

Modification 14 Planning Submission Engineering Advice

NOISE IMPACT ASSESSMENT

SEPTEMBER 2016

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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 its licence obligation to operate the site to an international standard, SEGL is proposing to advance a revitalisation of the existing complex.

SEGL 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 13 and Modification 14. All works pertaining to Modification 14 are detailed and addressed in this report in terms of acoustic assessment. Modification 13 will be detailed at a future time.

SEGL 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 in order 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 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.

1 MODIFICATION 14 PROPOSED WORKS

Modification 14 seeks approval for the following proposed works:

1. **Level B4 Infrastructure Upgrades** - Upgrades to existing generators, existing harbour heat rejection system, natural gas system, existing domestic cold water system and an additional sewer connection.
2. **Level 00 – Porte Cochere and Astral Lobby Upgrade** - Realignment of Porte Cochere to accommodate expanded and upgraded Astral Lobby, upgraded Astral Lobby Bar and retail expansion and upgrades of the Main Casino Entry, including valet improvements to the Porte Cochere.
3. **Level 00 Back of House Upgrades** - Internal upgrades and improvements to multiple aspects of the back of house space at Level 00.
4. **Level 00 Astral Luxury Retail Zone** - New luxury retail zone connecting from Astral Hotel Lobby out to Jones Bay Road. Change of use from office / back of house to retail.
5. **Level 00 - SELS Fitout** - Refurbish existing SELS Level 00 toilets at southern end of building to allow for adjacent lift lobby circulation areas. Upgrades and tenancy improvements to existing retail tenant at northern end of SELS building along Jones Bay Road. No external changes to SELS are proposed, with internal alterations only.
6. **Level 00 SELS Lighting** - External lighting of the SELS building along Pyrmont Street to celebrate the heritage elements of the building.
7. **Level 00 Darling Café** – New café within the existing Darling Hotel Lobby at Level 00.
8. **Level 00 to 01 - G-Star Raw Escalators** - Replace existing G-Star Raw retail shop at Level 00 with new escalators providing access from Level 00 to Main Gaming Floor at Level 01. Includes new arrival bar adjacent to escalators at Level 01.
9. **Level 01 - Main Gaming Floor Slab Infill** - Slab expansion off the Main gaming Floor at Level 01 over the existing main entry foyer facing Pirrama Road. No facade works are proposed.
10. **Level 02 – Oasis Gaming Area** – Minor external alterations to the Oasis unenclosed gaming area at Level 02.
11. **Level 03 - Sovereign Expansion** – Expansion to the existing Sovereign Room at Level 03. This includes refurbishment of existing food, beverage and gaming locations, expansion of food and beverage opportunities an VIP gaming and unenclosed gaming areas.
12. **Level 03 - Event Centre Pre-function Space** - New pre-function space adjacent to the MUEF at Level 03, to allow for circulation changes from the level 03 expansion.
13. **Vertical Transportation Drum** - New escalators as part of a vertical transport arrival strategy from Level 00 to Level 03.
14. **Level 04 – Star Administrative Offices** - Fitout of existing administrative offices within Astral Residences tower. Internal improvements only.
15. **Level 05 – VIP Lobby & Check-In** - Conversion of existing pool plant space and enclosed pool deck at Level 05 to a lobby for the VIP hotel guest lounge.
16. **Level 05 - Astral Residences Reception** - Conversion of meeting room to Reception and check-in lobby. Includes minor expansion to existing enclosed space.
17. **Northern Porte Cochere Canopy** - Removal of a section of the current glazing (retaining the canopy structure) of the current porte cochere canopy and include a new ceiling at a lower height over a section of the new slab (NW Gaming slab infill).

2 INTRODUCTION

WSP | Parsons Brinckerhoff has been commissioned to provide acoustic consultancy services for proposed alteration and addition to The Star, in Pyrmont, New South Wales.

The purpose of this report is to provide a noise impact assessment in support of Modification 14 to Major Project Approval MP08-0098 by the Department of Planning and Environment for the proposed works at the site as summarised in Chapter 1 and shown on the drawings by DWP Suters. This report also supports the consolidation of the operative planning approvals and conditions applying to the site.

This report reviews the acoustic conditions of Major Project Approval MP08-0098 applicable to The Star operations as well as the acoustic conditions in development consents relating to discrete approvals within The Star, and recommends an optimised collation of conditions for a consistent approach to the acoustic environment.

This noise impact assessment addresses the following acoustic items:

- Seeking permanency of current temporary noise conditions applicable on level 3 event deck and level 1 Unenclosed Gaming Area
- Seeking permanency of current trial periods relating to hours of operations applicable to:
 - Pizza Perta
 - Darling VIP balconies
 - Balla and Black restaurants
 - Oasis Gaming
 - North west gaming
- Noise egress from the operation of the development, including patron and music noise and building services noise
- Construction noise and vibration
- Change of hours of operation to resolve inconsistency between conditions

This noise impact assessment has been conducted based on the architectural submission package for The Star – Modification 14 by DWP Suters Architects.

2.1 Nearby noise sensitive receivers

The Star is surrounded by residential and commercial receivers. The locations of closest surrounding noise sensitive receivers to the changes for Modification 14 are illustrated in Figure 2-1.

Table 2-1 summarises the nearest noise sensitive receivers presenting the addresses, current uses, and proximity to the redevelopment.

