



Air Noise Environment
Environmental Monitoring and Assessment

Sydney Cricket Ground - Noise Management Plan

Sydney Cricket & Sports Ground Trust

Date of Issue: 30 April 2019

Prepared by:
Air Noise Environment

ABN: 13 081 834 513





Air

- Ambient Monitoring
- Auditing
- Computational Modelling
- Control Solutions
- Emission Inventories
- Expert Evidence
- Dust Assessment and Management
- Occupational Monitoring and Assessment
- Odour Monitoring and Assessment
- Research and Policy Studies
- Source Emission Monitoring



Noise

- Acoustic Design and Certification
- Computational Acoustic / Noise Modelling
- Entertainment Noise Modelling and Control
- Acoustic / Noise Control Solutions
- Acoustic Expert Evidence
- Liquor Licence Assessments
- Acoustic / Noise Monitoring
- Occupational Noise Monitoring and Control
- Acoustic / Noise Research and Policy studies
- Road Traffic and Transport Noise Studies
- Vibration Monitoring and Assessment
- Acoustic Calibrations



Environment

- Environmental Audits,
- Environmental Impact Statements,
- Environmental Management Plans and Systems,
- Environmental Policy and Compliance,
- Greenhouse Gas Emissions Inventories and Testing,
- National Pollutant Inventory, and
- National Greenhouse and Energy Reports.

This document has been prepared and issued by Air Noise Environment Pty Ltd in accordance with our Quality Assurance procedures. Authorship, copyright details and legal provisions relating to this document are provided on the following page. Should you have any queries regarding the contents of this document, please contact your nearest Air Noise Environment office:

Brisbane Office

A: Unit 3, 4 Tombo Street,
Capalaba, QLD 4157
T: +61 7 3245 7808
E: qld@ane.com.au

Sydney Office

A: Level 6, 69 Reservoir Street
Surry Hills, NSW 2010
T: +61 2 8217 0706
E: nsw@ane.com.au



DOCUMENT CONTROL SHEET

Document Details

Project Reference: 5605-SCGT-NMP-03.odt
Document Title: Sydney Cricket Ground - Noise Management Plan
Client: Sydney Cricket & Sports Ground Trust
Document Reference: /Network/Projects/5605/Reporting/5605-SCGT-NMP-03.odt

Revision History

Version:	Issue Date:	Author:	Description:	Approved by:
00	29-03-2019	Samuel Wong	Internal Draft	Beau Weyers
01	04-04-2019	Samuel Wong	Draft for Client	Beau Weyers
02	16-04-2019	Samuel Wong	Final for Client	Beau Weyers
03	30-04-2019	Samuel Wong	Final for Issue	Beau Weyers

Copyright:

Air Noise Environment retains ownership of the copyright to all reports, drawings, designs, plans, figures and other work produced by Air Noise Environment Pty Ltd during the course of fulfilling a commission. The client named on the cover of this document shall have a licence to use such documents and materials for the purpose of the subject commission provided they are reproduced in full or, alternatively, in part with due acknowledgement to Air Noise Environment. Third parties must not reproduce this document, in part or in full, without obtaining the prior permission of Air Noise Environment Pty Ltd.

Disclaimer:

This document has been prepared with all due care and attention by professional environmental practitioners according to accepted practices and techniques. This document is issued in confidence and is relevant only to the issues pertinent to the subject matter contained herein. Air Noise Environment Pty Ltd holds no responsibility for misapplication or misinterpretation by third parties of the contents of this document. If the revision history does not state that a Final version of the document has been issued, then it remains a draft. Draft versions of this document should not be relied upon for any purpose by the client, regulatory agencies or other interested parties.

Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s).

The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd for the purposes of this project is both complete and accurate.





Table of Contents

1	Introduction	7
1.1	Overview	7
1.2	Authorship of this NMP	7
1.3	Sydney Cricket Ground Trust	7
1.4	Project Locality	8
1.5	Venue Operations	9
2	Management Objectives	11
2.1	Background of this NMP	11
2.2	The 2019 SCGT NMP	11
3	Event Noise Restrictions	13
3.1	Noise Limits	13
3.1.1	Sporting Events	13
3.1.2	Concerts, Rehearsals and Sound Tests	13
3.1.3	Other Outdoor Events	14
3.2	Time of Events	14
3.2.1	Sporting Events	14
3.2.2	Concerts, Rehearsals and Sound Tests	14
3.2.3	Other Outdoor Events	14
3.3	Fireworks or Pyrotechnic Displays – Events Including Concerts	15
4	Management Strategy	17
4.1	Targets and Performance Goals	17
4.2	Noise Management Measures	17
4.2.1	Training and Awareness	17
4.2.2	Concert Noise Predictive Procedure	18
4.2.3	Ultimate Control	19
4.2.4	Sound Amplification Equipment	19
4.2.5	Early Warning Concert Noise Monitoring	19
4.2.6	Internal and External Concert Noise Monitoring	20
4.2.7	Coordination with Moore Park Entertainment Venues	20
5	Event Notification Procedure	21
5.1	Notification Boundary	21
5.2	Notification to Community	22
5.3	Notification to EPA	23
6	Monitoring Protocol	24
6.1	Monitoring Schedule	25





6.2	Noise Measurement Methodology	25
6.2.1	Monitoring Locations	26
7	Reporting	27
7.1	Overall Objectives	27
7.2	Sporting Events Monitoring	27
7.3	Concerts and Other Outdoor Events Monitoring	27
7.4	Reporting to the Community	28
7.5	Reporting to the EPA	28
8	Community Liaison and Complaint Handling	30
8.1	Grievance Mechanism	30
8.1.1	Consistent Approach	30
8.2	Staffing of Phone Hotline	31
8.3	Identification of Noise Management Issues	31
9	Noise Management Review	32
9.1	Components of the Annual NMP Review	32
9.2	Annual NMP Review Reporting	32
9.2.1	Methodology	32
9.3	Current NMP Review	33
9.3.1	Documentation Reviewed	33
9.3.2	NMP Review Summary	34
10	References	38
	Appendix A - Acoustic Glossary	39
	Appendix B - Noise Modelling (Music Concerts at the SCG)	42

Index of Tables

Table 3.1 - Fireworks or Pyrotechnic Criteria	15
Table 4.1 - Targets and Performance Goals	17
Table 9.1 - NMP Review	34
Table 9.2 - NMP vs EPL Review	36
Table B1 - Source Noise Data	45
Table B2 - Predicted Results dB(A)	52
Table B3 - Predicted Results dB(C)	53
Table B4 - Predicted FOH Levels	58

Index of Figures

Figure 1.1: Site Location and Surrounding Land Uses	9
---	---





Figure 5.1: Notification Boundary and Noise Monitoring Locations	22
Figure 6.1: Monitoring Protocol	24
Figure 9.1: Corrective Action Loop for NMP Review	32
Figure B1: Modelled Stage Locations and Orientations at the SCG	44
Figure B2: 3D Model View – Looking North	47
Figure B3: 3D Model View – Looking North-East	48
Figure B4: 3D Model View – Looking East	49
Figure B5: Modelled Receptor Locations	51
Figure B6: Predicted Noise Contours – Stage Facing South	54
Figure B7: Predicted Noise Contours – Stage Facing West	55
Figure B8: Predicted Noise Contours – Stage Facing North	56
Figure B9: Predicted Noise Contours – Stage Facing East	57





1 Introduction

1.1 Overview

Sydney Cricket Ground Trust (SCGT) commissioned Air Noise Environment to prepare a revised Noise Management Plan (NMP) for events held at the Sydney Cricket Ground (SCG). The NMP is intended to provide the framework through which noise from events held at the venue will be managed to achieve compliance with the requirements of *Environmental Protection Licence – Prevention Notice 1003904 (29 July 2002)* and *Variation of Prevention Notice 1517780 (2 December 2013)*.

This Noise Management Plan applies to all concerts and other outdoor events with sound amplification equipment held at the SCG. Historically the NMP also included activities at Allianz Stadium, however this NMP focuses on noise management associated with the SCG, as the Allianz Stadium has been recently demolished and is undergoing redevelopment.

1.2 Authorship of this NMP

It is noted that the wording and structure of the 2017 NMP¹ as authored by ERM has been preserved for this revised NMP, but edited or changed where considered necessary. This approach provides continuity and consistency with an already effective NMP that has been implemented by SCGT during the 2018 season.

1.3 Sydney Cricket Ground Trust

The SCGT is a self-funded statutory body of the NSW State Government responsible for managing two of Australia's premium sports venues including the Sydney Cricket Ground (SCG). These venues have been at the site for a number of decades, and in the case of the SCG for over 135 years. Together the grounds form a central sports precinct of international standing that also includes a sports museum, member fitness centre and club facilities.

The SCGT hosts nearly 100 sports and concert events and attracts more than 1.5 million visitors each year. Sporting events held at the SCG and Allianz Stadium include State, National and International games of cricket, rugby league, rugby union, Australian Rules and soccer.

The SCG and Allianz Stadium are home to the Australian Football League (AFL) Sydney Swans, National Rugby League (NRL), Sydney Roosters, South Sydney Rabbitohs, Cricket Australia and Cricket NSW and Sydney 6ERS; and the Socceroos and Sydney Football Club (FC) along with a range of other entertainment and concert events.

The SCGT's vision is to celebrate sport, create history, enhance entertainment and share the experience.

1 ERM, Sydney Cricket Ground and Allianz Stadium Noise Management Plan (NMP), January 2017, Reference 0348672RP01_F03.





1.4 Project Locality

The SCG is bounded by Moore Park Road and Drive Avenue in Moore Park. The Moore Park Showground Precinct is located directly south-east of the venue, and includes Fox Studios, Hordern Pavilion and the Entertainment Quarter.

The nearest noise sensitive receivers to the venue include residential houses at the following locations:

- Paddington suburb to the north, with the nearest houses being located along Moore Park Road;
- Centennial Park suburb to the east and south, with the nearest houses located along Poate Road, Furber Lane, Cook Road and Robertson Road; and
- Houses on the western side of the Eastern Distributor within the suburbs of Redfern and Surry Hills.

The Sydney Boys High School and Sydney Girls High School are also located to the west of the venue, on the western side of Anzac Parade.

A number of public parks and recreational facilities are located in the area including Moore Park and Centennial Park. Figure 1.1 presents the site location and surrounding land uses.





Figure 1.1: Site Location and Surrounding Land Uses

1.5 Venue Operations

The SCG is used as a multi-purpose sports stadium and is the home ground for various teams including:

- Sydney Swans (AFL);
- Sydney Roosters, South Sydney Rabbitohs (NRL);
- NSW Waratahs (Super Rugby);
- Sydney Sixers (Big Bash League);





- Cricket Australia; and
- Cricket NSW.

During sport events, amplified sound is generally intermittent and includes background entertainment music, public announcements and on-ground announcements. The SCGT has recently installed a new PA system (D & B Audiotechnik speaker system) with improved noise distribution within the venue and reduced noise spill to the surrounding area.

Over recent years, the majority of concert events have been held at the Allianz Stadium. However, during the construction period of the new Allianz Stadium, there is a potential for more sporting events, and concerts (in recent years held exclusively at Allianz Stadium) to be held at the SCG. The most recent major concert events at the SCG occurred in 2009. Where concert events are held at the SCG, temporary amplification equipment is installed by the concert promoter. A typical arrangement to is to locate the amplification at the northern end of the oval, facing south.





2 Management Objectives

The overall purpose of the SCGT NMP is to minimise disturbance of residents and other noise sensitive receptors from sporting events, concerts and other outdoor events held at both venues that utilise sound amplification equipment.

