative of the relevant State agency, the construction works occurring during the approved extended construction hours must cease operation until 'attenuation works' are carried out. Extended construction hours must not commence until compliance with the relevant noise conditions can be achieved. All heavy demolition and construction works shall be restricted to between the hours of 9:00am – 4:00pm Mondays to Saturdays.		
E1 (A) CERTIFICATION OF NOISE MITIGATION MEASURES Prior to the issues of an Occupation Certificate for any stage of the approved development, a report is to be prepared and submitted by a qualified acoustic engineer confirming that the development has been constructed in accordance with the recommendations of: a. The Acoustic Assessment Report, prepared by ARUP, September 2008; b. Addendum Report prepared by Acoustic Logic Consultancy dated August 2009; and c. Acoustic Assessment Report prepared by AECOM dated 7 October 2010 as may be relevant to the completed works.	E1 (A) CERTIFICATION OF NOISE MITIGATION MEASURES Prior to the issue of an Occupation Certificate for any stage of the approved development, a report is to be prepared and submitted by a qualified acoustic engineer confirming that the development has been constructed in accordance with the **conditions of this approval.** ~~a. The Acoustic Assessment Report, prepared by ARUP, September 2008;~~ ~~b. Addendum Report prepared by Acoustic Logic Consultancy dated August 2009; and~~ ~~c. Acoustic Assessment Report prepared by AECOM dated 7 October 2010 as may be relevant to the completed works.~~	Altered to ensure continued relevance to the whole of site noise limits.
E1 NOISE CONTROL - PLANT AND MACHINERY Noise associated with the operation of any plant, machinery or other equipment on the site, shall not give rise to any one or more of the following: 1. Transmission of "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any place of different occupancy. 2. A sound pressure level at any affected residential property that exceeds the background ($L_{A90,\ 15\ minute}$) noise level by more than 5dB(A). The background noise level must be measured in the absence of noise emitted from the premises. The source noise level must be assessed as a $L_{Aeq,\ 15\ minute}$. 3. Notwithstanding compliance with (1) and (2) above, the noise from mechanical plant	Delete	Deleted condition for the following reasons: Point 1 is deleted as if the use is approved, and it complies with its conditions of consent, it cannot be considered "offensive noise". Point 2 is a replication of condition F4, which is retained. Point 3 is deleted as this refers to inaudibility. See section 17.2 for justification. Point 4 is replication of condition E1(A).

associated with the premises must not be audible in any habitable room in any residential property between the hours of 12.00 midnight and 7.00am. 4. Prior to issue of any Occupation Certificate a report is to be prepared and submitted by a qualified acoustic engineer confirming that the development has been constructed in accordance with the recommendations in the Acoustic Assessment Report prepared by ARUP, September 2008 and addendum provided by Acoustic Logic Consultancy, 14 August 2009.		
F1 NO SPEAKERS OR MUSIC OUTSIDE Speakers must not be installed and music must not be played in any of the outdoor areas associated with the premises including the public domain and outdoor terraces/decks/gaming areas, excluding the: a. Level 3 Outdoor Pool Deck area of the hotel development; b. Level 3 Pirrama Road Entertainment Deck, c. Level 1 Pirrama Road Outdoor Gaming Areas, d. Oasis Outdoor Gaming Area fronting Pyrmont Street (as shown on Drawing No MOD-A9202A); and e. Sovereign Level 3 Outdoor Gaming Areas within the site and those fronting Pirrama Road and Pyrmont Streets (as shown on Drawing No MOD14-A0703). Speakers located within the premises must not be placed so as to direct the playing of music towards the outdoor areas associated with the premises.	Retain with no changes	Retained with no changes
F1A TRIAL USE OF SPEAKERS AND MUSIC OUTSIDE The use of speakers and amplified music in those outdoor areas identified in Condition F1(b) to F1(e) above is subject to a two-year trial period which shall commence grant of approval of MP08_0098 MOD 14 or within one month of the issue of an Occupation Certificate for the outdoor areas whichever is the latter. The proponent shall notify Council and the Department in writing of the commencement of the trial period for each of the outdoor areas identified in Condition F1(b) to F1(e) above. Email notification to Council of the commencement of the trial period shall be sent to liquor@cityofsydney.nsw.gov.au. Note: A modification application may be lodged to continue the trial period specified in this condition permanently. Provided the application to continue the trial period is lodged no earlier than 120 days before the end of the trial period and no later than 60 days before the end of the trial period, then the activity the subject of the application for extension may continue until such time as the application is determined.	Retain with no changes	Retained with no changes
F1B LEVEL 3 OUTDOOR POOL DECK Operation of speakers at the Level 3 Outdoor Pool Deck areas of the hotel must be in accordance with the following: a. The maximum allowable speaker output for playback of background music is to comply with the recommendations identified in the	Retain with no changes	Retained with no changes

AECOM Noise Emissions Assessment dated 6 June 2012; b. The speakers that are permitted to be installed to the Level 3 Outdoor Pool Deck area of the hotel development are limited to twelve Meyer Sound Miniature Speakers (MM-4XP) and two subwoofers. The location of the speakers is illustrated in plan titled 'Darling Pool Terrace'; c. Management/administrative measures to assist in reducing operation noise impacts are to comply with the Operational Noise Management Plan prepared by AECOM and dated 6 June 2012, and includes but is not limited to the following: i. Restricting the number of patrons permitted on the pool deck to 200 in the 'Night-time (midnight to 7.00 am) period; ii. The ELIAS system is not to be used during the 'Night-time' (midnight to 7.00 am) period; iii. No announcements are to be made during the 'Night-time' (midnight to 7.00 am) period, except in the case of an emergency; and No DJ/live band/amplified music events are to commence during the 'Night-time' (midnight to 7.00 am) period.		
F1C LEVEL 3 PIRRAMA ROAD ENTERTAINMENT DECK Speakers and amplification equipment must be installed/constructed and operated at the Level 3 Pirrama Road Entertainment Deck in accordance with all recommendations and performance parameters contained in the report entitled *The Star – Pirrama Road External Entertainment Deck – Amplified Music Acoustic Assessment*, prepared by Renzo Tonin and Associates and dated 8 May 2014. The use of the equipment must comply with the following: a. The use of the Level 3 Pirrama Road Entertainment Deck must comply with maximum allowable noise levels outlined in Section 4.2 (Table 6) of abovementioned report; b. Sound speaker noise levels from each speaker must comply with Section 5 (Table 7) of the report entitled The Star – Pirrama Road External Entertainment Deck – Amplified Music Acoustic Assessment, prepared by Renzo Tonin and Associates and dated 8 May 2014 c. The use of the speakers for the playing of live or recorded music is limited to between 7.00am and 12.00am; d. There shall be no playing of amplified music or the use of speakers between 12.00am and 7.00am; e. Music noise limits to be controlled using a sound-pressure measurement/limiter device (e.g. CESVA LRF-04 and LRF-05 or APEX Argos and HERA) so that music noise levels will be controlled dependent on the overall noise generated by patrons and music combined. Where an alternative sound system is proposed, it is recommended that the noise level be controlled by an electronic frequency dependant RMS limiting device (e.g. a Rane HAL, BSS Blu-16, Symetrix Jupiter 8 or MediaMatrix X-Frame 88);	Retain with no changes	Retained with no changes