Table 2-1 – Nearest noise sensitive receivers

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

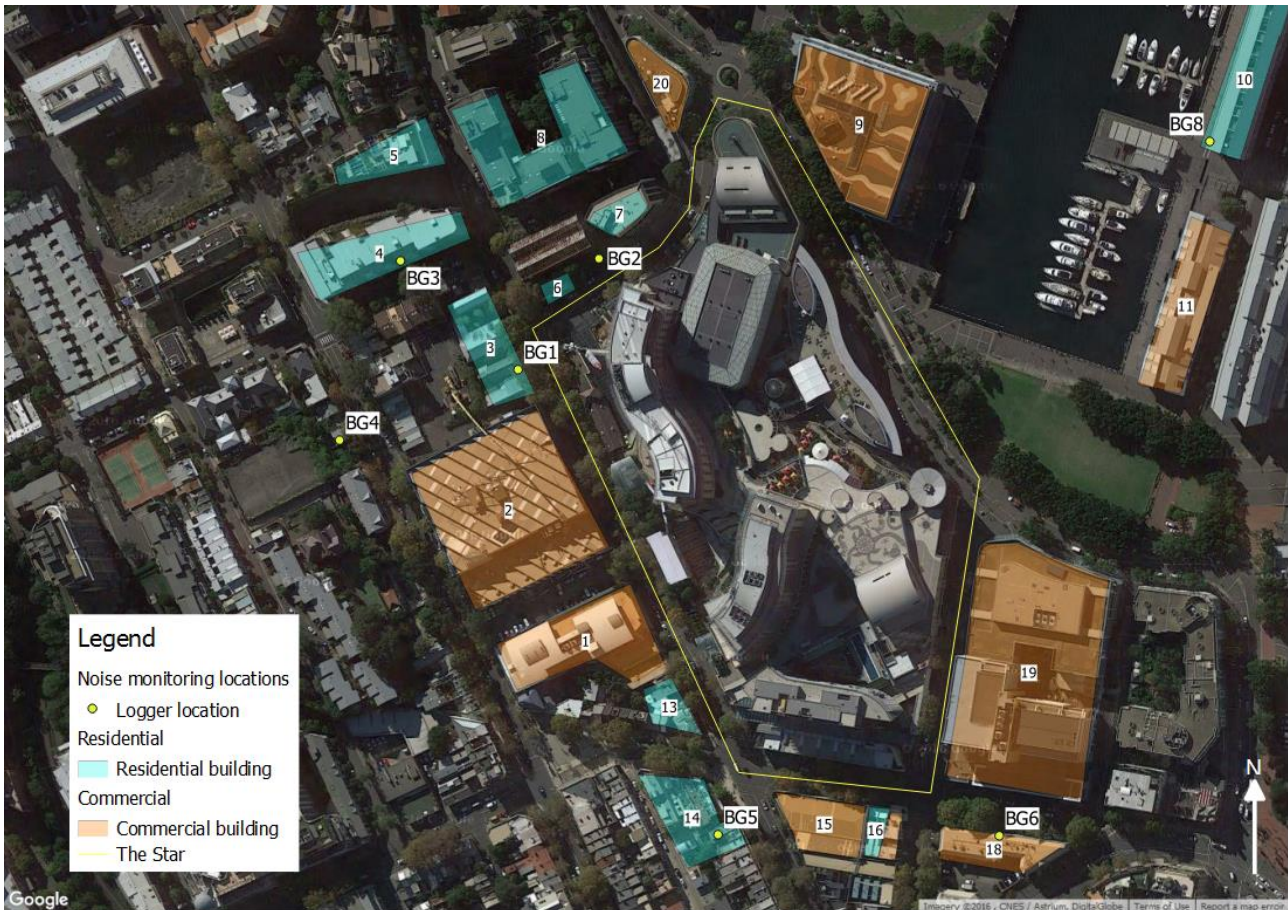


Figure 2-1 – Location map of receivers and monitoring locations

3 EXISTING NOISE ENVIRONMENT

To assess the noise environment at nearest noise sensitive receivers to the proposed works and relevant to the rationalisation of operating hours, noise monitoring was conducted in the proximity of The Star. The collected noise data are considered representative of the current noise environment at nearby noise sensitive receivers.

This section provides a summary of the relevant noise data, including the locations and dates of noise surveys, measured noise levels for the noise surveys.

The noise surveys data are from recent long-term noise logging conducted at locations representative of nearby receivers conducted within two years.

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 majority of locations.

Measurement locations are indicated within Figure 2-1. Details of the noise survey data adopted for this report are presented in Table 3-1. Graphs of the noise monitoring for locations BG2 to BG6 are presented in Appendix C.

Table 3-1 – Noise survey data details

Equipment type	Location ID	Location	Reflection conditions	Manufacturer & Type No.	Serial No.	Start date	Finish date
Unattended monitor	BG1	33-43 Pyrmont Street	Free-field	Svantek 955	28808	10/12/2015	17/12/2015
Unattended monitor	BG2	2 Jones Bay Road	Free-field	Svantek 958	28808	22/07/2016	1/08/2016
Unattended monitor	BG3	88 John St	Facade	Svantek 958	21094	25/07/2016	2/08/2016
Unattended monitor	BG4	67 Harris St	Free-field	Svantek 958	35873	22/07/2016	1/08/2016
Unattended monitor	BG5	103 Pyrmont St	Free-field	Svantek 958	27552	25/07/2016	2/08/2016
Unattended monitor	BG6	37-69 Union St	Free-field	Svantek 958	23294	22/07/2016	1/08/2016
Unattended monitor	BG8	Wharf 9, Pyrmont	Free-field	N/A ²	N/A ²	03/02/2016	04/03/2016
Calibrator	-	-	-	Pulsar 105	64928	-	-

Note 1: Surveys locations are indicated in Figure 2-1.

Note 2: Noise monitoring used from Renzo Tonin and Associates report TG004-13F05 (r2) L1 UGA Report dated 08/05/2014 (see Appendix D). This data is used as it is still considered relevant and access was not possible for WSP | PB to measure in this same location.

The data were gathered over a period of typical traffic movement and activity in the area (i.e. outside of school holiday periods). The monitoring equipment was fitted with windshields and were field calibrated before and after monitoring. No significant drifts in calibration ($\pm 1.0\text{dB}$) were noted.

The monitoring locations were predominately in the free-field (i.e. more than 3.5 metres to any vertical reflecting surface) positions. Where measurements were identified as façade affected at BG3, a -2.5 dBA correction has been applied to convert to an equivalent free-field noise level.

The weather conditions at the time of monitoring were recorded at Sydney Observatory Hill (Bureau of Meteorology station number 66062), which is located approximately eight kilometres north-east of the proposal site.

Periods of inclement weather (wind speeds greater than 5 metres per second and significant rainfall) and extraneous noise that were identified to adversely affect the noise monitoring were excluded from the monitoring data.

3.1 Noise survey summary

A summary of the measured noise levels at the survey locations are presented in Table 3-2. Results have been presented in accordance with NSW Industrial Noise Policy time period classifications.

Table 3-2 – Summary of measured noise levels

Survey location	Ambient noise level, dBA L_{eq} (15 minute)			RBL (Rating Background Level), dBA		
	Day	Evening	Night	Day	Evening	Night
	7am - 6pm	6pm - 10pm	10pm - 7am	7am - 6pm	6pm - 10pm	10pm - 7am
BG1	63	61	60	55	54	50
BG2	64	63	60	54	53	51
BG3	61	58	55	48	47	42
BG4	58	55	51	49	47	44
BG5	66	66	64	56	56	52
BG6	61	61	61	54	53	49
BG8	57	55	52	54	52	48

A summary of the measured background (L_{90}) octave band noise levels for daytime (7am to midnight) and night-time (midnight to 7am) is presented in Table 3-3. This is included in order to allow assessments to be made in accordance with Condition F5 in the Major Approval MP08-0098 for entertainment venues noise conditions.

Table 3-3 – 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	Day	61	59	57	54	51	51	48	40	31
	Night	58	55	54	51	48	47	43	36	25
BG2	Day	62	62	58	54	51	49	47	39	30
	Night	62	62	58	54	51	49	47	39	30

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
BG3	Day	52	55	51	47	44	43	40	31	20
	Night	57	60	56	52	49	48	45	36	25
BG4	Day	55	56	55	47	45	45	41	33	23
	Night	60	61	60	52	50	50	46	38	28
BG5	Day	67	65	58	55	53	52	48	41	31
	Night	65	64	57	54	52	51	47	40	30
BG6	Day	61	59	56	49	49	51	45	39	34
	Night	65	63	60	53	53	55	49	43	38
BG8	Day	57	54	52	51	50	46	40	29	20
	Night	55	52	50	48	44	41	35	27	17

Note 1: 'Day' is defined as 7am to 12am and 'Night' is defined as 12am to 7am, in accordance with Condition F5 in the Major Approval MP08-0098 This differs from the time periods in accordance with the NSW Industrial Noise Policy presented in Table 3-2.

4 CRITERIA

WSP | Parsons Brinckerhoff has undertaken a review of the acoustic conditions applying to The Star operations under MP08-0098 and the operative provisions of the City of Sydney consents being captured by site wide conditions within MP08-0098. The review is to rationalise and optimise the acoustic conditions, and to demonstrate suitability of operating hours and continued use of speakers and music in nominated locations.