This is achieved by the NMP documenting (and assisting to facilitate the implementation) of environmental protection requirements specified by regulatory authorities. These requirements are augmented by additional measures and specific procedures and processes developed and improved by the SCGT since the initial NMP was adopted in 2003.

2.1 Background of this NMP

The NMP was initially developed with due regard to Environment Protection Licence - Prevention Notice 1003904, issued on 29 July 2002 (the prevention notice). The prevention notice sets out the operational conditions for outdoor entertainment activities at the SCG and Allianz Stadium in order to manage noise impacts on nearby communities. The Prevention Notice was varied on 2 December 2013 (Variation of Prevent Notice 1517780).

Section (1) of the EPL specifically states that the prevention notice *'applies to any noise from outdoor entertainment activities involving 200 or more people, where sound amplification equipment is used as part of that activity and the activity takes place on Trust lands.'*

The conditions of the notice included prescribed noise limits for events, a limit of the number of concerts per year, the requirement for noise monitoring of concerts and a process to manage complaints from nearby residents. Subsequent to the initial development of the SCGT NMP, a number of variations to the prevention notice have been sought and approved by the NSW Environment Protection Authority (EPA) in consultation with other stakeholders. In each case the variations were sought to ensure the prevention notice, and importantly the NMP, remain useful noise management tools that accurately reflect the concerns of the community, developments in environmental noise practices and modern event management requirements.

The EPA considers that the SCGT must take preventive action to prevent or minimise the emission of noise from the SCG to ensure those specified activities are carried on in an environmentally satisfactory manner and in accordance with the notice. The EPA acknowledges the importance of state significant concert and sporting events and the notice aims to help facilitate outdoor events whilst protecting the amenity of the community. The EPA considers this prevention notice to be the most appropriate mechanism to regulate noise emissions from outdoor events held at the SCG.

2.2 The 2019 SCGT NMP

This NMP is a revision of the most recent NMP version prepared by Environmental Resource Management Australia Pty Ltd (ERM) issued on 25 January 2017. Key aspects of review include the following:





- demolition and redevelopment of the Allianz Stadium;
- review of noise criteria;
- consideration of holding music concerts at the SCG (which have been primarily held at the Allianz Stadium during recent years).

Section 9.3.2 presents further details of the review undertaken of the 2017 NMP.

As the Allianz Stadium is being redeveloped at the time of preparing this NMP, management of amplified noise from this venue is not relevant until such time as the new stadium becomes operational. Therefore, this revised NMP focuses on events held at the SCG only. A subsequent review of the NMP will take place to establish relevant noise management measures for the new Allianz Stadium once construction has been completed.





3 Event Noise Restrictions

This section presents the event limits that are applied to minimise noise generated at the SCG from sound amplification equipment. The event limits include:

- Identification of potentially sensitive receptors;
- Prevention notice noise level limits; and
- Approved times of events.

3.1 Noise Limits

This section presents the noise level limits that apply to sporting events, concerts and other outdoor events held on SCGT lands (including the SCG) with the use of sound amplification equipment.

3.1.1 Sporting Events

When measured at the specified monitoring locations, the L_{Amax} of noise emanating from any sound amplification equipment must not exceed 60 dB(A) during any sporting events.

This noise limit applies to wind speeds up to 5 m/s, above which wind generated noise on the microphone limits measurement accuracy. During periods of wind greater than 5 m/s this noise limit does not apply.

Noise levels measured when wind speed exceed 5 m/s (at microphone height) should not be used to measure compliance with noise limits, as wind generated noise may influence measurement accuracy. During periods of wind greater than 5 m/s the SCGT must continue to take all reasonable and feasible actions to minimise noise.

3.1.2 Concerts, Rehearsals and Sound Tests

Both dB(A) and dB(C) limits are specified for concerts, as a particular impact on local receptors of amplified music is low-tone bass sounds – measured in dB(C).

During sound test(s), rehearsal(s) and concert(s), L_{Amax} and the L_{Cmax} measured at the monitoring locations will not exceed:

- For activities conducted at the SCG: 70 dB(A) and 90 dB(C).

An exceedence of the noise level limit by a maximum of 5 dB(A) and/or 5 dB(C) during a single five (5) minute period during the first ten (10) minutes of the performance of each new act will not be taken to be a breach of the limits.

Noise levels measured when wind speed exceeds 5 m/s (at microphone height) should not be used to measure compliance with noise limits in the Notice, as wind generated noise may limit measurement accuracy. During periods of wind greater than 5 m/s the SCGT must continue to take all reasonable and feasible actions to minimise noise





3.1.3 Other Outdoor Events

For other outdoor events held on SCGT land (not covered by Section 3.1.1 and 3.1.2), and where not otherwise specified in this notice, the L_{Amax} of noise from any sound amplification equipment must not exceed 55 dB(A) at any of the locations referred to in Condition 5. Condition 5 refers to the noise monitoring locations which are presented in Section 6.2.1.

3.2 Time of Events

The following timing limits apply to sporting, concert and other events and are adhered to strictly unless exceptional circumstances arise.

3.2.1 Sporting Events

Sporting events will not commence before 0800 hours or finish after 2230 hours. Notwithstanding the above, events may continue until 2300 hours if an occurrence beyond the control of the SCGT delays the sporting event.

3.2.2 Concerts, Rehearsals and Sound Tests

For the following activities, the following limits apply:

- **Concerts:** A concert must not commence prior to 1000 hours or finish after 2230 hours on any day. Not with-standing the above concerts may continue until 2300 hours if an occurrence beyond the control of the SCGT delays the concert. The total length of a concert must not be greater than five (5) hours;
- **Rehearsals:** Rehearsals will not commence prior to 1000 hours or finish after 1900 hours. The total duration of rehearsals will be kept to an absolute minimum; and
- **Sound Tests:** Sound test(s) will not commence prior to 1000 hours or finish after 1900 hours. The total duration of sound tests will be kept to an absolute minimum.

Number of Concerts

The combined number of concerts held on SCGT land, including the SCG and the SFS must not exceed an average of four (4) concerts per calendar year averaged over any five (5) year period.

The number of concerts held on Trust land, including the SCG, must not exceed six (6) concerts over any event period.

Note: For the purposes of this condition, the term “event period” means the period of twelve months after 1 July 2010, and each subsequent period of 12 months.

3.2.3 Other Outdoor Events

For other outdoor events as much as practicable, events on days preceding working days will not commence before 1000 hours or finish after 2000 hours; and events held on days preceding days that are not working days will not commence before 1000 hours or finish after 2230 hours.





3.3 Fireworks or Pyrotechnic Displays – Events Including Concerts

The SCGT NMP focuses on noise management measures, monitoring procedures and protocol that are applicable to events which utilise sound amplification equipment.

However it is also important to recognise potential noise impacts associated with emissions from fireworks or pyrotechnic displays.

Due to the impulsive or transient, and tonal characteristics, of the noise they generate the ignition of fireworks or pyrotechnic displays can be particularly annoying, such that the SCGT have defined specific measures for the management of noise.

All fireworks or pyrotechnic displays for all events (including concerts, sporting and other entertainment events) at the Sydney Cricket Ground which are expected to emit audible or dominant noise of any duration must be undertaken in conjunction with the following criteria identified in Table 3.1.

Managing and approving the measures described for FPC1 to FPC5 in Table 3.1 is the responsibility of SCGT event management.

Table 3.1 - Fireworks or Pyrotechnic Criteria

ID	Description
FPC1	The provider shall submit a risk management plan for the display/s to the SCGT for approval at least 30 days prior to the display taking place. The risk management plan should specifically address the risk of noise pollution focusing on: <ul style="list-style-type: none">• The effects on local residents; and• The effects on local wildlife.
FPC2	Upon consideration and approval of the risk management plan by the SCGT, the venue hirer, provider and/or the SCGT must notify local residents: <ul style="list-style-type: none">• By means of letterbox drop at least 21 days from the date of the display:<ul style="list-style-type: none">• Letters should note the date, specific start and finish times of the display/s and details of the pyrotechnics used;• Letters should provide clear details of how to contact the SCGT should residents have any questions or wish to make a complaint before, during or following the display;• Letters should also provide details on the SCGT information hotline (refer Section 8.2) and website address where noise management information can be found including access to a copy of this NMP; and• By means of the SCGT placing the information as specified above on its website at least 21 days prior to the day of the display. The SCGT shall notify the EPA where the SCGT is unable to meet the 21 days' notice period and make all reasonable effort to ensure that residents and sensitive receivers are given adequate notice.





ID	Description
FPC3	Noise from the ignition of pyrotechnics and fireworks must cease prior to 2230. Duration shall be of limited time (i.e. < 30 seconds), unless approved by EPA prior.
FPC4	Aerial Shells and other high noise impact pyrotechnics are not permitted to be used in any display at the Sydney Cricket Ground. Pyrotechnics that produce a less noise impact are to be utilised within the SCGT precinct.
FPC5	Providers must complete the SCGT's "Pyrotechnics Pre-Start Checklist" on the day of the display which shall include: <ul style="list-style-type: none">● Specific acknowledgement of the SCGT NMP;● Specific acknowledgement that the display will be as per the details provided in the risk management plan and resident notifications; and● Upon request the SCGT will provide the EPA a copy of the pyrotechnics pre-start checklist to ensure due diligence is followed.





4 Management Strategy

This section presents the noise management strategy that is applied to minimise noise generated by events at the SCGT which utilise sound amplification equipment. This strategy includes:

- SCGT targets and performance criteria;
- Noise management measures specific to the SCGT, with key responsibilities assigned.

4.1 Targets and Performance Goals

Based on the requirements of the prevention notice, subsequent variations and the SCGT's own environmental management goals and strategies, the following targets have been set for managing noise emissions from events. These targets and performance goals are presented in Table 4.1 below.

Any deviation from the targets will result in SCGT event management immediately implementing corrective actions, including additional measures or monitoring, where necessary.

Table 4.1 - Targets and Performance Goals

Metric/Measure	Target	When	Accountability
Number of non-compliant noise monitoring results	Zero	All Events	SCGT Event Management/ Noise Monitoring Consultant
Number of non-compliant events times	Zero	All Events	SCGT Event Management
Number of actions taken by regulators	Zero	All Events	SCGT Event Management
Number of noise nuisance complaints	Zero	All Events	SCGT Event Management
Review the effectiveness of the NMP, and revise	Annual	October	SCGT Event Management/ Noise Monitoring Consultant

4.2 Noise Management Measures

To achieve the event noise limits and SCGT targets and performance goals above, the following management measures are adopted. For each measure, key SCGT management personnel and accountabilities are provided.

4.2.1 Training and Awareness

The SCGT ensures that all personnel responsible for event planning, management and for the implementation of the SCGT NMP are competent on the basis of education, training or experience. All personnel (including contractors) are provided with environmental noise training appropriate to their



scope of activity and level of responsibility. Noise training focuses on:

- Objectives, targets and performance goals;
- The intent of the NMP, location of receptors and noise criteria;
- Measures that are required to be implemented;
- Additional measures that may arise if a non-compliance occurs;
- Noise monitoring and reporting requirements; and
- Incident investigation and response.

Training is to be provided prior to all concerts. Any noise related management tasks are updated on a case by case basis if circumstances change.

The provision of training is the responsibility of SCGT event management.