f. Management/administrative measures to assist in reducing operational noise impacts are to comply with the Operational Noise Management Plan entitled The Use of Speakers and Delivery of Music on the Pirrama Road External Entertainment Deck, The Star, prepared by The Star Ltd and dated 8 May 2014; and g. Notwithstanding compliance with (a) to (f) above operations on the Level 3 Pirrama Road Deck shall comply with the requirements of Conditions F5 and F6 when cumulatively assessed with other operations at the premises.		
F1D USE OF SPEAKERS IN OUTDOOR AREAS 1. During the trial period (Condition F1A), speakers and amplification equipment must be constructed and operated at the Level 1 Pirrama Road Outdoor Gaming Area in accordance with all recommendations and performance parameters contained in the report entitled The Star – Pirrama Road Level 1 Unenclosed Gaming Areas Speakers and Music Assessment, prepared by Renzo Tonin and Associates and dated 8 May 2014. The use of the equipment must comply with the following: a. The use of the Level 1 Pirrama Road Outdoor Gaming Areas must comply with maximum allowable noise levels outlined in Section 4.2 (Table 6) of the abovementioned report; b. No PA (public address) announcements are permitted between 12 am and 7 am; c. Only low level background music that is below existing ambient noise levels in the Level 1 Pirrama Road Outdoor Gaming Areas is permitted to be played between 12 am and 7 am; d. The noise levels of the speakers and amplification equipment shall be controlled by an electronic dependant RMS limiting device (e.g. a Rane HAL, BSS Blu-16, Symetrix Jupiter 8 or MediaMatrix X-Frame 88) so that all noise emissions comply with the requirements of Condition F5; e. Management/administrative measures to assist in reducing operational noise impacts are to comply with the Operational Noise Management Plan entitled The Installation and Use of Speakers to Deliver Background Music and Announcements to the Level 1 Unenclosed Gaming Areas, The Star, prepared by Pure Projects and dated 8 May 2014; and f. Notwithstanding compliance with paragraphs (a) to (e) above operations on the Level 1 Pirrama Road Deck shall comply with the requirements of Conditions F5 and F6 when cumulatively assessed with other operations at the premises. 2. Any speakers and amplification equipment installed in the Oasis Outdoor Gaming Area, the expanded Level 1 Outdoor Gaming Area, or the Sovereign Outdoor Gaming Areas (internal to the site, fronting Pirrama Road or Pyrmont Street) must be constructed and operated in accordance with all recommendations and performance parameters contained in the report entitled The Star – Pirrama Road Level 1 Unenclosed Gaming	Retain with no changes	Retained with no changes

Areas Speakers and Music Assessment, prepared by Renzo Tonin and Associates and dated 8 May 2014 and the recommendations of the Noise Impact Assessment prepared by WSP/Parsons Brinckerhoff dated September 2016 and Supplementary Report dated February 2017. The use of the equipment must comply with the following: a. No PA (public address) announcements are permitted between 12 am and 7 am; b. Only low level background music that is below existing ambient noise levels in the Level 1 Pirrama Road Outdoor Gaming Areas is permitted to be played between 12 am and 7 am; c. The noise levels of the speakers and amplification equipment shall be controlled by an electronic dependant RMS limiting device (e.g. a Rane HAL, BSS Blu-16, Symetrix Jupiter 8 or MediaMatrix X-Frame 88) so that all noise emissions comply with the requirements of Condition F5; and d. Management/administrative measures to assist in reducing operational noise impacts are to comply with the Operational Noise Management Plan entitled The Installation and Use of Speakers to Deliver Background Music and Announcements to the Level 1 Unenclosed Gaming Areas, The Star, prepared by Pure Projects and dated 8 May 2014; and e. Notwithstanding compliance with paragraphs (a) to (d) above operations within the Unenclosed Gaming Areas shall comply with the following requirements: i. All gaming machines in the unenclosed gaming areas are to be turned to half volume between 12 am and 7 am. ii. The UGA is to be isolated off from the main gaming area via automatic door closers. Operation of each unenclosed gaming area shall comply with the requirements of Conditions F5 and F6 when cumulatively assessed with other operations at the premises.		
F1E MONITORING		
An appropriately qualified acoustic consultant who possesses the qualifications to render them eligible for membership of the Australian Acoustic Society, Institution of Engineers Australia or the Association of Australian Acoustic Consultants must be appointed within two weeks of the approval of MP08_0098 MOD 14 or prior to occupation of the areas nominated in condition F1 (b) to (e) and F3 (1) and (2) whichever is the sooner and details of that appointment submitted to Council. During the first 90 days of entertainment and use of outdoor speakers in those outdoor areas identified in Condition F1 (b) to (e) and F3 (1) and (2), the following acoustic measures must be undertaken: 1. The acoustic consultant must: a. Measure and verify that the cumulative noise emanating from the premises complies with the noise criteria in Condition F5 Noise; and b. If necessary, make recommendations to ensure that the cumulative noise emanating from the premises complies with the noise. 2. The noise measurements must be: a. Undertaken without the knowledge of the applicant, manager or operator of the	Retain with no changes	Delete - No longer required with the removal of trial periods.

premises; b. Undertaken on at least three different occasions on three different days of the week (excluding Monday, Tuesday and Wednesday) for a time period which is deemed suitable by the acoustic consultant to determine if cumulative noise emanating from the premises complies with the noise criteria in Condition F5 Noise; and c. Submitted to the City of Sydney Council, Health and Building Area Manager (West) within 7 days of the testing. 3. If the acoustic consultant recommends that additional treatment or works be undertaken under condition (1) (ii) above, those recommendations must be: a. Submitted to the City of Sydney Council, Health and Building Area Manager (West) with the noise measurements as required in (2)(b) above; and b. Implemented to the acoustic consultant's and the Council's satisfaction within one (1) month of the date of the acoustic consultant's report. 4. If the acoustic consultant's recommendations are not implemented in accordance with this condition, the premises must not use/operate speakers in outdoor areas until such time as the recommendations are implemented and verified.		
F1F NOISE LIMITERS Use of all amplification equipment must comply with the following: a. All amplification equipment used on the pool deck must be controlled by a Root Mean Square (RMS) noise limiter, calibrated by an acoustic consultant in accordance with manufactures specification to ensure that resultant amplified sound complies with the Council's licensed premises noise criteria. The noise limited and any independent output adjustments on the speaker system must be tamper proof and only operable by the acoustic consultant. b. All on-stage and front of house sound equipment must be controlled by noise limitation equipment as detailed in (a) above. c. Access to noise limiter settings must be restricted to the Licensee of manager of the premises. The limiter settings/calibration levels must be available to Council officers upon request. d. The Acoustical consultant must submit Certificate of Compliance to the Council to certify that the limiters are installed and calibrated to satisfy Council's noise criteria for the licensed venues.	F1F NOISE LIMITERS Use of all amplification equipment must comply with the following: a. All amplification equipment used on the pool deck **or the outside entertainment areas** must be controlled by a Root Mean Square (RMS) noise limiter, calibrated by an acoustic consultant in accordance with manufactures specification to ensure that resultant amplified sound **level** complies with ~~the Council's licensed premises noise criteria~~ **condition F5A**. The noise **limiter**~~limited~~ and any independent output adjustments on the speaker system must be tamper proof and only operable by the acoustic consultant. b. All on-stage and front of house sound equipment must be controlled by noise limitation equipment as detailed in (a) above. c. Access to noise limiter settings must be restricted to the Licensee of manager of the premises. The limiter settings/calibration levels must be available to Council officers upon request. The Acoustical consultant must submit Certificate of Compliance to the Council to certify that the limiters are installed and calibrated to satisfy ~~Council's noise criteria for the licensed venues.~~ **condition F5A.**	Changed to ensure relevance to the updated conditions.
F1G COMPLAINTS HANDLING The Proponent shall operate a noise complaint handling procedure for the use of all outdoor speaker and amplification systems in accordance with the relevant Operational Environmental Management Plan (OEMP) including: a. The OEMP prepared by AECOM and dated 6 June 2012; b. The OEMP entitled The Use of Speakers and Delivery of Music on the Pirrama Road	F1G COMPLAINTS HANDLING The Proponent shall operate a noise complaint handling procedure for the use of all outdoor speaker and amplification systems in accordance with the relevant Operational Environmental Management Plan (OEMP) including: a. The OEMP prepared by AECOM and dated 6 June 2012; b. The OEMP entitled The Use of Speakers and Delivery of Music on the Pirrama Road	Retained to ensure methodology is in place to effectively address complaints should they occur. Updated to refer to recommended condition changes.