In general, noise criteria applicable to control operational noise emission from the redevelopment are based on previous conditions of consent and from City of Sydney Council approved Development Applications.

The list of MP08-0098 conditions reviewed, comments and recommendations are presented in Appendix A. The list of City of Sydney consent conditions applicable to specific areas of The Star operation which were reviewed are presented in Appendix B.

The approach taken to rationalise and optimise the acoustic conditions are as follows.

- Remove any duplicates of acoustic conditions
- Remove “area specific” conditions and incorporate them into the established “site-wide” conditions – compliance with site-wide cumulative conditions would mean area-specific conditions are also complied with
- Based on the existing MP08-0098 conditions, establish holistic acoustic conditions which assess the noise impacts from each of the following three aspects:
 - Overall mechanical noise emission
 - Overall patron and music noise emission
 - Overall construction noise and vibration

4.1 Summary of site-wide acoustic conditions

Table 4-1 presents the proposed site wide acoustic conditions, based upon the conditions in Major Project Approval MP08-0098

Table 4-1 - Proposed site wide acoustic conditions

Conditions	Details	Comments
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 anyone 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 (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 premises. The	Matches Major Project Approval MP08-0098 Condition E1 with only amendment being removal of 'inaudibility' clause. See Section 4.2.1 for further details.

	source noise level must be assessed as a LAeq, 15 minute.	
F5 Noise (Patron and music)	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. 2. The L10 noise level emitted from the use must not exceed 5dB above the background (L90) 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 L10 noise level emitted from the use must not exceed the background (L90) 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. The L10 noise level emitted from the use must not exceed the background noise level (L90) in any Octave Band Centre Frequency (31.5 Hz to 8kHz inclusive) by more than 3dB when assessed indoors at any affected commercial premises.	Matches Major Project Approval MP08-0098 Condition F5 with only amendment being removal of 'inaudibility' clause. See Section 4.2.2 for further details.
<u>D11 Construction Hours of Work</u>	The hours of construction, including the delivery of materials to and from the site, shall be restricted as follows: 1. between 7:00 am and 5.30 pm, Mondays to Fridays inclusive; 2. between 8:00 am and 3.00 pm, Saturdays; 3. between 9:00 am and 3.30 pm, Mondays to Fridays for mechanical rock blasting; 4. no work on Sundays and public holidays. Works may be undertaken outside these hours where: 1. the delivery of materials is required outside these hours by the Police or other authorities; 2. it is required in an emergency to avoid the loss of life, damage to property and/or to prevent environmental harm; and 3. residents likely to be affected by the works are notified of the timing and duration of	Matches Major Project Approval MP08-0098 Condition D11 with additional clauses to reference relevant NSW construction noise guidance. See Section 4.3.1-4.3.3 for further details.

- these works at least 48 hours prior to the commencement of the works; and
4. the work is approved by the Director-General or his nominee.

All works internal to the existing building, including building/demolition and excavation work, in connection with the proposed development can be carried out on a 24 hour basis, 7 days per week, with safety inspections being permitted at 7.00am on work days.

Quantitative construction noise management levels in accordance with Interim Construction Noise Guidelines (ICNG) must be established and comply with.

4.2 Summary of established criteria

This section presents summaries of the established numerical criteria based on the conditions presents in Section 4.1 and noise survey data presented in Section 3.1.

4.2.1 Condition E1 Noise Control – Plant and Machinery

A summary of the established noise criteria in accordance with Condition E1 of the Major Project Approval MP08-0098 are presented in Table 4-2 apply to the overall environmental noise emissions from all mechanical plant associated with The Star operation. Plant and machinery noise emission criteria are applicable at the nearest residence to the proposed development site.

Condition E1 also includes an “inaudibility” clause which states 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. However, as inaudibility is a subjective quality and unmeasurable, it will not be possible to demonstrate compliance. Compliance with the quantitative criteria encapsulated in Condition E1 is considered to be sufficient to minimise adverse impact at noise sensitive receivers to protect the amenity of the receivers. Therefore, it is recommended that the “inaudibility” clause be removed from the Condition E1.

Table 4-2 – Summary of plant noise emission criteria in accordance with Condition E1

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
	Night 10pm - 7am	52	57
BG6	Daytime 7am - 6pm	54	59
	Evening 6pm - 10pm	53	58
	Night 10pm - 7am	49	54
BG8	Daytime 7am - 6pm	54	59
	Evening 6pm - 10pm	52	57
	Night 10pm - 7am	48	53

Offensive Noise

In addition to numerical assessment of noise emission, offensive noise assessment is also required in Condition E1 to be undertaken. Offensive noise is defined in the POEO Act as noise:

- a) *that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*
 - i. *is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
 - ii. *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
- b) *that is of a level, nature, character, or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations*

The NSW Noise Guide for Local Government (NGLG) 2010 provides guidance to determine if the noise is offensive, including the following:

- The loudness of the noise, especially compared with other noise in the area;
- The character of the noise;
- The time and duration of the noise;
- Whether the noise is typical for the area;
- How often the noise occurs; and
- The number of people affected by the noise.

4.2.2 Condition F5 – Music and Patron Noise Emission Criteria

Table 4-3 summarises the noise goals applicable at receivers near to the measurement locations related to music and other activities noise emissions from the proposed development.

Condition F5 includes an “inaudibility” clause which states that music and patron noise emission must not be audible within any habitable room in any residential property between the hours of 12.00 midnight and 7.00am. However, as inaudibility is a subjective quality and unmeasurable, it will not be possible to demonstrate compliance. Compliance with the quantitative criteria encapsulated in Condition F5 is

considered to be sufficient to minimise adverse impact at noise sensitive receivers to protect the amenity of the receivers. Therefore, it is recommended that the “inaudibility” clause be removed from the Condition F5.

Table 4-3 – Condition F5 octave band noise criteria for receivers near noise monitoring locations

Representative location	Time period ¹	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	Residential Day	66	64	62	59	56	56	53	45	36
	Residential Night	58	55	54	51	48	47	43	36	25
	Commercial (internal)	64	62	60	57	54	54	51	43	34
BG2	Residential Day	67	67	63	59	56	54	52	44	35
	Residential Night	60	60	55	50	49	46	43	36	26
	Commercial (internal)	65	65	61	57	54	52	50	42	33
BG3	Residential Day	54	60	56	52	49	48	45	36	25
	Residential Night	49	49	47	44	42	40	36	27	16
	Commercial (internal)	52	58	54	50	47	46	43	34	23
BG4	Residential Day	60	61	60	52	50	50	46	38	28
	Residential Night	51	51	48	43	41	39	35	25	13
	Commercial (internal)	58	59	58	50	48	48	44	36	26
BG5	Residential Day	72	70	63	60	58	57	53	46	36
	Residential Night	62	59	56	52	49	48	43	35	25
	Commercial (internal)	70	68	61	58	56	55	51	44	34
BG6	Residential Day	66	64	61	54	54	56	50	44	39
	Residential Night	58	55	52	47	46	45	40	32	22
	Commercial (internal)	64	62	59	52	52	54	48	42	37
BG8	Residential Day	62	59	57	56	55	51	45	34	25
	Residential Night	55	52	50	48	44	41	35	27	17
	Commercial (internal)	60	57	55	54	53	49	43	32	23

Note 1: Day is defined as 7am to 12am and Night is defined as 12am to 7am, in accordance with Condition F5 in the Major Approval MP08-0098. Commercial criteria apply when in use (assumed to be 7am to 12am).