4.2.2 Concert Noise Predictive Procedure

The following procedure is adopted to better understand potential noise levels from proposed major activities (e.g. concerts). These factors are reviewed by the SCGT in consultation with production and staging crew, and event promoters, for each concert event:

- Identify all major noise sources at the venue and consider stage optimisation, refer below;
- Identify the location of noise sources, including relative height above ground and select appropriate equipment, refer below;
- Identify the location of receptor areas;
- Check weather condition forecasts, particularly wind speed and direction and the potential presence of temperature inversions on the day of the event;
- Quantify the expected crowd attendance;
- Compare audio engineers proposed design of stage audio set up with previous configurations;
- Use rehearsals and sound checks to inform the concert operators at what internal volume settings residential noise limits are met. That is, residential noise monitoring during the day will be used to quantify the internal volume settings so that all parties, acoustic engineers outside and audio engineers inside, are equipped with data prior to the main concert at night; and
- Install a monitor at the concert mixing desk for the duration of all the performances. This data will be used to build on the existing information and improve the predictive accuracy of this procedure over time.

Stage Optimisation for Noise

Given the current redevelopment of the Allianz Stadium, there is a potential for more music concerts to be held at the SCG. Since 2010, the majority of music concerts have been held at the Allianz Stadium. To understand the potential noise levels associated with amplified music at the SCG, noise



modelling of a typical speaker arrangement during an event at the SCG has been undertaken. The outcomes of this modelling have been used to determine any additional or alternative noise management procedures to be implemented by SCGT during music concerts at the SCG. Appendix B presents a summary of the noise modelling undertaken. Any noise management procedures resulting from this modelling and agreed upon with SCGT have been incorporated into this revised NMP.

4.2.3 Ultimate Control

The SCGT must at all times retain ultimate control of the noise level caused by any sound amplification equipment.

An SCGT employee or Agent will be present at the sound-mixing desk for the duration of amplified noise activities. It is noted that during Concert events, the SCGT would engage a qualified acoustic consultant to provide feedback to FOH sound engineers in the first instance. However, an SCGT representative (usually the Event Manager) shall also exercise ultimate control for the duration of an event.

4.2.4 Sound Amplification Equipment

In the selection, siting and operation of sound amplification for an event (particularly for music concerts), due consideration shall be given to:

- selecting equipment that reduces 'throw' external to the venue and directs amplified sound inside the venue;
- siting sound amplification equipment in an optimum location that minimise noise levels at surrounding sensitive receivers (this can be determined through noise modelling as referred to in Section 4.2.2 and a review of previous music concerts);
- optimising volume and frequency in such a way to achieve an appropriate level of entertainment noise levels within the venue and compliance at external sensitive receptors (this shall be considered through an event as discussed in Section 4.2.5 and 4.2.6).

4.2.5 Early Warning Concert Noise Monitoring

During the entire concert, rehearsal or sound test, the SCGT will ensure that an SCGT employee or agent is present at the sound-mixing desk for the duration of the event and is able to provide direction to control noise levels from the sound amplification equipment during the event and to ensure compliance with the noise criteria.

The SCGT employee or agent will issue warnings to the Front of House (FOH) or sound operators at concerts when measured noise levels at the receptors are within 3 dB of the specified noise level limits. This will result in better noise management, reduce the potential for breaches and result in lower noise levels at residences. This 3 dB deduction from the noise level limits has been chosen on the basis of being slightly above the threshold of human perceptibility and also equates to half of the sound energy.





4.2.6 Internal and External Concert Noise Monitoring

The SCGT employee or agent present at the sound-mixing desk for the event will be equipped with a sound level meter and will measure internal noise levels for sound tests, rehearsals and concerts. An internal to external calibration point will be established for compliant noise levels (including the 3 dB warning levels) to proactively manage noise levels with FOH or sound operators at concerts. This reduces the time taken to communicate elevated noise levels to the sound operator and for actions to be taken, if necessary.

For example, during a sound test audio is played through the sound amplification equipment. External noise levels at the most affected monitoring location are measured to be L_{Amax} , 72 dB(A) and internal noise levels at the FOH are measured to be L_{Amax} , 112 dB(A). Noise levels are reduced to be 70 dB(A) at the receptors and 110 dB(A) inside the venue, complying with the noise level limits. A warning level of 107 dB(A) and an absolute limit level of 110 dB(A) is established and communicated to the sound operator. Actions are taken when noise levels approach or are measured above the warning level, if possible.

The internal noise measurement location can also be used to identify problem frequencies which are sometimes the cause of non-compliant levels at receptors, and actions taken accordingly to reduce them.

The early warning noise monitoring and internal to external calibration measures are the responsibility of SCGT event management.

4.2.7 Coordination with Moore Park Entertainment Venues

The SCGT is a member of Moore Park Events Operations Group (MEOG) which includes precinct partners, police, transport and other government agencies. MEOG aims to ensure a coordinated approach to the management of events held at the SCG, Fox Studios, Hordern Pavilion, Royal Hall of Industries, Entertainment Quarter and Randwick Racecourse.

Key SCGT event management personnel meet regularly with other MEOG members to discuss upcoming events and agree appropriate actions to be taken where potential cumulative impacts are identified due to concurrent events taking place. The SCGT shall give due to consideration to the MEOG operational management plan.

Attendance at these meetings and implementation of any actions are the responsibility of the SCGT event management.





5 Event Notification Procedure

For each concert the SCGT will make all reasonable efforts to ensure that residents and sensitive receptors, likely to be significantly impacted upon by noise, are given adequate (not less than 5 days and not more than 14 days) prior written notification of a concert(s), sound test(s) and rehearsal(s).

Notification will contain information demonstrating that the event is of significance to NSW as demonstrated by the anticipated crowd being greater than 25,000 people. This notification will include as a minimum the telephone number of an information hotline operated by the SCGT. The information hotline number will be the same for all events held by the SCGT.

Additional detail regarding the concert event notification process is provided in Section 5.2 below. The EPA notification process is detailed in Section 5.3 below.

Sporting events are widely publicised through various media, including television and the SCGT website.

5.1 Notification Boundary

The notification boundary, which includes approximately 4,600 residential dwellings, covers both the southern and northern sides of Oxford Street and extends along Oxford Street to the west to the intersection with Bourke Street. The boundary includes both sides of Bourke Street (Surry Hills) south to Lachlan Street (Waterloo), north along both sides of South Dowling Street to the intersection with Moore Park Road. The notification boundary is identified in Figure 5.1 below.



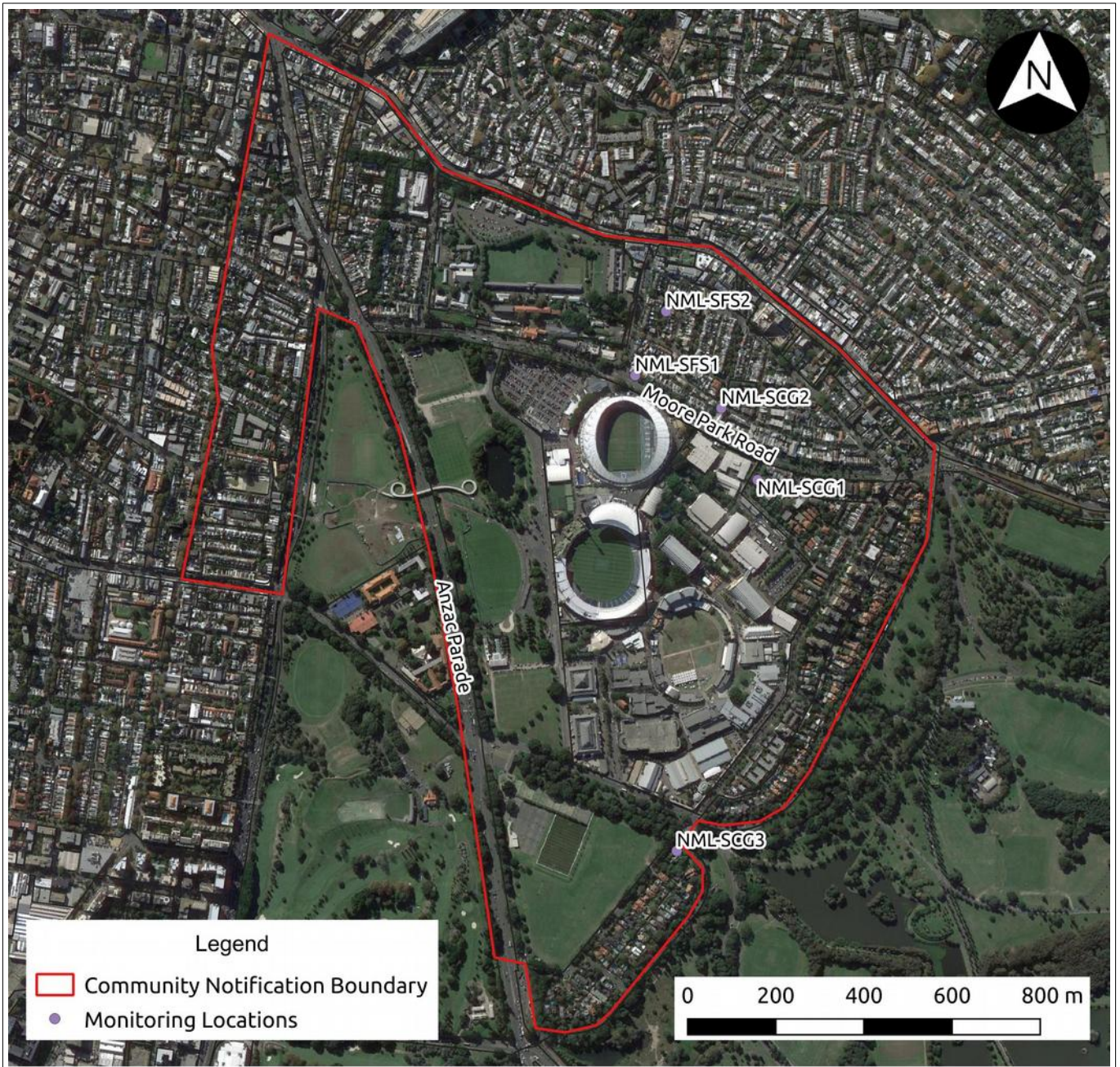


Figure 5.1: Notification Boundary and Noise Monitoring Locations

5.2 Notification to Community

Written notification of concerts will be distributed by letterbox drop and will include:

- The name and date of the concert;



- The commencement and finishing times of the concert and the likely time of sound checks and rehearsals;
- The time and duration of any planned fireworks;
- The telephone number of the SCGT information hotline which will be operated during concert(s), sound test(s) or rehearsals for the purpose of providing information about the concert and receiving any feedback from members of the public in relation to those activities; and
- The operating hours of the SCGT information hotline, refer Section 8.

5.3 Notification to EPA

At least twenty eight (28) days prior to the commencement date of the concert(s), the SCGT will inform the EPA Manager Metropolitan Infrastructure of:

- The times and dates of any proposed concert(s), sound test(s) and rehearsal(s);
- The name and contact details of a general liaison person for the purposes of communication with the EPA in connection with any concert(s), sound test(s) and rehearsal(s); and
- The name and contact details of a person appointed as the SCGT's representative specifically for the duration of any concert(s), sound test(s) and rehearsal(s).

The EPA will be notified of any changes to the details provided in accordance with this condition at least seven (7) days prior to the commencement date(s) of the concert(s), sound test(s) and rehearsal(s) or immediately after receipt of the information.



6 Monitoring Protocol

This section presents the noise monitoring protocol that is implemented to measure and assess noise levels from sporting events, concerts and other outdoor events, an overview is provided in Figure 6.1.