External Entertainment Deck, The Star, prepared by Pure Projects and dated 8 May 2014; and c. The OEMP entitled The Installation and Use of Speakers to Deliver Background Music and Announcements to the Level 1 Unenclosed Gaming Areas, The Star, prepared by Pure Projects and dated 8 May 2014. Should a noise complaint be received by Council and/or the Department that is substantiated, the speakers are to be decommissioned and music must cease until the noise emissions from the use of all outdoor speaker and amplification systems can comply with the noise criteria of Condition F5.	External Entertainment Deck, The Star, prepared by Pure Projects and dated 8 May 2014; and c. The OEMP entitled The Installation and Use of Speakers to Deliver Background Music and Announcements to the Level 1 Unenclosed Gaming Areas, The Star, prepared by Pure Projects and dated 8 May 2014. Should a noise complaint be received by Council and/or the Department that is substantiated, the speakers are to be decommissioned and music must cease until the noise emissions from the use of ~~all~~ **any relevant** outdoor speaker and amplification systems can comply with the noise criteria of Condition F5**A**.	
F3 HOURS OF OPERATION – OUTDOOR GAMING AREAS AND TERRACES 1. The hours of operation of the following areas is restricted to between 7.00am and 12.00 midnight, Mondays to Sunday inclusive: a. Level 3 Sovereign Room outdoor gaming areas fronting Pirrama Road and Pyrmont Street; b. Level 2 Oasis outdoor gaming area fronting Pyrmont Street; and c. Level 1 outdoor gaming areas fronting Pirrama Road. 2. The hours of operation of balconies serving the private gaming rooms adjacent to Union Street are restricted to between 10:00am and 10:00pm, Mondays to Sundays inclusive. 3. Notwithstanding (1a) above the Level 3 Sovereign Room outdoor gaming areas may operate 24 hours per day Mondays to Sundays (inclusive) for a two-year trial period which shall start on commencement of use of the outdoor terrace, 4. Notwithstanding (1b), (1c) and (2) above the outdoor areas may operate 24 hours per day Mondays to Sundays (inclusive) for a two year trial period which shall commence on grant of approval of Modification 14. 5. The proponent shall notify Council and the Department in writing of the commencement of the trial period for each of the outdoor areas identified in (1) and (2) above. Email notification to Council of the commencement of the trial period shall be sent to liquor@cityofsydney.nsw.gov.au. Operation of all outdoor areas shall comply with the requirements of Condition F5 and F6 when cumulatively assessed with other operations at the premises.	Delete	Approved Condition B5 requires an Operational Noise Management Plan (ONMP) to be prepared for the site in line with cumulative criteria for the site (condition F5). Noise management controls currently in operation (including hours of use) will be incorporated into the ONMP to ensure that such controls continue to be part of the operations of the site.
F4 MECHANICAL PLANT AND EQUIPMENT Noise associated with mechanical plant and equipment associated with the approved works must not give rise to any one or more of the following: 1. Transmission "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any affected receiver. 2. A sound pressure level at any affected receiver that exceeds the background (LA90, 15 minute) noise level by more than 5dB(A). The background noise level must be measured in the absence of noise emitted from the use in	F4 MECHANICAL PLANT AND EQUIPMENT Noise associated with mechanical plant and equipment ~~associated with the approved works~~ must not give rise to any one or more of the following: 1. Transmission **of** "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any affected receiver **outside the boundary**. 2. A sound pressure level (**$L_{Aeq,15minute}$**) at any affected receiver **outside the boundary** that exceeds the **RBL**~~background (LA90, 15 minute)~~ noise level by more than 5dB(A). The	Retained with additional clarification of applicable receivers measurement Reference to Assessing Vibration removed as it is not relevant to this condition.