4.3 Construction Noise and Vibration

During construction phase, hours of work for construction and associated activities are specified in Condition D11 of the Major Project Approval MP08-0098.

As excessive noise and vibration caused during construction works may have an adverse impact at nearby receivers, it is recommended that in addition to the hours of work prescribed in D11, quantitative numerical criteria is also established. Numerical criteria have been established in accordance with the Department of Environment and Climate Change *‘Interim Construction Noise Guideline:2009’* (ICNG).

The current Condition D11 and explanation for proposed amendments to the condition are presented in sections 4.3.1 to 4.3.3. The proposed revised wording of Condition D11 incorporating hours of work and management of construction noise and vibration is presented in Appendix A.

4.3.1 Condition D11

D11 Hours of Work

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

1. *between 7:00 am and 5.30 pm, Mondays to Fridays inclusive;*
2. *between 8:00 am and 3.00 pm, Saturdays;*
3. *between 9:00 am and 3.30 pm, Mondays to Fridays for mechanical rock blasting;*
4. *no work on Sundays and public holidays.*

Works may be undertaken outside these hours where:

1. *the delivery of materials is required outside these hours by the Police or other authorities;*
2. *it is required in an emergency to avoid the loss of life, damage to property and/or to prevent environmental harm; and*
3. *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*
4. *the work is approved by the Director-General or his nominee.*

The hours of works for construction specified in Condition D11 are mainly to control construction noise from adversely impacting nearby sensitive receivers. However, WSP | Parsons Brinckerhoff recommends the following additional condition regarding internal construction works to be incorporated into the approval.

All works internal to the existing building, including building/demolition and excavation work, in connection with the proposed development can be carried out on a 24 hour basis, 7 days per week, with safety inspections being permitted at 7.00am on work days.

As The Star operates on a 24 hour basis, internal works would predominantly be low impact and contained within the buildings, it is expected that no adverse impact on nearby residents will result due to these internal construction works. It is therefore recommended that internal works be allowed to occur 24 hours a day.

4.3.2 Interim Construction Noise Guidelines

It is recommended that quantitative numerical criteria based on the ICNG to assess construction noise and vibration be included in Condition D11. Conditions referring to the ICNG have previously been imposed by the City of Sydney Council in conditions of consents for construction of specific areas within The Star.

Table 4-4 presents the noise management levels associated with construction noise works. This is aimed to represent the level above which there may be some community reaction to construction noise.

The Rated Background Level (RBL), taken from the INP shown in Table 3-2, is used to determine the Noise Management Level (NML) for construction. As a guide the difference between the internal noise level and the external noise level is typically 10 dB with windows open for adequate ventilation.

Table 4-4 - 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 Highly noise affected 75 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15\text{minute})}$ 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. 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.

Table 4-5 presents the established construction noise management levels at the nearest residential receivers.

Table 4-5 – 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
BG8	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.

4.3.3 Ground-borne Vibration and Noise

Ground-borne noise at residences is the only relevant vibration criteria in the ICNG for the proposed works as there will be no blasting onsite. 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. During these times it is expected that no vibration generating activities will be undertaken and therefore no ground-borne noise created. Table 4-6 presents the ground-borne noise limits at nearby residential receivers.

Table 4-6 – 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

4.4 Road Noise Policy

To assess the effect of proposed Modification 14 changes in terms of the increase of traffic on the nearby residences, the NSW Government DECCW document –*NSW Road Noise Policy 2011* (RNP) provides objective criteria. The relevant criteria have been drawn out of the policy and detailed below.

The road policy is used in this assessment to address noise associated with potential traffic increases on surrounding road network. Noise generated by additional traffic on the road is to be assessed against façade corrected noise levels when measured in front of a building façade.

Note: Prevailing noise levels measured on-site are already above these criteria at numerous locations.

Table 4-7 – Extract from RNP Section 2.3.1- Noise assessment criteria - residential land uses

Project type/land use	Assessment criteria dBA	
	Day (7am-10pm)	Night (10pm-7am)
Land use development with potential to create additional traffic on local roads	L_{eq} (1 hour) 55 (external)	L_{eq} (1 hour) 50 (external)
Land use development with potential to create additional traffic on arterial, sub-arterial and collector roads	L_{eq} (15 hour) 60 (external)	L_{eq} (9 hour) 55 (external)

Where existing traffic noise levels are above the noise assessment criteria, the RNP stipulates to protect against excessive decreases in amenity as the result of a project. To control excessive increase in noise level, where road traffic noise increase by more than 2 dBA as a result of a land use development, mitigation should be considered.

In accordance with the RNP, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. Therefore, it is the applicable assessment criterion for receivers which are currently experiencing traffic noise levels greater than the assessment criteria in Table 4-7.

Assessment and discussion on traffic noise is presented in section 7.2.3

5 PIRRAMA ROAD LEVEL 3 ENTERTAINMENT DECK AND LEVEL 1 UNENCLOSED GAMING AREA

There are currently trial conditions applicable to The Star relevant to use of speakers and amplification equipment in specific outdoor areas facing Pirrama Road. The specific areas include:

- (a) Level 3 Pirrama Road Entertainment Deck – Condition F1C, and;
- (b) Level 1 Pirrama Road Outdoor Gaming Areas – Condition F1D.

Of the areas listed above, the area with the most potential to cause adverse noise impact at nearby receivers is the Level 3 Pirrama Road Entertainment Deck.

One of the objectives of Modification 14 is to seek permanency of the trial period conditions F1C and F1D detailed in Appendix A.

For noise emission from the Level 3 Entertainment Deck, a controlled noise emission assessment of the speakers and amplification equipment on the Entertainment Deck was undertaken to demonstrate compliance with the conditions.

For noise emission from the Level 1 Unenclosed Gaming Area, typical operational noise level within the UGA was measured to demonstrate compliance with the conditions.

5.1 Methodology

5.1.1 Level 3 Entertainment Deck

To demonstrate compliance of the sound system noise emission, attended noise measurements were undertaken on the evening of Tuesday 12 July 2016 between 10pm and midnight. The weather conditions during the monitoring period were generally dry with relatively calm winds and did not adversely affect the measurement results.

The representative worst case scenario was replicated by the following.

- Sound system for the assessment was setup as per the typical large events on the Level 3 Entertainment Deck, this includes the actual equipment installed, loudspeakers at the typical locations and oriented towards The Star, away from external receivers.
- Typical music contents were played back as the source. Play back levels were representative of typical event noise levels. The maximum output of the sound system was restricted by the use of system limiter in accordance with the requirement of the Condition F1C. A noise level of 85 dB $L_{Aeq,5mins}$ was measured at approximately at 2m from the speakers.
- In addition to the typical event noise level playback to show compliance, the playback noise level was increased in 5 dB increments for three steps and noise measurements were undertaken. This was to determine the actual maximum playback level before exceeding criteria at the receiver.

Simultaneous attended noise measurements were conducted at the following locations.