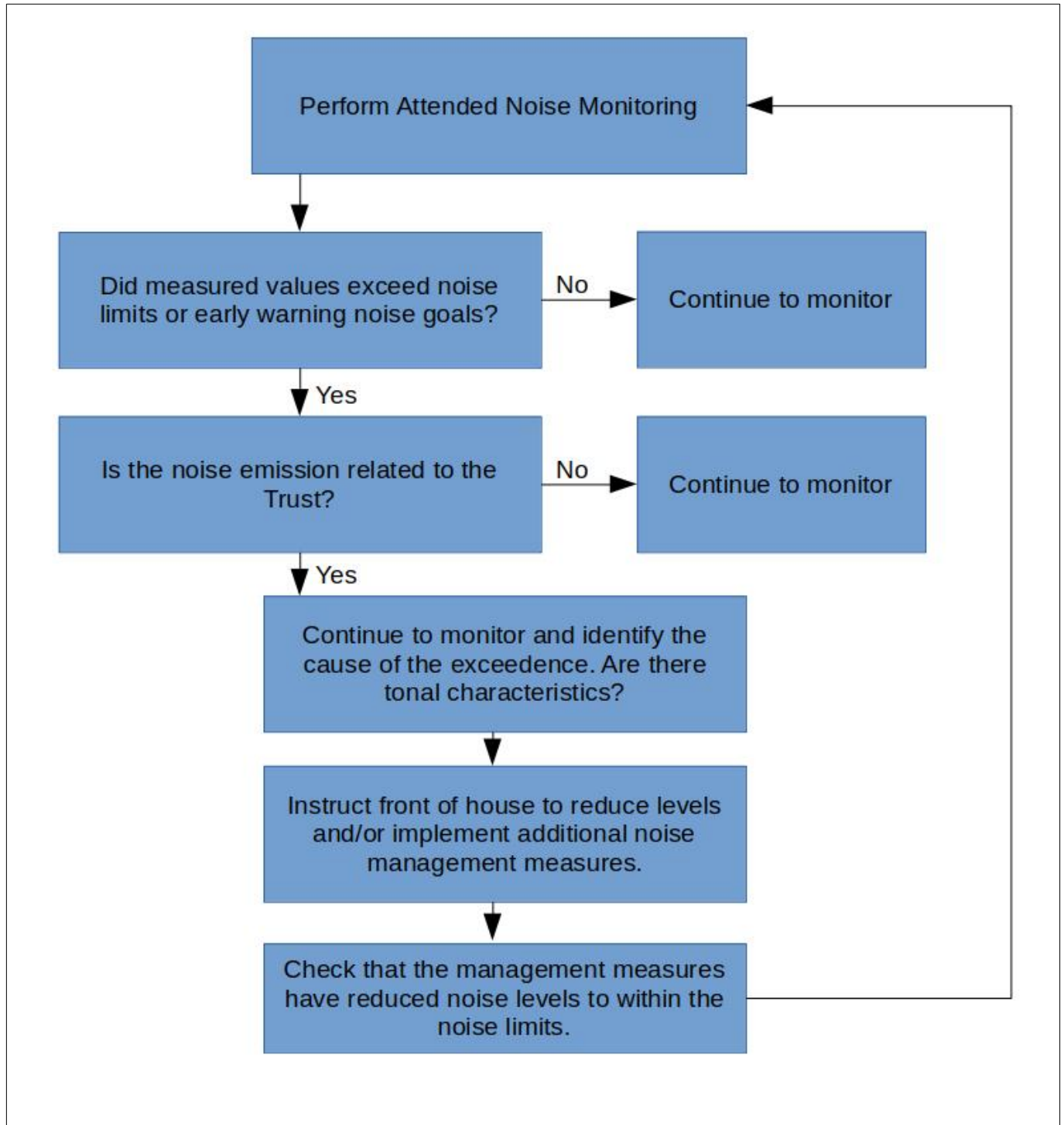


Figure 6.1: Monitoring Protocol





6.1 Monitoring Schedule

The noise schedule is presented below:

- At least once every calendar year, for at least one event at the SCG, noise levels will be continuously monitored by an accredited acoustical consultant throughout the entire sporting event.
- The sporting event/s measured must be representative of the various sporting events held on SCGT lands.
- For each concert or other outdoor event, rehearsal or sound test, noise levels will be continuously monitored by an accredited acoustical consultant throughout the entire concert, rehearsal or sound test as L_{Amax} and L_{Cmax} .

During an entire concert, other outdoor event, rehearsal or sound test, the SCGT will ensure that a SCGT employee or agent is present at the sound-mixing desk for the event and is able to exercise control of the noise levels from the sound amplification equipment during the event. The SCGT will also ensure that the employee or agent can contact and communicate with all of the acoustical consultants conducting the monitoring of the noise levels from the concert.

The sporting events measured will be representative of the various sporting events held on SCGT lands. It is noted in the interim of Allianz Stadium refurbishment, all sporting codes competitions are occurring at the SCG.

6.2 Noise Measurement Methodology

Noise monitoring will include attended noise measurements at nearby receptors i.e. the monitoring locations identified in Figure 5.1. Where the concert or other outdoor event is not being held at the SCG but is otherwise held on SCGT lands, the noise levels will be monitored at all of the locations. Other locations may be nominated from time to time by the EPA or SCGT which are the subject of complaints or may, in the opinion of the EPA or SCGT, experience noise levels that exceed the relevant noise limits in this notice.

Attended monitoring will continuously measure noise levels for the duration of events, except during device failure or down time.

All noise levels will be measured as the L_{Amax} and L_{Cmax} parameters, where applicable, for direct comparison to relevant noise limits. Site noise levels will be measured in the absence of any influential sound, that is audibly distinguishable and extraneous to the sound from the amplification equipment; and with the sound level meter microphone placed between 1.5 and 1.6 metres (m) above the ground.

Attended noise measurements will be undertaken by an operator using a hand held Type 1 or Type 2 'integrating-averaging' sound level meter set to "fast" time weighting. Measurements will be completed with due regard to and in accordance with the requirements of the:

- *Australian Standard AS 2659.1-1988 (AS2659) – Guide to the Use of Sound Measuring Equipment*





- *Portable Sound Level Meters, or any revisions of that standard which may be made by Standards Australia 2 ; and*

- *Standards Australia AS1055-2018 (AS1055) - Description and Measurement of Environmental Noise, Parts 1, 2 and 3.*

The device will be calibrated prior to and after all measurement rounds, with any change in calibration levels noted.

All measurements will be completed with the sound level meter mounted to a tripod and with a windscreen fitted. Noise monitoring will not be completed within 3 m of any reflective structure or wall, if possible. Where it is not possible to measure more than 3 m from any reflective structure or wall, a reduction of up to 2.5 dB will be applied to the measured site noise contribution to account for the likely increase in noise associated with reflective surfaces.

Instantaneous noise levels for all noted noise emission sources (extraneous or otherwise) and meteorological conditions (average and maximum wind speeds, temperature, precipitation and cloud cover etc.) shall be observed and recorded during all measurements.

6.2.1 Monitoring Locations

All monitoring locations are identified on Figure 5.1 of this NMP. For both sporting events and concerts attended monitoring locations will be as set out below.

For activities taking place at the SCG:

- At a point within one (1) metre of the residential boundary nearest to the SCG, at the corner of Poate Road and Poate Lane, Centennial Park;
- At a point within one (1) metre of the residential boundary nearest to the SCG, at the corner of Leinster and Regent Streets, Paddington; and
- At a point within one (1) metre of the residential boundary nearest to the SCG, at the corner of Robertson Road and Martin Road (northern intersection), Moore Park.



7 Reporting

7.1 Overall Objectives

The SCGT will undertake a reporting program to stakeholders. The objectives of this reporting are to:

- Provide stakeholders with timely updates on the results of noise monitoring of concerts, sporting and other outdoor events including any non-compliance with noise or time limits;
- Provide details of the incidence and duration of any noise exceedances during concerts sporting and other outdoor events;
- Provide details of feedback received by the SCGT relating to monitored concerts, sporting and other outdoor events; and
- In the longer term, provide information which will inform the review of the effectiveness of the NMP.

7.2 Sporting Events Monitoring

Following noise monitoring for sporting events, a report will be prepared by the acoustical consultant detailing:

- The date and times the monitoring occurred;
- The activities that were occurring on land administered by the SCGT during the monitoring;
- The sound pressure levels recorded, including any exceedances of the noise level limits;
- If any exceedances did occur, what measures were implemented to ensure they did not re-occur;
- The details of any feedback made during the sporting event, including the details required by this NMP; and
- Any other information relevant to the consideration of the noise impact on residents or other sensitive receptors.

A copy of any report will be kept for at least two (2) years.

7.3 Concerts and Other Outdoor Events Monitoring

Following noise monitoring for concerts or other events, a report will be prepared by the consultant detailing:

- The date and times the monitoring occurred;
- The activities that were occurring on land administered by the SCGT during the monitoring;
- The sound pressure levels recorded, including any exceedances of the noise level limits;



- If any exceedances did occur, what measures were implemented to ensure they did not re-occur;
- The details of any complaints made during the event, including the details required by this NMP;
- Any other information relevant to the consideration of the noise impact on residents or other sensitive receptors.

A copy of any report will be kept for at least two (2) years.

7.4 Reporting to the Community

Within 72 hours of the completion of each separate concert or other outdoor event the SCGT will publish on its website summary results of noise monitoring conducted by the acoustic consultant. The summary report will set out:

- Compliance or non-compliance with noise and time limits; and
- The times and duration of any occasions where exceedances of the noise and time limits and what measures were implemented to ensure that the exceedance(s) did not reoccur.

The information will be understandable to the general public and will not contain any unnecessary jargon, with all technical terms explained in plain language.

When available, the SCGT will also publish on its website a full copy of the noise monitoring report for the sporting event, concert or other outdoor event.

7.5 Reporting to the EPA

At the earliest opportunity following the completion of each separate concert and no longer than two (2) working days after each concert, the SCGT must provide a report in writing to the EPA Manager Metropolitan Infrastructure on the following issues:

- Compliance or non-compliance with noise and time limits;
- The times and duration of any occasions where exceedances of the noise and time limits occurred and what measures were implemented to ensure that the exceedance(s) did not reoccur; and
- The number and nature of complaints received.

Not later than twenty eight (28) days after the completion of a concert, series of concerts or other outdoor event, the SCGT will provide a report in writing to the EPA Manager Sydney Local Government. The report will meet the following conditions:

- An accredited acoustical consultant will prepare the written report.
- The report will contain the following:
 - The name address and telephone number of the person who prepared the report;
 - The relevant date(s) and the commencement and completion times of the test(s),



rehearsal(s) and concert(s) on each day;

- The times and location(s), including a site plan, at which the noise measurements were taken;
- Details of the equipment and methods used to take measurements;
- A statement of any time(s) at which the noise level limits were exceeded and why, the level(s) and duration of any exceedance(s); and
- Any other information relevant to the consideration of the noise impact from the event on residents or other sensitive receptors.

In the same written report, the SCGT must provide the following information:

- The estimated total number of people that were anticipated to attend the concert(s) on each day and the number who actually attended;
- A summary of the number, location and times of any feedback received by the SCGT;
- If any exceedances occurred or any feedback were received, details of what the SCGT intends to do (or do differently) for any future events; and
- Any other information relevant to the consideration of the noise impact from the event on residents or other sensitive receptors.





8 Community Liaison and Complaint Handling

The SCGT implements a community liaison and complaint handling mechanism, which incorporates the following procedures.