accordance with Australian Standard AS 1055. Note: The method of measurement of vibration being carried out in accordance with "Assessing Vibration: Technical Guidelines: - DEC (EPA) AS 1055 for sound level measurements.	**RBL**~~background noise level~~ must be measured in the absence of noise emitted from the use in accordance with **the NSW EPA Noise Policy for Industry and** Australian Standard AS 1055. ~~Note: The method of measurement of vibration being carried out in accordance with "Assessing Vibration: Technical Guidelines: - DEC (EPA) AS 1055 for sound level measurements.~~	
F5 NOISE Cumulative noise caused by the approved use including music and other activities must comply with the following criteria: 1. The use must not result in the transmission of "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any place of different occupancy outside the boundary. 2. The L_{10} noise level emitted from the use must not exceed 5dB above the background (L_{90}) noise level in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) between the hours of 7.00am and 12.00 midnight when assessed at the boundary of the nearest affected property. The background noise level must be measured in the absence of noise emitted from the use. 3. The L_{10} noise level emitted from the use must not exceed the background (L_{90}) noise level in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) between the hours of 12.00 midnight and 7.00am when assessed at the boundary of the nearest affected property. The background noise level must be measured in the absence of noise emitted from the use. 4. Notwithstanding compliance with (1) and (2) above, the noise from the use must not be audible within any habitable room in any residential property between the hours of 12.00 midnight and 7.00am. 5. The L_{10} noise level emitted from the use must not exceed the background noise level (L_{90}) in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) by more than 3dB when assessed indoors at any affected commercial premises.	F5**A** NOISE **(LICENCED PREMISES)** Cumulative noise caused by the ~~approved use including music and other activities~~ **licensed premises when measured or assessed outside the boundary** must comply with the following criteria: 1. The use must not result in the transmission of "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any place of different occupancy outside the boundary. 2. The L_{10} noise level emitted from the use must not exceed 5dB above the background (L_{90}) noise level in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) between the hours of 7.00am and 12.00 midnight when assessed at the boundary of the nearest affected property. The background noise level must be measured in the absence of noise emitted from the use. 3. The L_{10} noise level emitted from the use must not exceed the background (L_{90}) noise level in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) between the hours of 12.00 midnight and 7.00am when assessed at the boundary of the nearest affected property . The background noise level must be measured in the absence of noise emitted from the use. 4. Notwithstanding compliance with (1) and (2) above, the noise from the use must not be audible within any habitable room in any residential property between the hours of 12.00 midnight and 7.00am. 5. The L_{10} noise level emitted from the use must not exceed the background noise level (L_{90}) in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) by more than 3dB when assessed indoors at any affected commercial premises.	Retained as this condition forms the basis of the cumulative entertainment noise requirements imposed on the site. Renamed to avoid confusion regarding applicable areas.
	F5B NOISE (OTHER OPERATIONAL NOISE) **Noise associated with uses other than that defined in condition F5A must not give rise to:** **A sound pressure level ($L_{Aeq,15minute}$) at any affected receiver outside the boundary that exceeds the RBL noise level by more than 5dB(A) when considered cumulatively with noise emitted by mechanical plant and equipment the subject of condition F4. The RBL must be measured in the absence of noise emitted from the site in accordance with the NSW EPA Noise Policy for Industry and Australian Standard AS 1055.**	New condition proposed to ensure all noise sources on the site are captured in the conditions.
F6 ACOUSTIC REVIEW Within 3 months of operation of the approval of MP08_0098 MOD 14, and within 3 months of the issue of an Occupation Certificate for the areas nominated below whichever is the sooner, acoustic review demonstrating compliance with the above conditions is	F6 ACOUSTIC REVIEW Within 3 months of operation of the approval of MP08_0098 ~~MOD 14~~**MOD 13**, and within 3 months of the issue of an Occupation Certificate for the areas nominated below whichever is the sooner, acoustic review demonstrating compliance with the above	Retained with new outdoor areas included.

to be submitted to the Department. The reviews are to include specific noise monitoring and testing at relevant times and in accordance with the Star's Noise Management Plan. Areas nominated are: ◆ Level 3 Unenclosed gaming area on Pyrmont St side; ◆ Level 3 Unenclosed gaming area and Level 1 Unenclosed gaming area on Pirrama Road side; ◆ Level 3 Pre-function space on Pyrmont St side; ◆ Level 3 Sovereign Room Outdoor Terrace; ◆ Level 1 Pirrama Road Outdoor Gaming Area; ◆ Level 3 Pirrama Road Entertainment Deck; and ◆ Level 2 Oasis Outdoor Gaming Area.	conditions is to be submitted to the Department. The reviews are to include specific noise monitoring and testing at relevant times and in accordance with the Star's Noise Management Plan. Areas nominated are: ◆ Level 3 Unenclosed gaming area on Pyrmont St side; ◆ Level 3 Unenclosed gaming area and Level 1 Unenclosed gaming area on Pirrama Road side; ◆ Level 3 Pre-function space on Pyrmont St side; ◆ Level 3 Sovereign Room Outdoor Terrace; ◆ Level 1 Pirrama Road Outdoor Gaming Area; ◆ ~~Level 3 Pirrama Road Entertainment Deck;~~ ~~and~~ ◆ Level 2 Oasis Outdoor Gaming Area. ◆ **Level 5 Terrace** ◆ **Level 7 Pool deck, and** ◆ **External F&B locations (Union Street , Pirrama Road and Jones Bay Road)**

APPENDIX B

NOISE MODELLING INPUTS

Noise modelling inputs were established during a series of attended noise measurements at The Star. The following table provides a summary of the noise sources and sound power levels for existing noise sources.

TABLE B-1 THE STAR EXISTING NOISE SOURCES

Name	Map ID	Location	Activity	Noise Source Type	Sound Power Level $L_{eq(15\ minute)}$ dBA	Notes	Reference
Astral Residence roof plant louvres facing Pyrmont St	Ex-1	Astral Residence	Mechanical plant	Area	68	Attended Measurements	WSP noise measurements 28/07/16
Astral Residence small louvre above door	Ex-2	Astral Residence	Mechanical plant	Point	65	Attended Measurements	WSP noise measurements 28/07/16
Astral Hotel Patron Lounge	Ex-3	Astral Hotel	Patrons outside	Area	85	Noise level from WSP assessment report ACG1521300	WSP Assessment report ACG1521300
Astral Hotel plantroom	Ex-4	Astral Hotel	Mechanical plant	Area	71	Attended Measurements	WSP noise measurements 28/07/16
Astral Residence podium plantroom	Ex-5	Astral Residence	Mechanical plant	Area	81	Attended Measurements	WSP noise measurements 28/07/16
Astral Residence roof fan 01	Ex-6	Astral Residence	Mechanical plant	Point	81	Attended Measurements	WSP noise measurements 28/07/16
Astral Residence roof fan 02	Ex-7	Astral Residence	Mechanical plant	Point	81	Unable to access to measure. Assumed to be similar to units on roof.	WSP noise measurements 28/07/16
Darling Tower plantroom near Edward St	Ex-8	Darling Tower	Mechanical plant	Point	57	Unable to access to measure. Assumed to be similar units to the ones that were measured on the same roof.	WSP noise measurements 28/07/16
Darling Tower plantroom near Pyrmont St	Ex-9	Darling Tower	Mechanical plant	Area	57	Unable to access to measure. Assumed similar to emissions from the Lyric Theatre plantroom	WSP noise measurements 28/07/16
Darling Tower roof plantroom 01	Ex-10	Darling Tower	Mechanical plant	Area	88	Could not measure externally. Assume louvres give no benefit (not acoustic louvres).	WSP noise measurements 28/07/16
Darling Tower roof plantroom 02	Ex-11	Darling Tower	Mechanical plant	Area	86	Could not measure externally. Assumes louvres give no benefit (not acoustic louvres).	WSP noise measurements 28/07/16
Darling Tower roof plantroom 03	Ex-12	Darling Tower	Mechanical plant	Area	91	Could not measure externally. Assumes louvres give no benefit (not acoustic louvres).	WSP noise measurements 28/07/16
Level 3 pool deck patrons	Ex-13	Level 3 Pool Deck	Patrons outside	Area	82	Use assumptions consistent with levels for male raised voice in ANSI 3-5-1997.	ANSI 3-5-1997
Level 3 pool deck loudspeaker 01	Ex-14	Level 3 Pool Deck	Amplified music	Point	105	Assumed similar to Sky Terrace speaker data.	WSP noise measurements 13/07/16