- 2 metres in front of a loudspeaker – measured noise levels are used to calculate the sound system level at the receiver location to validate sound system only noise contribution at receiver
- Nearest noise sensitive residential receiver 10 at the BG8 noise logging location (see Figure 2-1) – 15 minute noise measurements at the receiver were assessed against the calculated sound system levels and measured background noise levels to determine the sound system noise contribution compliance at

receiver location. Ambient noise environment at this measurement location is dominated by local traffic noise on Pirrama Road and urban hum.

5.1.2 Level 1 Unenclosed Gaming Area

To demonstrate compliance of the level 1 UGA operational noise emission, attended noise measurements were undertaken on the evening of Friday 29 July 2016 between 9pm and midnight. The weather conditions during the monitoring period were generally dry with relatively calm winds and did not adversely affect the measurement results.

Typical operational noise level within the Level 1 UGA was measured internally at the Pirrama Road façade. Noise from poker machines were main ambient noise with intermittent loud conversations between patrons. The operable façade of the level 1 unenclosed gaming area was fully opened during the measurement period.

Nearest noise sensitive residential receiver 10 at the BG8 noise logging location (see Figure 2-1) – 15 minute noise measurements at the receiver were assessed against the calculated noise emission level and measured background noise levels to determine the level 1 UGA noise contribution compliance at receiver location. Ambient noise environment at this measurement location is dominated by local traffic noise on Pirrama Road. Other sources of noise included boats creaking at the pontoon, a brief alarm on the street and urban hum.

5.2 Results and discussions

5.2.1 Level 3 Entertainment Deck

Compliance measurements

The compliance measurement results, including the measurements at the two locations, and the calculated noise levels contributed by sound system are presented in Table 5-1.

Table 5-1 – Sound system at typical event noise level - calculated and measured noise levels at receiver 10

	1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Daytime L_{A10} criteria at NSR 10 (7am – 12am) ¹	62	59	57	56	55	51	45	34	25
Measured noise level 2m from loudspeaker	66	87	80	81	81	82	77	72	69
Calculated sound system noise contribution at NSR 10	21	42	35	36	36	37	32	27	24
Measured L_{10} ambient noise level at NSR 10	62	57	46	50	46	43	35	13	12
Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

¹ Taken from Renzo Tonin and Associates Report TG004-13F05 (r2) L1 UGA Report dated 08/05/2014.

Table 5-1 results indicated that sound system noise emission at typical event noise level on the level 3 Entertainment Deck complies with the applicable daytime L_{A10} criteria at the nearest sensitive receiver 10.

During the compliance measurements, music playback from the sound system is audible at the receiver 10 measurement location, especially during lull of nearby local traffic noise and during calm weather. Subjective assessments at both measurement locations indicate that sound system noise output spectrum is mid frequencies dominant and weak in low frequency “bass” content. This correlates with the noise spectrum measured 2 metres away from the loudspeaker. As such, the measured lower frequencies noise levels are likely to be contributed by other ambient noise sources at the receiver location.

Based on this assessment, WSP | Parsons Brinckerhoff advises that the operations of the Level 3 Entertainment Deck complies with applicable noise emission criteria and that permanency of Condition F1C should be granted.

Maximum noise output testing

In addition to compliance measurements, controlled test measurements were conducted to investigate the maximum possible sound system output. Simultaneous noise measurements at the two locations as per the compliance measurements were undertaken. With the sound system limiter deactivated, playback noise level was increased in 5 dB increments when measured at 2 metres from the loudspeaker. Table 5-2 to Table 5-4 presents the test measurement results

Table 5-2 – Sound system at 85 to 90 dBA - calculated and measured noise levels at receiver 10 (BG8)

	1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Daytime L_{A10} criteria at NSR 10 (7am – 12am)	62	59	57	56	55	51	45	34	25
Measured noise level 2m from loudspeaker	69	92	83	87	85	84	80	76	72
Calculated sound system noise contribution at NSR 10	24	47	38	42	40	39	35	31	27
Measured L_{10} ambient noise level at NSR 10	48	52	42	54	49	45	36	31	21
Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Marginal

Table 5-3 – Sound system at 90 to 95 dBA - calculated and measured noise levels at receiver 10 (BG8)

	1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Daytime L_{A10} criteria at NSR 10 (7am – 12am)	62	59	57	56	55	51	45	34	25
Measured noise level 2m from loudspeaker	67	95	87	89	91	90	86	81	78
Calculated sound system noise contribution at NSR 10	22	50	42	44	46	45	41	36	33
Measured L_{10} ambient noise level at NSR 10	60	61	53	58	54	51	42	32	26
Compliance	Yes	Marginal	Yes	Marginal	Yes	Yes	Yes	Marginal	No

Table 5-4 – Sound system at maximum system output - calculated and measured noise levels at receiver 10 (BG8)

	1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Daytime L_{A10} criteria at NSR 10 (7am – 12am)	62	59	57	56	55	51	45	34	25
Measured noise level 2m from loudspeaker	66	96	87	89	91	92	87	80	78
Calculated sound system noise contribution at NSR 10	21	51	42	44	46	47	42	35	33
Measured L_{10} ambient noise level at NSR 10	55	66	49	57	55	53	42	27	21
Compliance	Yes	No	Yes	Marginal	Yes	Marginal	Yes	Marginal	No

Subjectively, noise emission from all three sound system testing output levels were clearly audible at the nearest sensitive receiver 10. As previously stated, subjective assessment of the sound system noise impact at the receiver is mid frequencies dominant and weak in low frequency “bass” content.

Table 5-2 results indicate that increasing the maximum sound system output level to a range of 85 to 90 dB $L_{Aeq,15mins}$ will still comply with the applicable Condition F1C noise criteria at the nearest sensitive receiver 10.

Table 5-3 and Table 5-4 results indicate that increasing the maximum sound system output level to 90 dB $L_{Aeq,15mins}$ or greater will likely to result in exceedances of the applicable Condition F1C noise criteria at the nearest sensitive receiver 10. Therefore, it is not recommended for the sound system to be operating at greater than 90 dB $L_{Aeq,15mins}$ when measured at 2m from the loudspeakers.

5.2.2 Level 1 Unenclosed Gaming Area

The compliance measurement results, including measurements within the Level 1 UGA and at the receiver 10 location, and the calculated noise levels contributed by Level 1 UGA operation are presented in Table 5-5.

Table 5-5 – Typical L1 UGA operational noise level - calculated and measured noise levels at receiver 10 (BG8)

	1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Night-time spectrum (12am-7am) at NSR 10	55	52	50	48	44	41	35	27	17
Measured noise level at L1 UGA	69	68	71	69	64	66	62	52	43
Calculated noise contribution at NSR 10	25	24	27	25	21	22	18	8	1
Measured L_{10} at NSR 10	48	47	44	39	36	34	28	20	12
Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5-5 results indicated that operational noise emission from the level 1 unenclosed gaming area complies with the applicable night time L_{A10} criteria at the nearest sensitive receiver 10.

During the compliance measurements, operational noise from level 1 unenclosed gaming area was not perceivable at the receiver measurement location. Based on measurements undertaken within the level 1 unenclosed gaming area and calculated noise contribution at the receiver, operational noise emission from the level 1 unenclosed gaming area is unlikely to contribute to the ambient noise at the receiver location. The measured L_{10} levels are likely to be contributed by other ambient noise sources at the receiver location.