8.1 Grievance Mechanism

Complaints arising from sporting events, concerts or other events are treated sensitively and in a manner that recognises the potential for noise to cause environmental impacts. Special consideration is given to complaints related to noise during concerts in order that additional measures can be implemented in a timely manner.

The grievance mechanism records shall include:

- Date and time of the complaint: when received by the SCGT;
- The method by which the complaint was made: phone/email/SCGT switchboard etc;
- Contact details for the complainant: name and phone number or email if the complainant wishes to share this information;
- Location of the complainant: if the complainant chooses not to give their exact address, the person staffing the information hotline will obtain a general indicative street location;
- Event and nature of complaint: Event to which the complaint relates and the nature of the complaint;
- Reply or response given: including any actions and any follow up consultation that is required or has been undertaken by SCGT staff; and
- SCGT responsibility: the name of the person who received the query/complaint.

The information provided above is managed electronically to assist with analysis of complaints over time.

8.1.1 Consistent Approach

A consistent approach to complaints handling is adopted including:

- A standard template used to log all feedback whether received via the information hotline, email or the SCGT switch; and
- All calls/emails received will be logged in the database – this includes those where a name and or address is not given.

The record of complaints will be held for at least two (2) years after the complaint was made.

An evaluation of the complaints database will be undertaken in conjunction with the annual review of the NMP. This review will aim to identify common causes or locations of complaints.





8.2 Staffing of Phone Hotline

The SCGT information hotline for concerts and events where pyrotechnics have been planned will be staffed from 12 noon to 12 midnight on the day of a concert or as the schedule of the concert requires. Local residents will be advised of the availability of the information hotline through the notification procedure and via the SCGT website.

8.3 Identification of Noise Management Issues

Analysis of complaints data is used to highlight the community concerns and noise management strategies (to address these issues) are considered with each annual NMP review.





9 Noise Management Review

The SCGT implements an annual program of review for the NMP to assess its effectiveness in achieving key noise objectives. This review has been undertaken as part of the preparation of the current SCGT NMP (January 2017) and informed the overall noise management strategy and management measures presented in this document.

9.1 Components of the Annual NMP Review

The annual NMP review includes:

- Assessment of compliance with noise and time limits through analysis of acoustic consultant noise monitoring reports;
- Review of complaints data received by the SCGT, EPA or Sydney City Council on concerts, sporting and other outdoor events; and
- Assessment of the outcomes of annual reporting to and consultation with the community.

The annual review will incorporate a “corrective action loop” framework. This will ensure that the noise management strategies are reviewed and amended as required. The diagram below shows the corrective action loop, which is the responsibility of SCGT event management personnel.

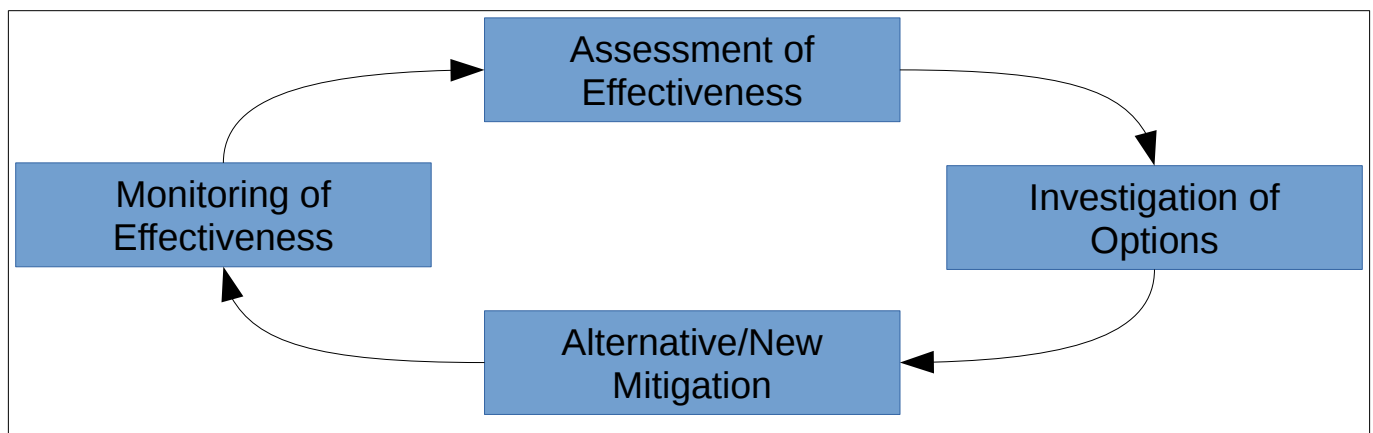


Figure 9.1: Corrective Action Loop for NMP Review

9.2 Annual NMP Review Reporting

The outcomes of the review will be considered by the SCGT and incorporated into the NMP revision in consultation with the acoustical consultant.

9.2.1 Methodology

In conducting the NMP review program the following steps will be undertaken:

- Review of the current NMP to ensure it remains an effective instrument for noise management;



- Review any existing 'Opportunities for Improvement' (OFI) identified during the previous annual review;
- Assessment of compliance with noise and time limits through review and analysis of noise compliance monitoring reports;
- Review of complaints data received by the SCGT, EPA and City of Sydney Council on concerts, sporting and other outdoor events;
- Assessment of the adequacy and timeliness of the SCGT's reporting to the community; and
- Revision of the NMP document to reflect monitoring and complaints data.

The revised NMP will be developed so that the noise management strategy and management measures continue to assist to minimise disturbance of residents and other noise sensitive receptors from sporting events, concerts and other outdoor events held at both SCGT venues that utilise sound amplification equipment.

9.3 Current NMP Review

Review of the now superseded SCGT NMP (January 2017) was conducted as part of the preparation of this version (April 2019).

9.3.1 Documentation Reviewed

To assist identify any necessary changes to the overall noise management strategy and management measures the following noise monitoring reports were reviewed:

- Event Noise Management, Noise Monitoring Big Bash League – Sydney Sixers vs Brisbane Heat, 18 January 2018, Report No. 5258_Report_BBL_01.odt.
- Event Noise Management, Noise Monitoring AFL – Sydney Swans vs Fremantle Dockers, 19 May 2018, Report No. 5386_Report_AFL_SCG.02.odt;
- Event Noise Management, Noise Monitoring, KFC Big Bash League – Sydney Sixers vs Sydney Thunder, 2 February 2019, Report No. 5662_Report_BBL_01.odt.

In addition, historical complaints data was reviewed for previously held concerts at the SCG:

- Live Earth on 6 July 2007;
- Sound Relief on 14 March 2009.

Documentation associated with the Allianz Stadium has not been reviewed as part of this NMP as it is not currently a source of event noise (as discussed earlier in this NMP, the Allianz Stadium is currently being demolished).



9.3.2 NMP Review Summary

9.3.2.1 Summary

Table 9.1 presents a brief summary of the review outcomes for key sections of the NMP. Subsequent sections provide further comments with regards noise management for sporting and concert events held at the SCG.

Table 9.1 - NMP Review

NMP Item Review	Findings
Sensitive Receptors	A review of the area did not identify any new sensitive receptors in the area.
Noise Limits	<p>All results of available noise monitoring reports show full compliance with the 60 dB(A) $L_{A_{Max}}$ noise limits for sport events. There were no music events in recent years hence, monitoring reports for a music event at the SCG could not be reviewed.</p> <p>For music concerts at the SCG, noise modelling suggests that an 80 dB(A) / 100 dB(C) criteria (equivalent to the Allianz Stadium criteria) is preferable, particularly where elevated receivers are considered.</p> <p>However for correlated compliance monitoring at ground floor SCG monitoring locations, the existing criteria (70 dB(A) / 90 dB(C)) is predicted to be suitable.</p>
Time Restrictions	As per Prevention Notice - no changes considered necessary.
Implementation of Fireworks and Pyrotechnic Criteria	The current fireworks management measures are considered appropriate.
Noise Management Measures	The current noise management measures are considered appropriate. Some additional sections have been added to reflect the current EPL for the site.
Noise Monitoring	As per Prevention Notice - no changes considered necessary. Some monitoring standard dates require updating.
Event notification - community	The current notification boundary is considered appropriate for SCG sporting events. However, if major concerts are held at the SCG in the interim, it is recommended that the notification boundary is extended south in the sensitive receptor area to the



NMP Item Review	Findings
	west of the venue.
Do the NMP sections address all elements of the EPL?	See Table 9.2

9.3.2.2 Sporting Events

Review of the noise monitoring reports indicates that amplified noise from SCG sporting events in 2018 and early 2019 were compliant with the relevant noise limit of 60 dB(A). In summary, $L_{A\text{Max}}$ noise levels were well below the limits as follows:

- Big Bash League, Sydney Sixers vs Brisbane Heat, 18 January 2018 – less than 52 dB(A);
- AFL, Sydney Swans vs Fremantle Dockers, 19 May 2018 – less than 55 dB(A); and
- Big Bash League, Sydney Sixers vs Sydney Thunder, 2 February 2019 – less than 56 dB(A).

During each event, the 8:00 am to 10:30 pm restrictions for a sporting event were complied with. Furthermore, no noise complaints were received.

The outcomes of the noise monitoring and absence of complaints indicate that noise from sporting events was being effectively managed under the previous NMP.

9.3.2.3 Concert Events

There have been no concert events held in recent years at the SCG, with the most recent major concert held in 2009. No noise monitoring reports could be tracked down by the SCGT to feed into this review. The following number of complaints were identified for major concerts at the SCG:

- Live Earth on 6 July 2007 – 8 noise complaints;
- Sound Relief on 14 March 2009 – 3 noise complaints.

In the absence of any noise management plans or monitoring reports for these events, it is not clear what management measures were being implemented at the time of the events. However, the number of complaints is not considered to be significant.

As mentioned earlier, with the redevelopment of the Allianz Stadium, additional music concerts could be held at the SCG during the year 2019. As major music concerts have been held at the Allianz Stadium since 2010, the SCGT has not had an opportunity to review the effectiveness of the current NMP with respect to holding music concerts at the SCG. To aid in understanding the potential impacts of a music concert at the SCG, noise modelling has been undertaken. The outcomes of the noise modelling are presented in Appendix B.

9.3.2.4 Review Against EPL

Table 9.2 presents a summary of the EPL sections and where these are addressed in the NMP. It is considered appropriate that NMP should address each clause of the EPL to ensure that compliance with the EPL is achieved.





Table 9.2 - NMP vs EPL Review

EPL Section	NMP Section Addressing EPL	Comments
(1) Scope	Noted in Section 2.1	None.
(2) Minimising Noise Impacts	Added Section 4.2.4	While achieved through the 2017 NMP, an additional section has been added to highlight the need for speaker optimisation.
(3) Complaint Management	Section 8.1	None.
(4) SCGT Retain Ultimate Control	Added Section 4.2.3	While referred in the 2017 NMP, a short additional section has been added for emphasis and importance.
(5) Monitoring Locations	Section 6.2.1	None.
(6) Monitoring Methods	Section 6.2	Updated dates of AS 1055 (2018) and IEC 61672.1 (2019).
Sporting Events		
(7) Times of Events	Section 3.2.1	None.
(8) Noise Level Limits	Section 3.1.1	<p>For music concerts at the SCG, noise modelling suggests that an 80 dB(A) / 100 dB(C) criteria (equivalent to the Allianz Stadium criteria) is preferable for high rise sensitive receivers and a few residential houses to the south in Centennial Park area.</p> <p>It is noted that compliance is predicted for 70 dB(A) / 90 dB(C) limit at the 3 monitoring locations for SCG events.</p>
(9) Monitoring and Reporting	Section 6.1	None.
Concerts		
(10) Number of Concerts	Updated Section 3.2.2	The 2017 NMP incorrectly states the maximum number of concerts that can be held per calendar year (5 per year averaged over 5 years). However, Section (10) states that only four (4) per calendar year can be held. Full details have been reinstated.
(11) Concerts at the Stadium	Not referred to.	Not relevant for this NMP – no Allianz Stadium operations
(12) Notification of any concerts held on SCGT lands including the SCG and the Stadium.	Section 5.3	The current notification boundary is considered appropriate for SCG sporting events. However, if major concerts are held at the SCG in the interim (during Allianz Stadium refurbishment), it is recommended that the notification boundary is extended south in the sensitive receptor area to the west of the venue.
(13) Notification of Residents and Sensitive Receivers	Section 5.1 and 5.2	None.