						Assumed 4 on pool deck.	
Level 3 pool deck loudspeaker 02	Ex-15	Level 3 Pool Deck	Amplified music	Point	105	Assumed similar to Sky Terrace speaker data. Assumed 4 on pool deck.	WSP noise measurements 13/07/16
Level 3 pool deck loudspeaker 03	Ex-16	Level 3 Pool Deck	Amplified music	Point	105	Assumed similar to Sky Terrace speaker data. Assumed 4 on pool deck.	WSP noise measurements 13/07/16
Level 3 pool deck loudspeaker 04	Ex-17	Level 3 Pool Deck	Amplified music	Point	105	Assumed similar to Sky Terrace speaker data. Assumed 4 on pool deck.	WSP noise measurements 13/07/16
Lyric Theatre exhaust	Ex-18	Lyric Theatre	Mechanical plant	Point	86	Attended Measurements	WSP noise measurements 28/07/16
Lyric Theatre louvres	Ex-19	Lyric Theatre	Mechanical plant	Area	57	Attended Measurements	WSP noise measurements 28/07/16
Lyric Theatre roof louvre	Ex-20	Lyric Theatre	Mechanical plant	Area	57	Unable to access or measure. Assumed similar to other Lyric Theatre plant.	WSP noise measurements 28/07/16
Lyric Theatre roof louvre	Ex-21	Lyric Theatre	Mechanical plant	Area	57	Unable to access or measure. Assumed similar to other Lyric Theatre plant.	WSP noise measurements 28/07/16
Lyric Theatre round enclosure	Ex-22	Lyric Theatre	Mechanical plant	Point	74	Attended Measurements.	WSP noise measurements 28/07/16
MUEF Plantroom facing JBR	Ex-23	MUEF	Mechanical plant	Area	60	Attended Measurements	WSP noise measurements 28/07/16
Pirrama Rd Level 1 UGA, segment 001	Ex-24	UGA, Pirrama Rd	Patrons in unenclosed gaming area	Area	79	Attended measurements	WSP noise measurements 29/07/16
Pirrama Rd Level 1 UGA, segment 002	Ex-25	UGA, Pirrama Rd	Patrons in unenclosed gaming area	Area	77	Attended measurements	WSP noise measurements 29/07/16
Pirrama Rd Level 1 UGA, segment 003	Ex-26	UGA, Pirrama Rd	Patrons in unenclosed gaming area	Area	79	Attended measurements	WSP noise measurements 29/07/16
Pirrama Rd Level 1 UGA, segment 004	Ex-27	UGA, Pirrama Rd	Patrons in unenclosed gaming area	Area	77	Attended measurements	WSP noise measurements 29/07/16
Pirrama Rd Level 1 UGA, segment 005	Ex-28	UGA, Pirrama Rd	Patrons in unenclosed gaming area	Area	79	Attended measurements	WSP noise measurements 29/07/16
Pirrama Rd Level 1 UGA, segment 006	Ex-29	UGA, Pirrama Rd	Patrons in unenclosed gaming area	Area	80	Attended measurements	WSP noise measurements 29/07/16

Porte Cochere entry	Ex-30	Jones Bay Road	Vehicles idling inside Porte Cochere	Area	74	Could not measure due to extraneous noise. Calculated break-out from Porte Cochere based on other measurements of 10 idling cars.	WSP noise measurements 30/08/16
Porte Cochere opening Pyrmont St	Ex-31	Pyrmont St	Vehicles idling inside Porte Cochere	Area	80	Could not measure due to extraneous noise Calculated break-out from Porte Cochere based other measurements of 10 idling cars.	WSP noise measurements 30/08/16
Pyrmont St fountains	Ex-32	Pyrmont St	Fountains operating	Area	71	Attended Measurements	WSP noise measurements 22/08/16