Based on this assessment, WSP | Parsons Brinckerhoff advises that the operations of the Level 1 unenclosed gaming area complies with applicable noise emission criteria and that permanency of Condition F1D should be granted.

5.3 Section 5 summary

The compliance measurements and the testing measurements conducted and presented in this section indicate the following:

- Typical event sound system setup and noise emission on Level 3 Entertainment Deck currently complies with noise criteria and requirements in the Conditions F1C
- Typical operational noise emission from Level 1 Unenclosed Gaming area complies with noise criteria and requirements in the Condition F1D
- Both sets of measurements and assessments indicate that there is currently no objective issues which preclude Conditions F1C and F1D to be granted permanency. Noise mitigation measures outlined in Conditions F1C and F1D will continue to be implemented to ensure compliance with relevant noise conditions.

6 AREAS ON TRIAL CONDITIONS

In addition to the locations addressed in Section 5, there are other specific areas of operations within The Star with trial periods which in the context of Modification 14 SEGL is seeking an end to the trial periods for their uses. These areas include:

- Pizzaperta (D/2013/1259/A)
- Darling VIP balconies (D/2015/233)
- Balla and Black restaurants (D/2011/18/B and D/2011/19/B)
- Oasis Gaming (D/2015/1072)

This section of the report provides justification to end the trial periods for each of the specific areas.

6.1 Pizzaperta (D-2013-1259-A)

The Pizzaperta Restaurant is located along Pirrama Road frontage of The Star. It has a capacity for 250 patrons and is permitted to operate between 7.00am and 10.00pm, with a trial period for operation between 10pm and 12am midnight.

A previous noise impact assessment conducted by Acoustic Logic (see Appendix E) demonstrated that the Pizzaperta Restaurant operation can comply with the noise conditions applicable the nearest receiver (receiver 10 in Figure 2-1) up to 12am midnight, provided that the recommended management conditions are implemented. The recommended management conditions which have been implemented as ongoing operational measures for Pizzaperta are:

- The playing of music to Pizzaperta is to include background levels only set to a maximum SPL within the internal restaurant space of 70 dB(A) with speakers facing away from the external dining area as required by the existing conditions of consent. **Implemented**
- The operation of Pizzaperta regarding all deliveries and waste removal is to operate within the existing controls and conditions of the Star. **Implemented**

WSP | Parsons Brinckerhoff advises that based upon the above control measures being implemented, permanency of the Pizzaperta restaurant's operation between 10pm and 12am midnight should be granted.

6.2 Darling VIP Balconies (D-2015-233)

The Darling VIP private gaming lounge on Union Street has two small balconies, one on each of end of the building, serving the private gaming rooms. The balconies are used as smoking terraces for the VIP guests of the Darling VIP area and do not include external music or sound systems.

Hours of operations for the balconies serving private gaming rooms at two ends of the Darling VIP are currently permitted for between 10am and 10pm, with a trial period for 24 hour operation of the two balconies.

Due to the size of the balconies, and access limited to Darling VIP guests only, the maximum number of patrons using each balcony is expected to be four at any one time. The nature of the balconies' use as smoking terraces means that the only noise source from the balconies is patron conversations.

With the nearest receiver 13 (BG5) being 50 m from the eastern end balcony, and two of the four patrons on the balcony speaking at conversational level, Table 6-1 demonstrates the likely noise impact at the nearest

receiver. Compliance with the night time period would deem compliance for all time periods of the day and acceptable for 24 hour operation.

Table 6-1 – Patron noise levels at NSR 13 (BG5) for night time periods

	SPL, dB L ₁₀ at 1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Night time period									
Predicted patron noise level at NSR 13 (12am to 7am)	9	9	19	29	33	27	20	14	9
Patron noise night time criteria at NSR 13 (12am to 7am)	62	59	56	52	49	48	43	35	25
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6-1 indicates that the patron noise emission as a result of the 24 hour operations of the Darling VIP balconies can be assessed to comply with and is well below the patron noise criteria at the nearby sensitive receivers.

Based on this assessment, WSP | Parsons Brinckerhoff advises that the trial period for 24 hour operations of the Darling VIP balconies complies with applicable noise emission criteria and that permanency of 24 hour operations should be granted.

6.3 Balla and Black restaurants (D-2011-18-B and D-2011-19-B)

Balla and Black are two licensed restaurants currently on ground level of The Star facing on to Pirrama Road with both restaurants having fully enclosed façades with no external spaces. The nearest noise sensitive receiver is Receiver 10, 200m away on the opposite side of Pirrama Road. Both restaurants are currently permitted to operate between 7am and 10pm daily with a trial period to operate between the hours of 10pm and 2am the following day.

Due to the nature of their operations as fine dining restaurants with low ambient noise levels, the noise mitigation of the façade, and the distance of more than 200 m to the nearest sensitive receiver, noise emissions from the operations of the two restaurants will not cause adverse noise impacts at any time of day.

WSP | Parsons Brinckerhoff advises that due to lack of noise impacts, permanency of the Balla and Black restaurants' operations between 10pm and 2am should be granted.

6.4 Oasis Unenclosed Gaming Area (D-2015-1072)

The Oasis gaming lounge has an Unenclosed Gaming Area (UGA) facing onto Pyrmont Street. The Oasis UGA is permitted to operate between 7am to 12am midnight with a trial period for 24 hour operation.

A previous noise impact assessment conducted by Acoustic Logic (see Appendix F) demonstrated that the Oasis UGA operation can comply with the noise conditions applicable the nearest receiver (receiver 13 in Figure 2-1) during the night time period, provided that the recommended management conditions are implemented. The recommended management conditions which have been implemented as ongoing operational measures for Oasis UGA are:

- All gaming machines in the UGA are to be turned to half volume to ensure compliance with the criteria for 12am to 6am. The sound pressure level in the UGA should not exceed 60dB(A) L10 in the absence of the noise associated with patrons. **Implemented**
- Loud or boisterous behaviour is not to be tolerated within the UGA. Noise predictions have been based on patrons using the UGA for the use of operating the pokies, not as a congregation space (i.e. beer garden). **Implemented** through continued management policy of the space.
- No music (apart from that associated with gaming machines) is to be played within the UGA. **Implemented**
- The UGA is to be isolated off from the main gaming area via automatic door closers. **Implemented**
- All facade elements, other than those that provide access to the UGA, are to be fixed closed. **Implemented**

WSP | Parsons Brinckerhoff advises that based upon the above control measures being implemented, permanency of the Oasis UGA 24 hour operation should be granted.

7 OPERATIONAL NOISE ASSESSMENT

The following are the operational noise emission assessments of Modification 14 against the applicable noise criteria presented in Section 4. Noise emission assessments presented in this section address selected areas of Modification 14 works which have been identified to potentially have noise impacts on nearby receivers. The internal modification works are not considered to impact external receivers and have not been included.

7.1 Assumptions

The assumptions of the operational noise emission are presented below. These assumptions have been made based on worst case scenario and our understanding of the site and conditions.