EPL Section	NMP Section Addressing EPL	Comments
(14) Hours for Concerts, Rehearsals and Sound Tests	Section 3.2.2	None.
(15) Noise Level Limits	Section 3.1.2	None.
(16) Monitoring Points and Acoustical Consultant	Section 6.2.1	None.
(17) Initial Report to the EPA	Section 7.5	None.
(18) Final Report to the EPA	Section 7.5	None.
Other Outdoors Events with Sound Amplification		
(19) Times of Events	Section 3.2.3	None.
(20) Noise Level Limit	Section 3.1.3	None.





10 References

Environment Protection Licence - Prevention Notice 1003904, issued on 29 July 2002

Variation of Prevention Notice (1517780), dated Monday, 2 December 2013

Australian Standard AS 2659.1-1988 (AS2659) – Guide to the Use of Sound Measuring Equipment – Portable Sound Level Meters, or any revisions of that standard which may be made by Standards Australia

Standards Australia AS1055-2018 (AS1055) – Measurement of Environmental Noise, Parts 1, 2 and 3

Standards Australia AS IEC 61672.1-2019 (AS61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990TM (AS1259) – Acoustics – Sound Level Meters – Integrating Averaging as applicable to the device

Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard – Electroacoustics – Sound Calibrators





Appendix A - Acoustic Glossary





APPENDIX A: GLOSSARY OF TERMINOLOGY

SCG	Sydney Cricket Ground
Allianz Stadium	Previously Sydney Football Stadium or SFS (currently undergoing demolition)
SCGT	Sydney Cricket & Sports Ground Trust (previously referred to as 'The Trust')
SCGT Lands	Meaning given to it in the <i>Sydney Cricket and Sports Ground Act 1978</i> .
Concert	Musical entertainment carried on outdoors with sound amplification equipment used as part of the activity
Rehearsal	The use of sound amplification equipment in preparation for a concert or sporting activity that is carried on outdoors
Sound Test	The testing and/or balancing of the sound amplification equipment to fine tune the audio system prior to an event
Concert Noise	Any sound generated by the amplification equipment during a musical event. This does not include sound generated during rehearsals and sound tests
Rehearsal Noise	Any sound generated by the amplification equipment during preparations for a musical or sporting event
Sporting Event	Sport entertainment carried on outdoors where sound amplification equipment is used as part of the activity.
Sensitive Receptor	Places such as nursing homes, hospitals, schools and residences.
Accredited Acoustic Consultant	An acoustical consultant who is a member of one or more of the following organisations: The Association of Australian Acoustical Consultants; The Australian Acoustical Society; or the Institution of Engineers Australia.
Attended Monitoring	Monitoring undertaken by an appropriately qualified and experienced person who is present at the monitoring location whilst the monitoring is being conducted, and who is able to, and does, differentiate between amplified noise from the activity being monitored and ambient noise whilst conducting the monitoring
A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
C-weighting	A response provided by an electronic circuit which modifies sound in such a way that it correlates with the human response to high noise levels.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the





	sound field and the reference pressure (0.00002N/m ²).
dB(A)	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
dB(C)	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'C' weighting) to compensate for sensitivity of the human ear to sound at a high levels.
L _{Max}	The maximum Root Mean Square (RMS) sound pressure level measured over a one-eighth of a second (1/8) interval. Measured as Fast time-weighting.
L _{Aeq} Equivalent Continuous Sound Level	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. For a steady sound with small fluctuations, its value is close to the average sound pressure level.
Hertz (Hz)	A measure of the frequency of sound. It measures the number of pressure peaks per second passing a point when a pure tone is present.





Appendix B – Noise Modelling (Music Concerts at the SCG)





APPENDIX B - NOISE MODELLING OF A CONCERT EVENT AT SCG

This Appendix presents the methodology, results and outcomes of noise modelling completed for a music concert event at the SCG.

The purpose of the modelling is to confirm the suitability of the venue for music concerts and to identify FOH levels conducive to achieving compliance with the noise criteria at sensitive receptors external to the venue. Section 4.2.6 of the NMP provides a procedure for confirming FOH levels during the sounds tests and rehearsals of an event. The noise modelling achieves a similar purpose by identifying suitable FOH levels however, in addition this, the modelling allows consideration of source-to-receiver winds and a range of stage orientations. This information is useful for the planning stage of the event and provides a proactive basis for identifying FOH levels prior to the event itself. Ultimately, the modelling assists in achieving the overall outcomes of the NMP which is to minimise disturbance of residents and other noise sensitive receptors from outdoor events that utilise sound amplification equipment, while achieving a reasonable volume of sound for patrons associated with a large scale concert production.

Noise Modelling Methodology

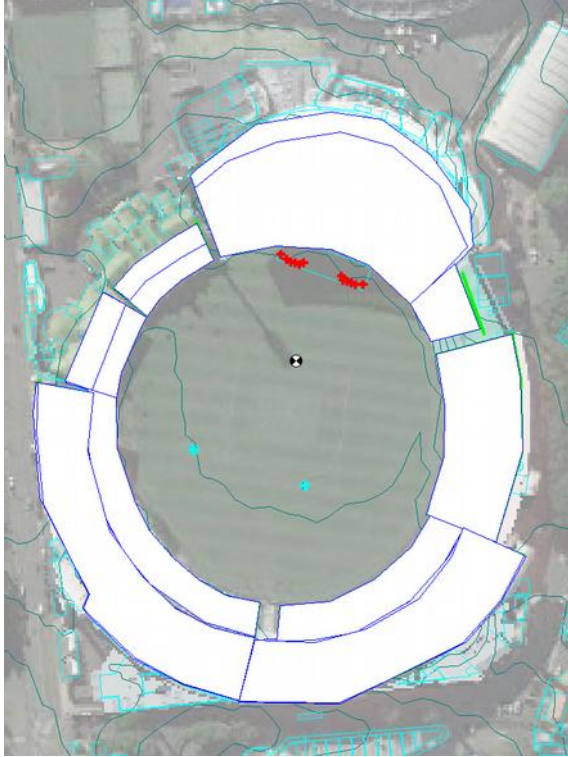
For the purposes of predicting impacts associated with noise emissions from the proposed development on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software CadnaA (Computer Aided Noise Abatement Model) developed by DataKustik. CadnaA incorporates the influence of meteorology, terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. The prediction method incorporated into CadnaA is in accordance with *ISO Standard 9613-2 (1996) Acoustics - Attenuation of sound during propagation outdoors*.

The model is utilised to assess the potential noise emissions from the site under a range of operating scenarios and meteorological conditions. The noise modelling also allows investigation of possible noise management solutions, in the event that non-compliance with the assessment criterion is predicted.

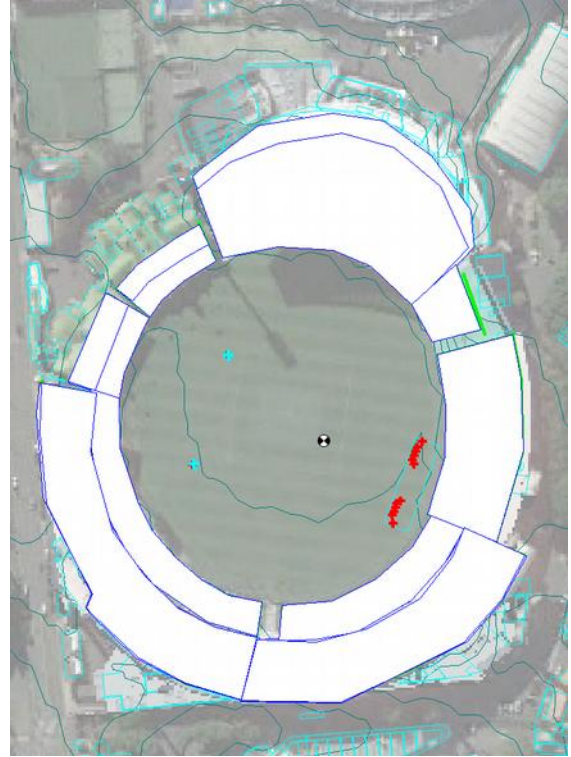
Potential Stage Orientations

Based on discussions with SCGT, a typical stage for a music concert at the SCG is located in the northern section facing south. For the purpose of this investigation, consideration has also been given to a stage facing west, north and east. Figure B1 presents the modelled stage locations and orientations.

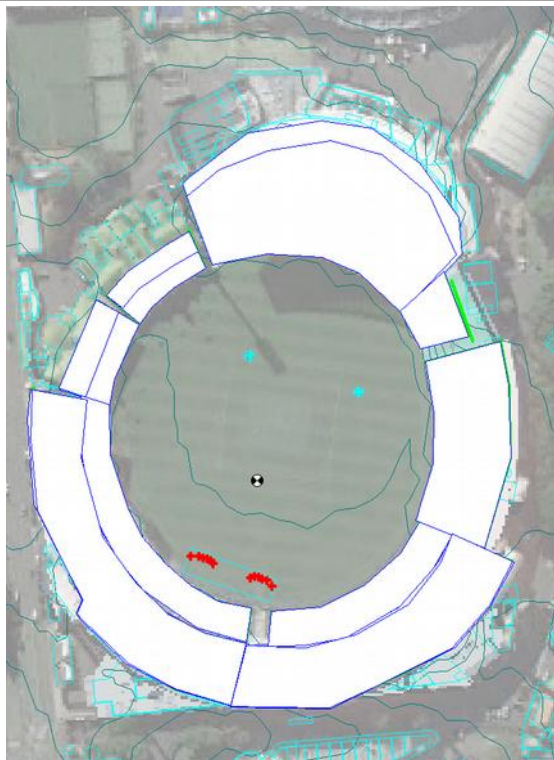




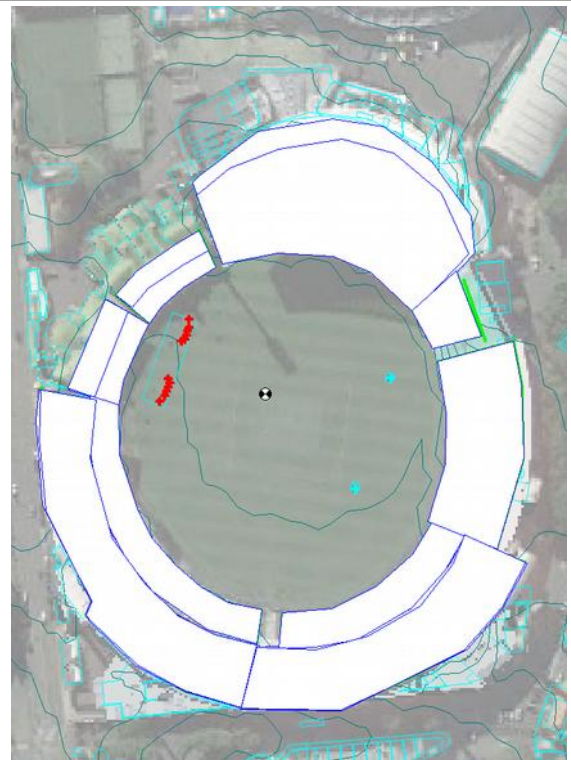
Facing South



Facing West



Facing North



Facing East

✚ Stage Speakers ✚ Relay Speakers ● Front of House

Figure B1: Modelled Stage Locations and Orientations at the SCG





Amplified Speaker System

The acoustic modelling has assumed a full scale sound system typical of those utilised during large scale performances in recent years at Allianz Stadium (Taylor Swift, Foo Fighters, ColdPlay, SIA) including elevated hanging speakers in a 'j-curve' array, sub-woofers along the front of the stage, and flown delay towers specifically for the rear audience areas.