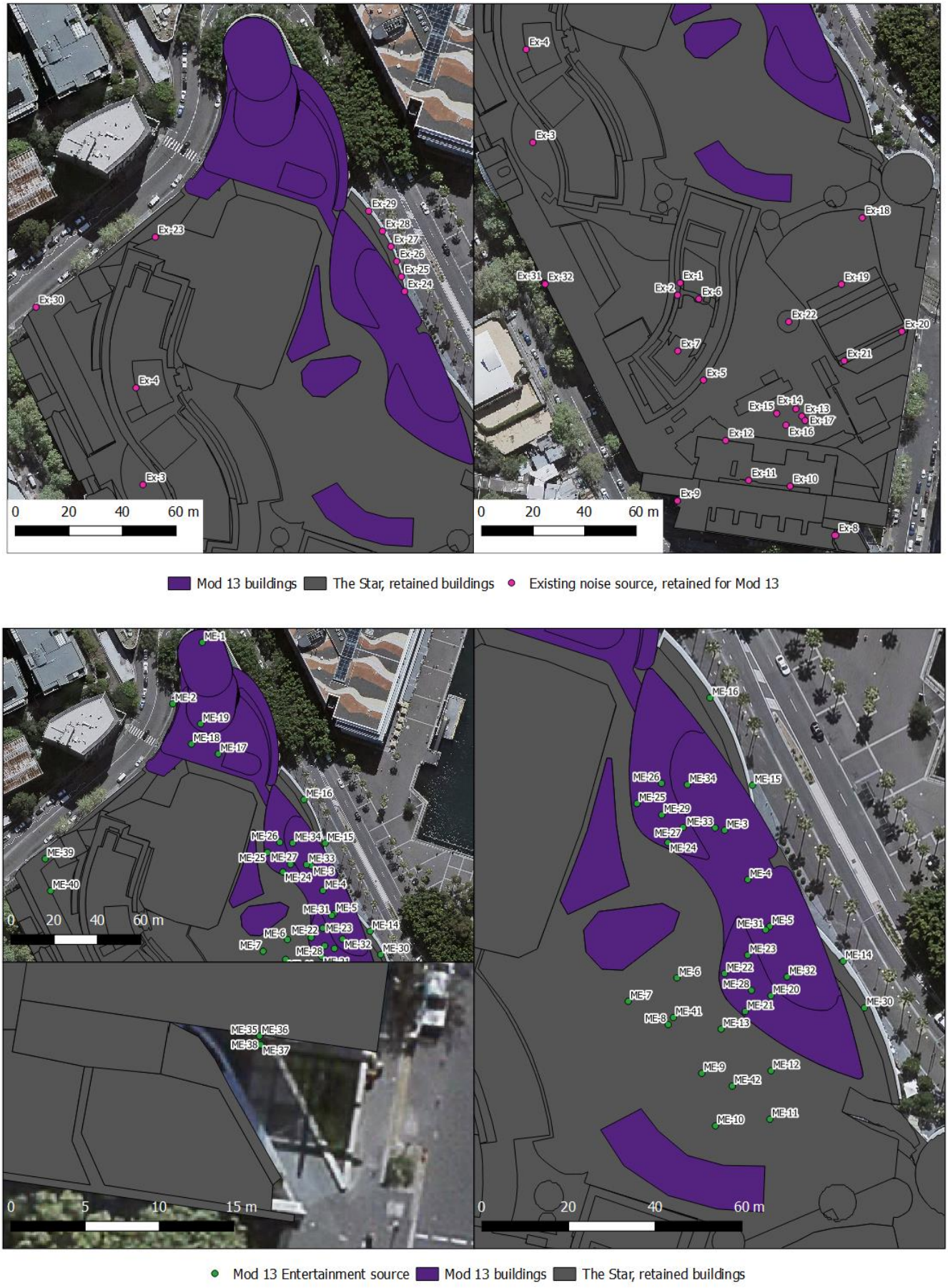


FIGURE B-2 – PROPOSED MOD 13 ENTERTAINMENT NOISE SOURCE LOCATIONS

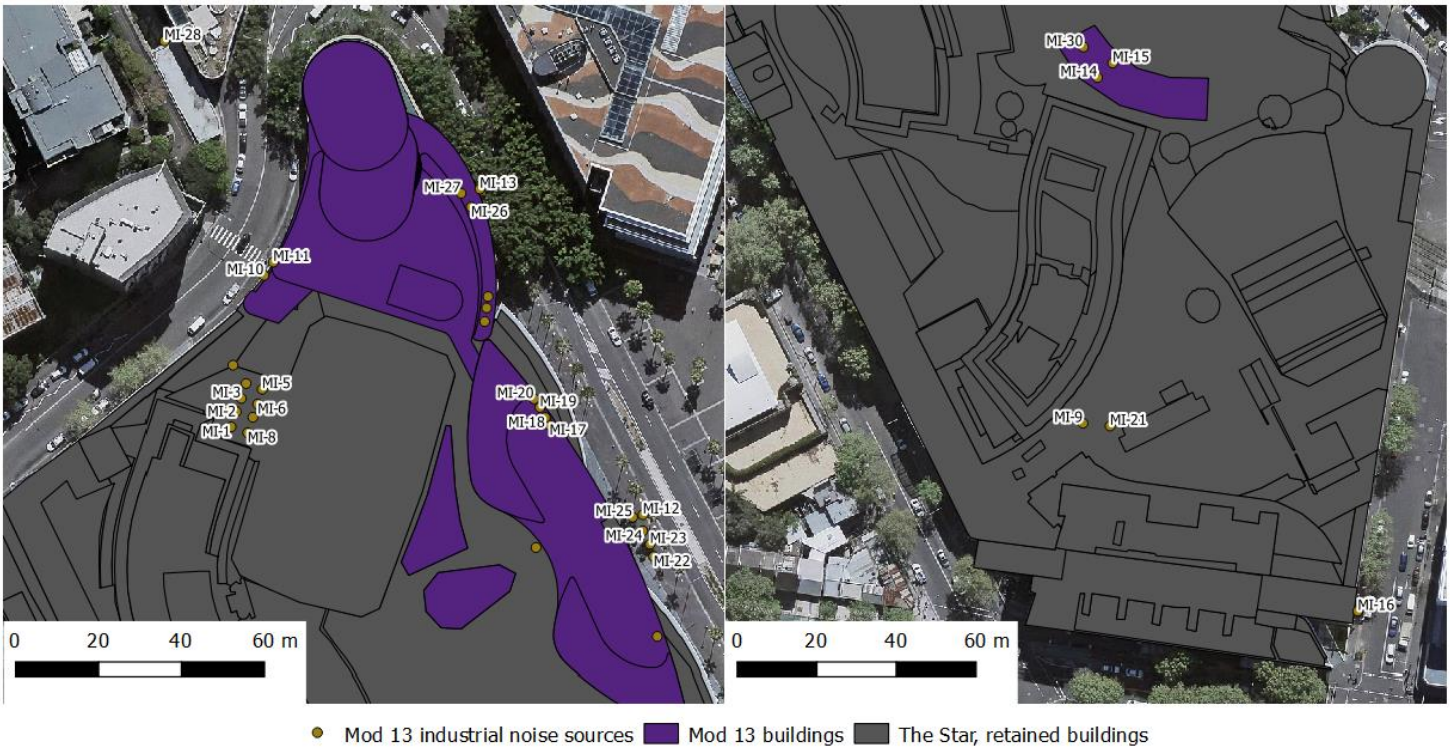


FIGURE B-3 – PROPOSED MOD 13 MECHANICAL AND OPERATIONAL NOISE SOURCE LOCATIONS

TABLE B-2 – MECHANICAL PLANT AND EQUIPMENT, AND OPERATIONAL NOISE SOURCES

Source ID	Description	Source ID	Description	Source ID	Description	Source ID	Description
MI-1	345 cooling tower 1	**MI-10**	Capstone exhaust tower, Jones Bay Road 1	**MI-19**	Kitchen exhaust Level 7evel 7 04	**MI-28**	Service road opening
MI-2	345 cooling tower 2	**MI-11**	Capstone exhaust tower, Jones Bay Road 2	**MI-20**	Kitchen exhaust Level 7 05	**MI-29**	Taxis departing site
MI-3	345 cooling tower 3	**MI-12**	Cars through Ritz Carlton porte cochere	**MI-21**	Level 3 Capstone Plantroom opening	**MI-30**	Toilet exhaust 01
MI-4	345 cooling tower 4	**MI-13**	Cars through Ritz Carlton porte cochere	**MI-22**	Pirrama Rd Taxi 01	**MI-31**	Diesel Generator Exhaust Stack
MI-5	345 cooling tower 5	**MI-14**	Kitchen exhaust 01	**MI-23**	Pirrama Rd Taxi 02	**MI-32**	Kitchen exhaust Level 7 01
MI-6	345 cooling tower 6	**MI-15**	Kitchen exhaust 02	**MI-24**	Pirrama Rd Taxi 03	**MI-33**	Kitchen exhaust RC 01
MI-7	345 cooling tower 7	**MI-16**	Kitchen exhaust Union F&B 01	**MI-25**	Pirrama Rd Taxi 04	**MI-34**	Opening to Transport Hub facing Pirrama Rd
MI-8	345 cooling tower 8	**MI-17**	Kitchen exhaust Level 7 02	**MI-26**	Ritz Carlton taxi 01	**MI-35**	Kitchen exhaust RC 02
MI-9	Capstone exhaust tower	**MI-18**	Kitchen exhaust Level 7 03	**MI-27**	Ritz Carlton taxi 02	**MI-36**	Kitchen exhaust RC 03

TABLE B-2 – LICENSED PREMISES SOURCES

Source ID	Description	Source ID	Description	Source ID	Description	Source ID	Description
ME-1	Community balcony	**ME-12**	L5 outdoor loudspeaker 7	**ME-23**	Level 07 bar loudspeaker 04	**ME-34**	Level 07 pool patrons 04
ME-2	JBR restaurants	**ME-13**	L5 outdoor loudspeaker 8	**ME-24**	Level 07 bar loudspeaker 05	**ME-35**	Union St F&B breakout lower
ME-3	L5 indoor event patrons 01	**ME-14**	Level B2 Pirrama Restaurant 1	**ME-25**	Level 07 bar loudspeaker 06	**ME-36**	Union St F&B breakout upper
ME-4	L5 indoor event patrons 02	**ME-15**	Level B2 Pirrama Restaurant 2	**ME-26**	Level 07 bar loudspeaker 07	**ME-37**	Union St F&B terrace lower patrons
ME-5	L5 indoor event patrons 03	**ME-16**	Pirrama Rd Level 00 F&B breakout	**ME-27**	Level 07 bar loudspeaker 08	**ME-38**	Union St F&B terrace upper patrons
ME-6	L5 outdoor loudspeaker 1	**ME-17**	Residential tower communal patrons 01	**ME-28**	Level 07 bar patrons 01	**ME-39**	Jones Bay Rd Pre-function space, facing NW
ME-7	L5 outdoor loudspeaker 2	**ME-18**	Residential tower pool patrons 01	**ME-29**	Level 07 bar patrons 02	**ME-40**	Jones Bay Rd Pre-function facing SW
ME-8	L5 outdoor loudspeaker 3	**ME-19**	Residential tower pool patrons 02	**ME-30**	Ribbon lvl3 smoking balcony	**ME-41**	L5 outdoor event terrace patrons 01
ME-9	L5 outdoor loudspeaker 4	**ME-20**	Level 07 bar loudspeaker 01	**ME-31**	Level 07 pool patrons 01	**ME-42**	L5 outdoor event terrace patrons 02
ME-10	L5 outdoor loudspeaker 5	**ME-21**	Level 07 loudspeaker 02	**ME-32**	Level 07 pool patrons 02		
ME-11	L5 outdoor loudspeaker 6	**ME-22**	Level 07 bar loudspeaker 03	**ME-33**	Level 07 pool patrons 03		