7.1.1 Mechanical Noise

Proposed upgrades to the generator plantroom includes locating three C100 capstone units in the existing plantroom and one C1000 capstone located in the existing cooling tower enclosure. The generator plantroom will continue to accommodate the existing 1400kW and 2000kW diesel generator, with the removal of two existing 1400kW diesel generators. Currently, it is anticipated that the exhaust from the generators will remain at the current exhaust stacks location at the northern end of the site.

The established criteria in Section 4.2.1 have been used to calculate the maximum allowable noise levels of the exhaust stacks associated with the infrastructure upgrades. The following assumptions were used in the calculation:

- Receiver 7 is the closest affected noise sensitive receiver (see Figure 2-1)
- The distance between the discharge path of the noise source and the closest affected noise receiver is approximately 40 metres
- The proposed capstone units will be operating continuously

7.1.2 Patron Noise

Pirrama Road

The cumulative patron noise emission from the Pirrama Road side of The Star includes:

- proposed unenclosed gaming area (UGA) on level 3
- proposed terrace on level 3 facing Pirrama Road
- existing unenclosed gaming area (UGA) on level 1
- existing Pizzaperta restaurant

Cumulative patron noise emissions are calculated using the measured noise level for level 1 unenclosed gaming area (see Table 5-5) and noise level for Pizzaperta (from Renzo Tonin's *TG982-02F02 (r3) updated 21/05/2015*). Calculation of patron noise level at the most affected receiver (receiver 10 see Figure 2-1) represents the cumulative impact from the following noise sources. Octave band noise source levels for each of the above mentioned areas used in the calculations are presented in Table 7-1. The following are the assumptions made for the representative noise sources

- noise prediction of Pizzaperta at full capacity based on the assumption that 250 patrons occupy the restaurant between 7am to 12am.

- noise monitoring results for noise levels within the existing Level 1 unenclosed gaming area
- estimated noise levels within the proposed Level 3 unenclosed gaming area at the facade, by taking 50% of the noise level for existing Level 1 unenclosed gaming area.
- assumed 50 patrons on the terrace and 50% of patrons speaking with raised voice simultaneously

Table 7-1 - Noise levels used for patron noise emission calculation

Noise source	Predicted SPL, dB L ₁₀ at 1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Pizzaperta Restaurant noise level (7am to 12am)	67	67	67	72	78	75	70	62	51
Existing Level 1 UGA noise level	69	68	71	69	64	66	62	52	43
Predicted Level 3 UGA noise level	66	65	68	66	61	63	59	49	40
Predicted Level 3 terrace noise level	62	62	73	83	89	86	78	71	62

The cumulative octave band noise levels for patron noise emission between 7am to 12am and 12am to 7am are presented in Table 7-2.

Table 7-2 – Cumulative patron noise levels

Noise source	Predicted SPL, dB L ₁₀ at 1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Patron noise level (7am – 12am)	73	72	76	84	89	86	79	72	63
Patron noise level (12am to 7am)	71	70	76	84	89	86	78	71	63

Pymont Street

The cumulative patron noise emission from the Pymont Street side of The Star, which includes the proposed unenclosed gaming area (UGA) on level 3, are calculated using source noise levels adopted from *Acoustic Logic 20150935.1/2307A/R1/BW The Star – Oasis Unenclosed gaming area Noise Impact Assessment Report updated 23/07/2015*. Calculation of patron noise level at the nearest affected receiver (receiver 13) takes into consideration the cumulative impact from the following noise sources presented in Table 7-3. Night time (midnight to 7am) octave band noise levels used in the calculations are presented in Table 7-3:

Table 7-3 - Noise levels used for patron noise emission calculation (Pymont Street)

	Predicted SPL, dB L ₁₀ at 1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Existing Oasis UGA noise level	60	60	58	59	60	59	55	48	41
Predicted Level 3 UGA noise level	60	60	58	59	60	59	55	48	41

7.1.3 Road Traffic Noise

The traffic noise assessments have been based on existing traffic flow data provided by the project traffic consultant, Mott McDonald. Existing traffic data used are presented in the Table 7-4 below.

Table 7-4 – Summary of existing traffic data

	Number of vehicles, seven day average	% heavy vehicles
Jones Bay Road	9,015	3.9
Pirrama Road	8,036	6.6
Pymont Street	8,339	3.4

7.2 Results

7.2.1 Mechanical Noise

Overall mechanical and plant noise emission from The Star must be controlled to achieve the noise criteria specified in Condition E1 of the Major Project Approval MP08-0098 as presented in Table 4-2.

In order to achieve the noise criteria, consideration must be made for the selection and design of all mechanical equipment that emit noise. If selected equipment is in excess of these criteria, 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.

In particular to the infrastructure upgrade described in section 7.1.1, in order to achieve the mechanical noise emission criteria at receiver 7 (see Figure 2-1) on Jones Bay Road, exhaust stack emission must be controlled to a maximum sound pressure level of 75 dBA when measure 1m on axis from the end of each stack.

7.2.2 Patron Noise

Pirrama Road side receivers

The cumulative octave band noise levels for patron noise emission including the proposed Level 3 unenclosed gaming area (UGA) and terrace, existing level 1 UGA, and Pizzaperta, at receiver 10 are presented in Table 7-5 below. Predicted noise levels are shown to comply with criteria established in Section 4.

Table 7-5 – Cumulative patron noise levels at NSR 10 for daytime and night time periods

	SPL, dB L ₁₀ at 1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Day time period									
Predicted cumulative patron noise level at NSR 10 (7am to 12am)	19	18	22	30	35	32	25	18	9
Patron noise daytime criteria at NSR 10 (7am to 12am)	62	59	57	56	55	51	45	34	25
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Night time period									
Predicted cumulative patron noise level at NSR 10 (12am to 7am)	17	16	22	30	35	32	24	17	8
Patron noise night time criteria at NSR 10 (12am to 7am)	61	59	57	55	51	49	43	33	23
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Pymont Street side receivers

The cumulative octave band noise levels for patron noise emission at receiver 13 (see Figure 2-1) are presented in Table 7-6 below. The calculation for the cumulative noise level at the receiver takes into consideration a balustrade of 1.2m height at the façade of the proposed Level 3 unenclosed gaming area (UGA). Predicted noise levels are shown to comply with criteria established in Section 4.

Table 7-6 - Cumulative patron noise level at NSR 13 for night time periods(BG4)

	SPL, dB L ₁₀ at 1/1 Octave band centre frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
Night time period									
Predicted cumulative patron noise level at NSR 13 (midnight to 7am)	26	26	24	25	26	25	21	14	7
Patron noise night time criteria at NSR 13 (midnight to 7am)	51	51	48	43	41	39	35	25	13
Complies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Oasis unenclosed gaming area

The proposed alteration to the Oasis unenclosed gaming area involves creating access to a small outdoor area. It is anticipated that the outdoor space will be used as a smokers terrace and no noise generating equipment such as gaming machines or amplified music will be located in the area. Due to the intended usage of the area, it is not expected that the alteration will significantly contribute to the noise emission from the current Oasis unenclosed gaming area operation.

Maintaining the current management conditions applicable to the Oasis unenclosed gaming area will therefore be sufficient to control noise emission from the area to the nearest sensitive receivers on Pymont Street.