Typical speaker performance data for high quality audio equipment have been considered in the modelling, including the relative directivity of different speaker types (low, mid, and high frequency models), as well as the orientation and elevations.

Source noise data obtained from the Cold Play concert held at the Allianz Stadium in December 2016 has been modelled. The source data has been adjusted in the model to achieve a FOH level of $L_{A_{Max}}$ 112 dB(A) and $L_{C_{Max}}$ 115 dB(C) at 40 metres from the stage. Table B1 presents the modelled source noise data.

Table B1 - Source Noise Data





Noise Source	Frequency Spectra (SWL)									Total	
	31.5	63	125	250	500	1k	2k	4k	8k	A	C
Speaker System	103	115	106	109	115	114	105	97	91	112	115

Meteorological Conditions

All predictions have been undertaken in accordance with *ISO Standard 9613-2 (1996) Acoustics - Attenuation of sound during propagation outdoors*. ISO 9613-2 predictions are relevant for light to moderate downwind conditions (1 to 5 m/s) or a well-developed moderate ground-based temperature inversion (e.g. clear, calm night).

Topography

Topography for the sites have been included based on 1 m satellite data.

The noise model has taken into account the SCG structure and surrounding building topography, which aide in shielding noise from the nearest sensitive receptors. As a conservative approach, the modelling assumes that the Allianz Stadium is demolished and there is no shielding of noise to the northern receptors. This is expected to progressively change over time as the new Allianz Stadium is constructed.

Figures B2 to B4 present a 3D view of the modelled SCG and surrounding area.



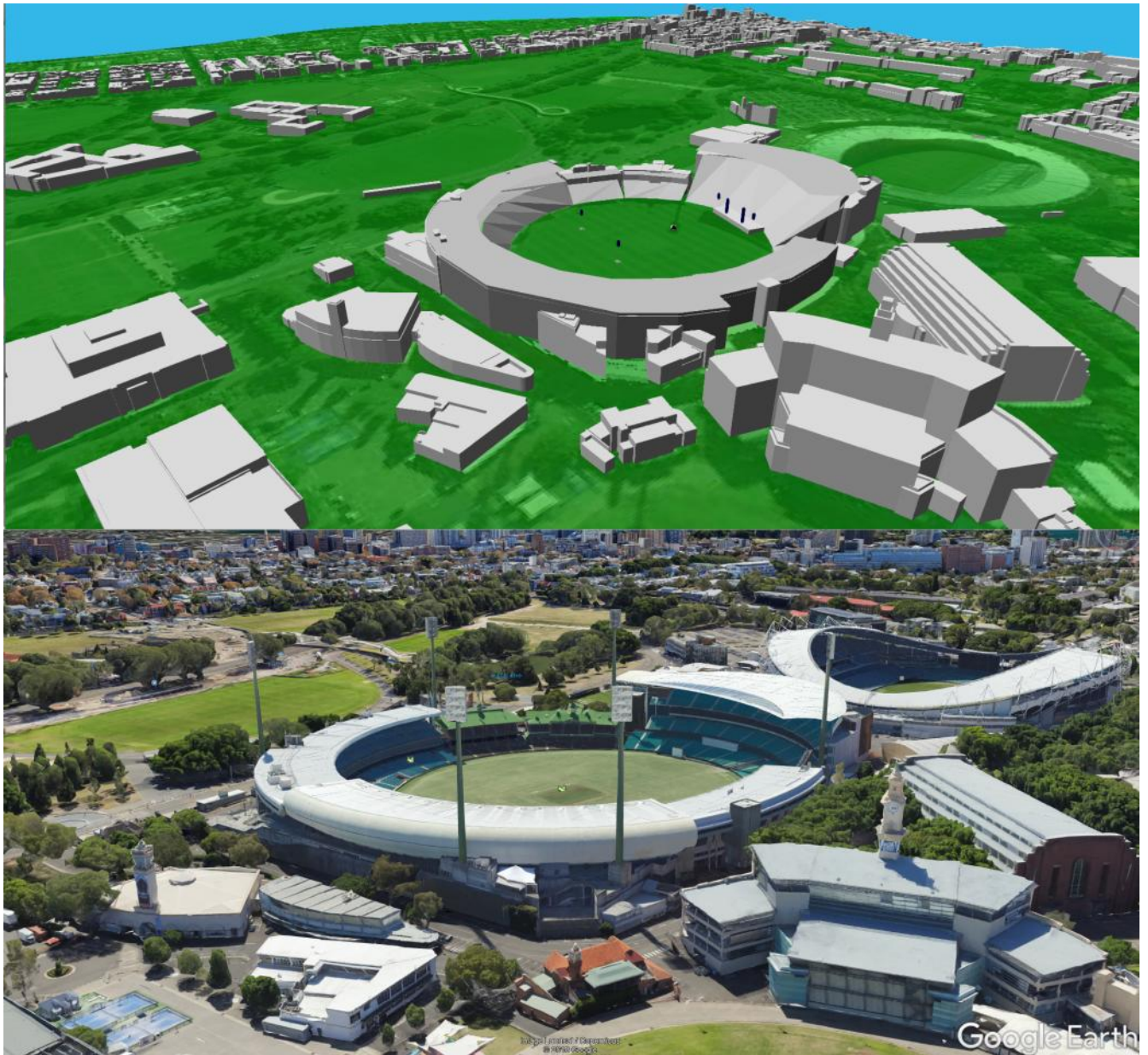


Figure B2: 3D Model View – Looking North



Figure B3: 3D Model View – Looking North-East



Figure B4: 3D Model View – Looking East



Modelled Sensitive Receptors

Figure B5 presents the modelled sensitive receptor locations. Receptors have been divided into four receptor groups:

- Receptor Group 1 – residential buildings to the north along Moore Park Road;
- Receptor Group 2 – residential buildings to east;
- Receptor Group 3 – residential buildings in Centennial Park to the south;
- Receptor Group 4 – residential buildings to the west along Anzac Parade.

The modelling has taken into consideration the multi-storey configuration of residential buildings where applicable.

Noise Criteria

Modelling has adopted the current Prevention Notice Criteria of:

During sound test(s), rehearsal(s) and concert(s), L_{Amax} and the L_{Cmax} measured at the monitoring locations will not exceed:

- *For activities conducted at the SCG: 70 dB(A) and 90 dB(C)*



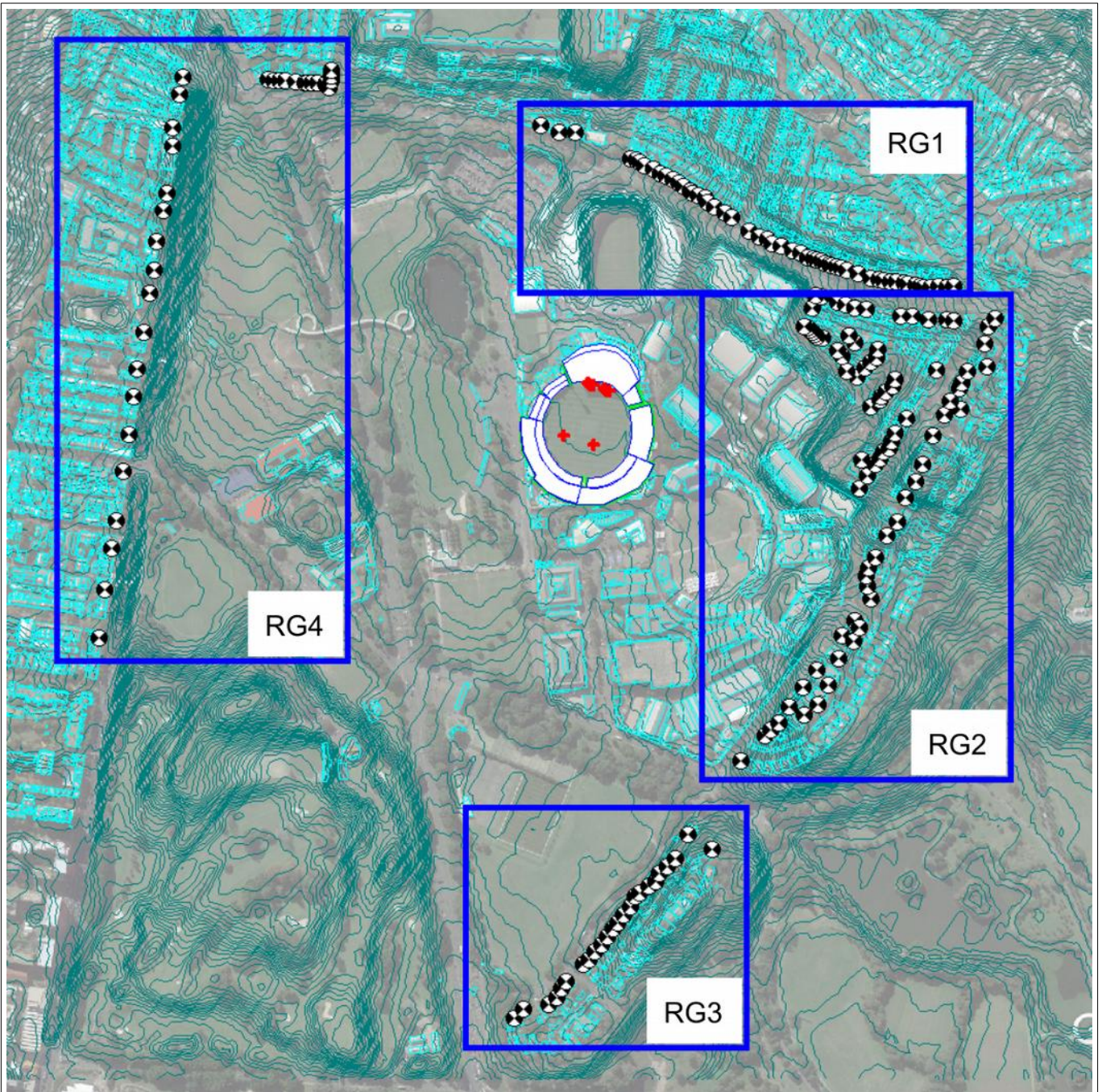


Figure B5: Modelled Receptor Locations



Predicted Results

Table B2 presents predicted noise levels assuming a FOH levels for a music concert of $L_{A_{Max}}$ 112 dB(A) and $L_{C_{Max}}$ 115 dB(C). Figures B6 to B9 present noise contours for each stage orientation.