APPENDIX C

NOISE MONITORING RESULT TABLES

TABLE C-1 – RESULTS FOR LOCATION BG1

Date	Assessment Background Level, L_{90}			Ambient Noise Level, $L_{eq(period)}$		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Thursday, 10 December 2015		54	54		62	61
Friday 11 December 2015	55	56	50	63	62	60
Saturday, 12 December 2015	52	56	52	61	66	61
Sunday, 13 December 2015	52	53	51	61	61	60
Monday, 14 December 2015	55	52	49	63	60	59
Tuesday, 15 December 2015	55	53	49	65	61	58
Wednesday, 16 December 2015	56	54	49	67	61	60
Thursday, 17 December 2015	56		50	63		60
Min	52	52	49	61	60	59
Max	56	56	54	67	66	61
Average				64	62	60
Median	55	54	50			
	RBL(Rating Background Level)			Ambient Noise Level, $L_{eq(period)}$		
Measured Noise Level, dBA	55	54	50	63	61	60

TABLE C-2 – RESULTS FOR LOCATION BG2

Date	Assessment Background Level, L_{90}			Ambient Noise Level, $L_{eq(period)}$		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Friday, 22 July 2016	55	53	52	65	63	63
Saturday, 23 July 2016	54	55	53	63	62	63
Sunday, 24 July 2016	53	52	51	61	61	59
Monday, 25 July 2016	55	52	51	64	62	59
Tuesday, 26 July 2016	55	52	50	65	62	60
Wednesday, 27 July 2016	55	52	51	65	62	59
Thursday, 28 July 2016	54	54	52	66	63	60
Friday, 29 July 2016	54	54	52	64	63	61
Saturday, 30 July 2016	53	54	53	63	66	62
Sunday, 31 July 2016	52	52	50	62	61	59
Min	52	52	50	61	61	59
Max	55	55	53	66	66	63
Average				64	63	60
Median	54	53	51			
	RBL (Rating Background Level)			Ambient Noise Level, $L_{eq(period)}$		
Measured Noise Level dBA	54	53	51	64	63	60

TABLE C-3 – RESULTS FOR LOCATION BG3

Date	Assessment Background Level, L_{90}			Ambient Noise Level, $L_{eq(period)}$		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Monday, 25 July 2016	51	46	44	62	60	56
Tuesday, 26 July 2016	51	48	44	65	61	56
Wednesday, 27 July 2016	51	50	44	63	61	57
Thursday, 28 July 2016	50	51	45	65	61	57
Friday, 29 July 2016	50	50	45	64	62	59
Saturday, 30 July 2016	49	49	47	61	61	59
Sunday, 31 July 2016	48	47	44	61	60	56
Monday, 1 August 2016	49	48	44	63	61	57
Min	48	46	44	61	60	56
Max	51	51	47	65	62	59
Average				63	61	57
Median	50	49	45			
	RBL (Rating Background Level)			Ambient Noise Level, $L_{eq(period)}$		
Measured Noise Level dBA	50	49	45	63	61	57

TABLE C-4 – RESULTS FOR LOCATION BG4

Date	Assessment Background Level, L_{90}			Ambient Noise Level, $L_{eq(period)}$		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Friday, 22 July 2016	51	47	44	59	55	54
Saturday, 23 July 2016	49	47	44	58	55	52
Sunday, 24 July 2016	47	46	44	56	54	50
Monday, 25 July 2016	49	45	43	61	55	51
Tuesday, 26 July 2016	49	46	43	57	55	51
Wednesday, 27 July 2016	50	47	44	58	56	51
Thursday, 28 July 2016	49	47	44	58	55	51
Friday, 29 July 2016	49	48	45	57	56	51
Saturday, 30 July 2016	48	47	44	56	55	51
Sunday, 31 July 2016	46	46	44	55	54	50
Min	46	45	43	55	54	50
Max	51	48	45	61	56	54
Average				58	55	51
Median	49	47	44			
	RBL (Rating Background Level)			Ambient Noise Level, $L_{eq(period)}$		
Measured Noise Level dBA	49	47	44	58	55	51

TABLE C-5 – RESULTS FOR LOCATION BG5

Date	Assessment Background Level, L_{90}			Ambient Noise Level, $L_{eq(15min)}$		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Friday, 22 July 2016	52	54	51	64	65	62
Saturday, 23 July 2016	57	55	51	66	65	63
Sunday, 24 July 2016	57	55	51	69	65	66
Monday, 25 July 2016	56	56	52	67	65	64
Tuesday, 26 July 2016	57	56	54	66	68	65
Wednesday, 27 July 2016	55	56	54	64	69	66
Thursday, 28 July 2016	54	55	52	65	64	63
Friday, 29 July 2016	56	55	51	67	64	63
Min	52	54	51	64	64	62
Max	57	56	54	69	69	66
Average				66	66	64
Median	56	55	52			
	RBL (Rating Background Level)			Ambient Noise Level, $L_{eq(period)}$		
Measured Noise Level dBA	56	55	52	66	66	64