Level 3 unenclosed gaming area

New unenclosed gaming area is proposed on Level 3 towards the Pymont Street side of the site. Based on the results demonstrated in Table 7-6 above, and the assumed mitigation measures similar to the current Oasis unenclosed gaming area adopted in the calculation, it is expected that noise emission from Level 3 unenclosed gaming area can be controlled to meet the applicable criteria at receiver 13. Due to the relative height differences between the proposed level 3 unenclosed gaming area to receiver 13 compared to that of Oasis unenclosed gaming area, it is anticipated that any noise impact at receiver 13 from the proposed level 3 UGA will be less than the noise from Oasis.

To ensure compliance with the noise criteria is achieved, recommended physical noise mitigation measures and management strategies for Level 3 unenclosed gaming area as listed below should be implemented. These mitigation measures and management strategies are similar to those as recommended in Acoustic Logic's report 20150935.1/2307A/R1/BW and currently implemented for the Oasis unenclosed gaming area.

- Balustrade along the façade of the Level 3 unenclosed gaming area is to be constructed with a solid material to a minimum height of 1.2m above the UGA floor level
- Limit the noise output of gaming machines to half of normal level during night time period between midnight to 7am
- No amplified music is to be played within the UGA area with exception of music from gaming machines
- Patrons' behaviour within the UGA are to be strictly managed to ensure "rowdy" patrons are restricted from the area and large groups of patrons are prevented from congregating near open sides.

Porte Cochere alteration

It is proposed that a small section of the existing Porte Cochere glazed canopy over the North West gaming area is to be removed and a new ceiling section will be installed over. As the location of this canopy alteration is located away from the façade and at high level, and with the shielding provided by surrounding building structures of The Star, noise emission impact due to this alteration will only be to those receivers with direct line of sight which overlooks this Porte Cochere canopy. With noise sensitive receivers with possible direct line of sight onto this canopy being receivers 4, 5, and 8 (Figure 2-1) more than 90m away, it is not expected that this alteration will result in any adverse noise impact.

7.2.3 Road Noise Policy summary

Based on the existing traffic numbers and the predicted largest traffic impact of 12% increase likely at the intersection of Union Street and Edward Street, it is unlikely that Modification 14 will increase patron numbers to an extent which results in additional traffic noise generation of 2 dB or more increase. Generally, an increase in traffic volume of around 60% is required to result in a 2 dB increase in traffic noise level. Therefore, noise increase at the receivers associated with the traffic generated by Modification 14 can be considered to be within the allowable 2 dB increase criterion set out in Section 4.4.

7.2.4 Offensive Noise Assessment

Conditions E1 and F5 of MP08-0098 stipulate that noise emissions associated with mechanical plant and equipment and other uses from the redevelopment must not result in "offensive noise". Table 7-7 presents

the assessment of the mechanical plant and equipment noise and the approved uses noise against the offensive noise checklist.

Table 7-7 – Offensive noise checklist

Offensive noise test	Assessment of mechanical plant and equipment noise	Assessment of approved uses including music and other uses noise	Potential for offensive noise
The loudness of the noise, especially compared with other noise in the area	Noise is not loud in absolute sense or compared to other noise in the area	Noise is not loud in absolute sense or compared to other noise in the area	No
The character of the noise	Noise does not contain annoying characteristics or tones	Noise does not contain annoying characteristics or tones	No
The time and duration of the noise	Noise may occur at all periods of the day continuously	Noise will occur during evenings and nights	Possibly
Whether the noise is typical for the area	The noise is typical for the area	The noise is not typical for the area	Possibly
How often the noise occurs	Noise may occur continuously	Noise will occur during operation of the gaming area and during seasonal outdoor events on entertainment decks	Possibly
The number of people affected by the noise	Based on the predicted noise levels, limited number of people are likely to be affected	Based on the predicted noise levels, limited number of people are likely to be affected	No

The offensive noise checklist uses an ‘on balance’ test where a majority of answers determines if a noise is offensive. Based on the checklist results, noise from both mechanical equipment and other approved uses from the redevelopment is not considered to be offensive at nearby receivers. Hence “offensive noise” criteria stipulated in Conditions F4 and F5 can be assessed as compliant.

8 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

8.1 Interim Construction Noise Guideline (ICNG)

As the Managing Contractor has not yet been appointed for the development, any Construction Noise and Vibration Management Plan (CNVMP) undertaken at this stage would be conceptual only. The Managing Contractor is key to the provision of a 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 the main 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.

8.1.1 Noise

The noise affected management trigger levels represents the noise level above which there may be some community reaction to noise. If noise from construction activity are predicted or measured to exceed this limit then the following is required:

- The proponent should apply all feasible and reasonable work practices to meet the noise affected level
- 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.

Strategies to address these requirements will be developed with the main contractor leading up to and during the construction phase.

8.1.2 Ground-borne Noise

Ground-borne noise is not considered an issue as:

- The ICNG only specifies vibration limits for outside of working hours, and
- The works are on elevated levels of the buildings and ground borne noise is likely to be negligible.

8.2 Hours of work for internal works

The hours of works for construction specified in Condition D11 of Major Project Approval MP08-0098 are mainly to control construction noise from adversely impacting nearby sensitive receivers. However, WSP | Parsons Brinckerhoff recommends the following additional condition regarding internal construction works to be considered.

All works internal to the existing building, including building/demolition and excavation work, in connection with the proposed development can be carried out on a 24 hour basis, 7 days per week, with safety inspections being permitted at 7.00am on work days.

As The Star operates on a 24 hour basis, internal works would predominantly be low impact and contained within the buildings, it is expected that no adverse impact on nearby residents will result due to these internal construction works. It is therefore requested that low impact internal works within fully enclosed areas of The Star be allowed to occur 24 hours a day.

9 SUMMARY

WSP | Parsons Brinckerhoff has been appointed to undertake a noise impact assessment for the proposed Modification 14 at The Star, at Pyrmont, NSW. This report is prepared to be submitted to the Department of Planning and Environment as part of the S75W application for Modification 14 works.

Currently there are Conditions F1C and F1D applicable to The Star relevant to use of speakers and amplification equipment in specific outdoor areas. Representative compliance measurements and controlled test measurements were undertaken to demonstrate compliance. Details of measurements, results and assessments are provided in Section 5. It is recommended that permanency to Conditions F1C and F1D be granted.

In addition to the locations addressed in Section 5, there are other specific areas of operations within The Star with trial periods which in the context of Modification 14 SEGL is seeking an end to the trial periods for their hours of operations. These are discussed in Section 6 to seek permanencies for the trial periods.

Operational noise emission criteria have been established based on the conditions and recent noise monitoring undertaken around The Star. This includes broadband noise criteria for mechanical services noise and octave band noise criteria entertainment and patron noise.

Patron noise associated with Modification 14 works have been assessed to comply with the entertainment venue noise criteria set out in section 4.2.2. Building services operational noise associated with the redevelopment have been assessed and maximum noise emission levels have been specified to comply with criteria in section 4.2.1. No adverse impacts are expected in terms of noise associated with the redevelopment, and acoustic measures can be effectively implemented to protect the amenity of the nearby receivers.

Construction noise and vibration management levels have been established based on the Interim Construction Noise Guideline. A detailed assessment will need to be undertaken once the main contractor is appointed and construction methods are known.

WSP | Parsons Brinckerhoff advises that based on the assessment results, the proposed changes of Modification 14 at The Star, can be designed to achieve the applicable noise criteria to the site.