TABLE C-6 – RESULTS FOR LOCATION BG6

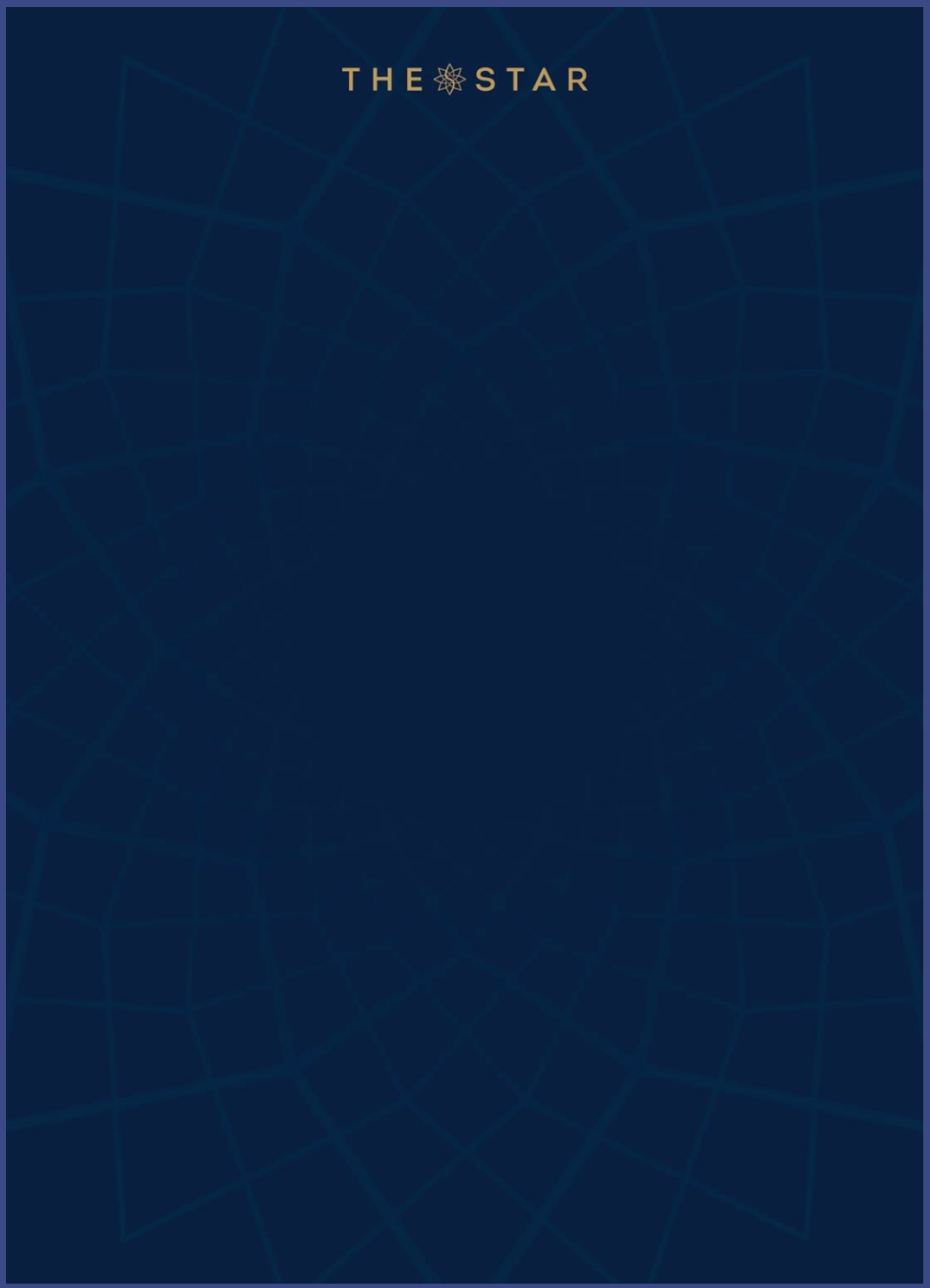
Date	Assessment Background Level, L_{90}			Ambient Noise Level, $L_{eq(15min)}$		
	Day	Evening	Night	Day	Evening	Night
	7am-6pm	6pm-10pm	10pm-7am	7am-6pm	6pm-10pm	10pm-7am
Friday, 22 July 2016	54	53	51	62	59	62
Saturday, 23 July 2016	53	54	51	62	61	62
Sunday, 24 July 2016	52	52	48	61	62	59
Monday, 25 July 2016	54	52	49	61	61	60
Tuesday, 26 July 2016	54	53	49	62	61	61
Wednesday, 27 July 2016	54	53	48	62	62	61
Thursday, 28 July 2016	54	53	49	62	61	59
Friday, 29 July 2016	54	54	51	62	62	60
Saturday, 30 July 2016	53	54	51	61	62	61
Sunday, 31 July 2016	51	52	49	60	60	63
Monday, 1 August 2016	53			61		
Min	51	52	48	60	59	59
Max	54	54	51	62	62	63
Average				61	61	61
Median	54	53	49			
	RBL (Rating Background Level)			Ambient Noise Level, $L_{eq(period)}$		
Measured Noise Level dBA	54	53	49	61	61	61

TABLE C-7 – MEASURED VIBRATION LEVELS, LIGHT RAIL ARRIVALS

ID	Track	Measured rms velocity levels, dB rel 1x10^{-9} m/s at 1/1 Octave bands, Hz										
		1 Hz	2 Hz	4 Hz	8 Hz	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz
1	U1	73.2	67.5	61.9	64.7	68.5	64.4	69.1	65.0	55.9	51.1	40.0
2	D1	74.3	65.9	59.5	60.4	65.4	61.6	56.2	52.4	49.0	42.0	32.1
3	D1	74.7	66.7	59.7	59.2	63.4	62.0	55.7	53.1	51.0	46.3	36.1
4	U1	73.9	67.8	61.3	62.3	70.2	66.8	71.7	68.3	59.1	51.2	39.8
5	U1	73.7	67.3	60.0	65.3	72.8	71.2	73.2	68.1	59.5	56.0	46.9
6	D1	73.3	67.6	61.0	60.2	68.2	62.1	58.5	57.9	52.9	51.1	39.2
7	U1	74.8	65.8	62.2	69.2	78.7	72.3	77.0	67.7	58.8	52.5	43.5
8	D1	73.2	67.8	60.7	58.8	66.5	62.3	56.9	51.3	50.4	44.6	36.3
9	D1	76.0	68.1	60.8	59.8	64.1	59.6	57.6	51.3	49.1	42.8	33.5
10	U1	74.6	66.9	61.4	64.5	70.2	65.1	66.7	67.7	57.3	49.3	38.7
11	D1	72.6	68.1	61.0	57.8	62.7	59.2	57.0	50.1	48.1	42.5	32.7

TABLE C-8 – MEASURED VIBRATION LEVELS, LIGHT RAIL DEPARTURES

ID	Track	Measured rms velocity levels, dB rel 1x10^{-9} m/s at 1/1 Octave bands, Hz										
		1 Hz	2 Hz	4 Hz	8 Hz	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz
1	U1	75.3	67.0	61.4	60.1	63.7	61.0	57.0	53.9	52.3	45.9	40.2
2	D1	73.8	67.9	61.6	64.2	71.5	63.3	66.7	63.6	57.6	49.7	38.8
3	D1	74.0	67.8	60.8	65.8	73.0	64.9	66.6	66.6	57.5	52.7	41.0
4	U1	74.5	67.4	61.6	59.2	66.4	59.7	57.6	59.7	60.0	56.8	48.2
5	U1	75.3	66.9	60.7	58.7	66.6	63.3	55.6	52.2	50.5	47.8	39.0
6	D1	72.1	68.9	61.0	62.1	71.3	63.6	68.4	65.4	58.2	50.9	38.0
7	U1	73.8	69.5	60.0	60.1	64.1	59.0	57.3	48.7	48.3	45.9	32.7
8	D1	74.1	66.4	60.1	63.3	73.5	63.3	68.7	65.6	57.3	50.5	38.5
9	D1	74.6	68.2	62.1	62.7	71.7	65.5	72.7	61.1	59.3	57.7	40.3
10	U1	73.2	68.0	62.0	58.9	66.9	59.5	58.1	52.4	51.2	44.6	33.5
11	D1	70.3	68.5	61.5	62.7	72.2	68.9	67.1	65.4	58.3	54.2	39.6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