The results of the modelling indicate predicted exceedences of the $L_{A_{Max}}$ criteria (70 dB(A)) for each stage orientation.

Worst-case noise levels are associated with a north facing stage towards Moore Park Road receptors (RG1). Due to the absence of the Allianz Stadium (which would normally provide significant shielding), predicted noise levels are up to 18 dB above the criterion level.

The lowest receptor noise levels are associated with a south facing stage, for which exceedences of up to 8 dB(A) are predicted (at RG3). While there are a number of buildings surrounding the SCG which provide noise shielding, it is noted that there is direct pathway for noise to propagate along Errol Flynn Boulevard towards RG3 for a south facing stage. This results in a predicted exceedence of up to 8.1 dB(A) along Robertson Road.

For dB(C) noise levels, compliance is predicted with the $L_{C_{Max}}$ criteria (90 dB(C)) for a south facing stage. Exceedences are predicted for other stage orientation but by a lesser extent compared to dB(A) levels. Exceedences of up to 0.4-4.4 dB(C) are predicted for the other stage orientations.

It should be noted that ColdPlay were identified to have significant $L_{A_{Max}}$ values comparative to other historic performances, with dB(C) levels generally the most likely to result in complaints.

Historic noise monitoring also identifies that $L_{A_{Max}}$ spikes are generally brief, and often comparable to those from birds and traffic, where dB(C) levels can be consistently high (during periods of continuous percussive instruments or dance music bass).

Table B2 - Predicted Results dB(A)

Receptor Group	Predicted $L_{A_{Max}}$ dB(A) Noise Levels) for Different Stage Orientations			
	Facing South	Facing East	Facing North	Facing West
MP1	71.5	59.4	53.7	66.0
MP2	63.5	65.1	73.5	76.0
MP3	56.9	67.0	82.7	68.9
1	67.8	71.9	88.0	80.5
2	74.9	72.2	79.8	84.9
3	78.1	60.0	56.8	73.6
4	74.7	81.2	74.7	70.8
Criteria	70			

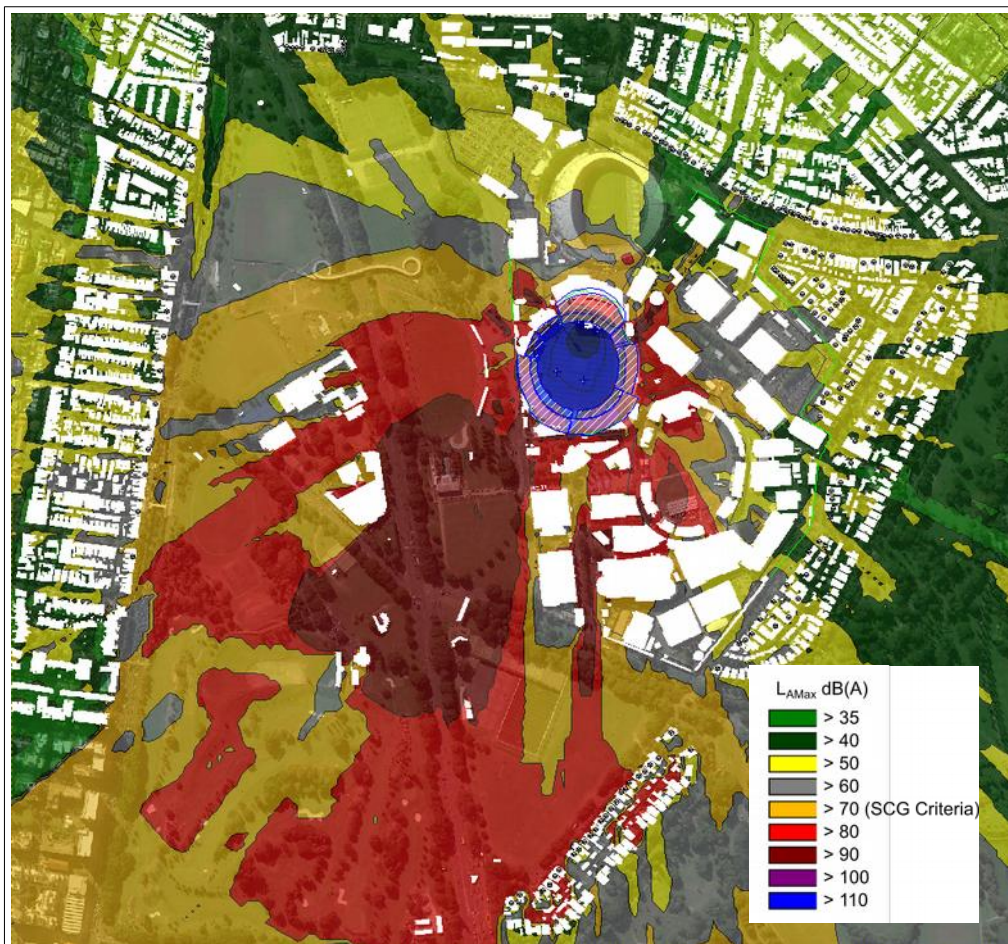




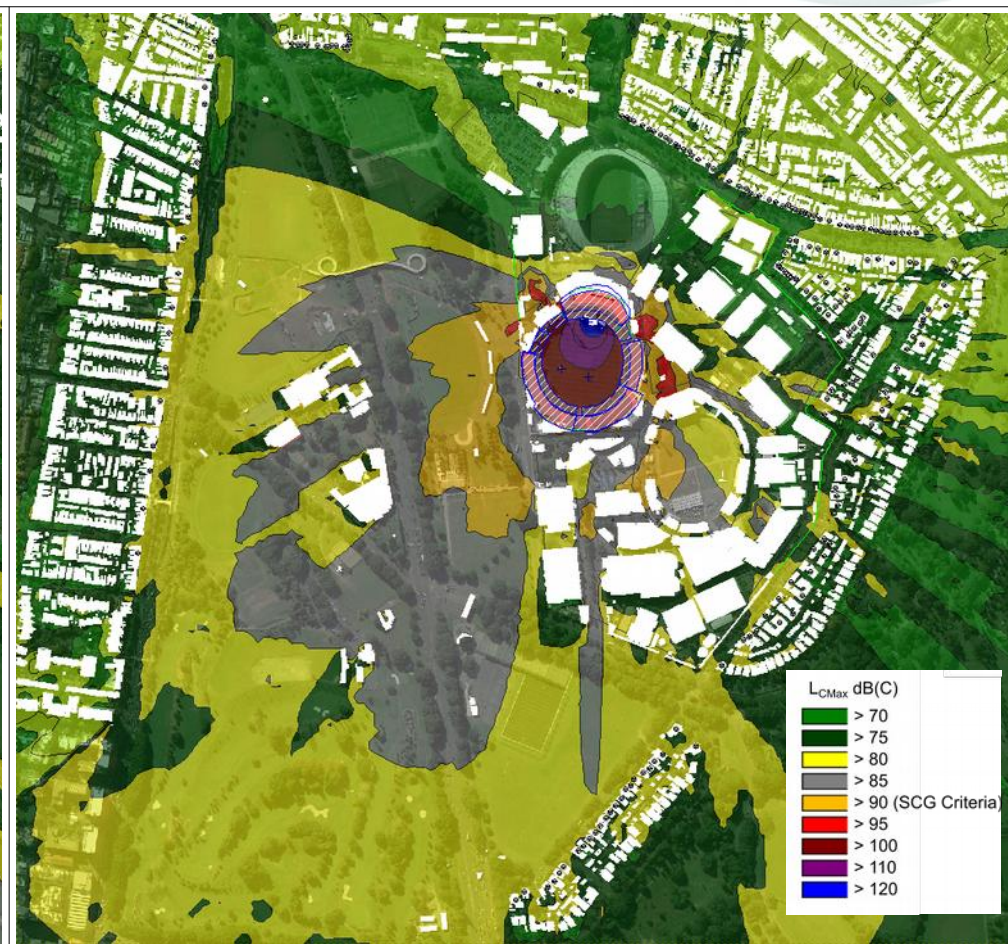
Table B3 - Predicted Results dB(C)

Receptor Group	Predicted L_{CMax} dB(C) Noise Levels) for Different Stage Orientations			
	Facing South	Facing East	Facing North	Facing West
MP1	82.1	67.7	65.1	80.5
MP2	72.8	72.8	86.4	87.1
MP3	79.5	82.2	90.8	85.0
1	80.3	91.3	94.4	89.1
2	86.0	76.7	89.4	90.4
3	85.4	74.1	69.0	87.9
4	83.9	88.1	84.9	74.9
Criteria	90			



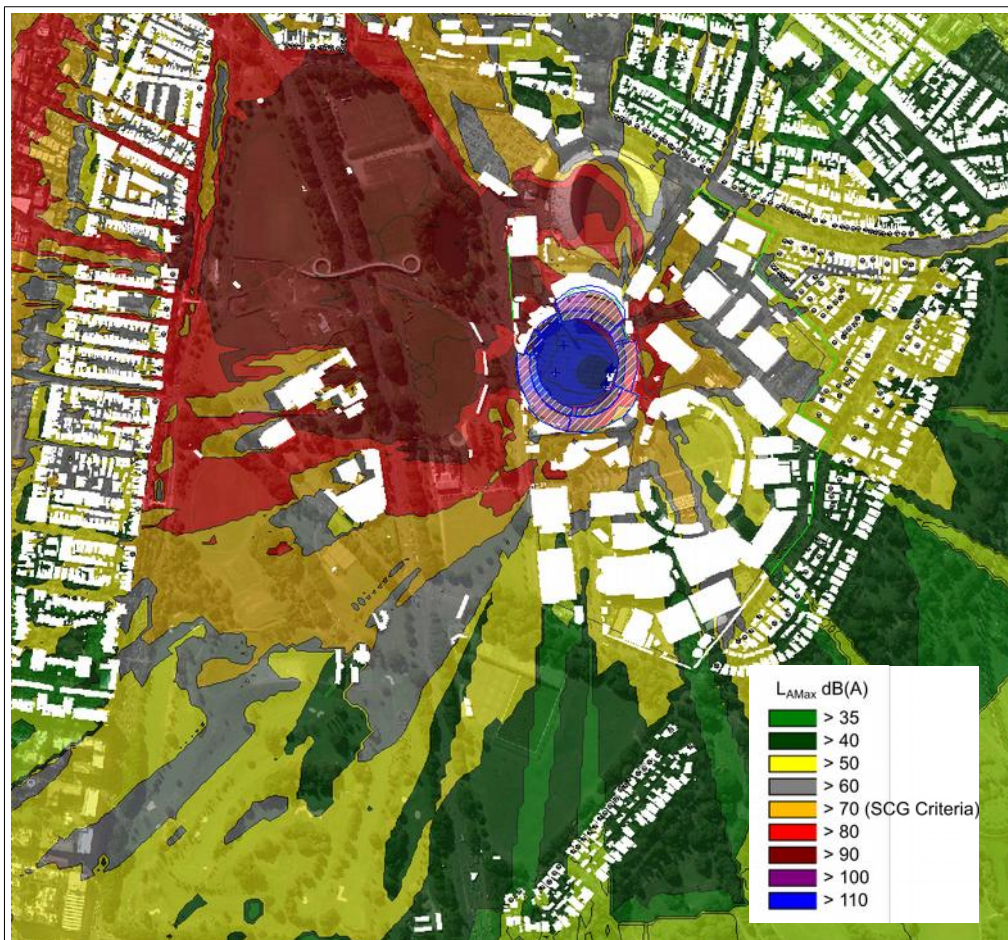


L_{AMax} Predictions

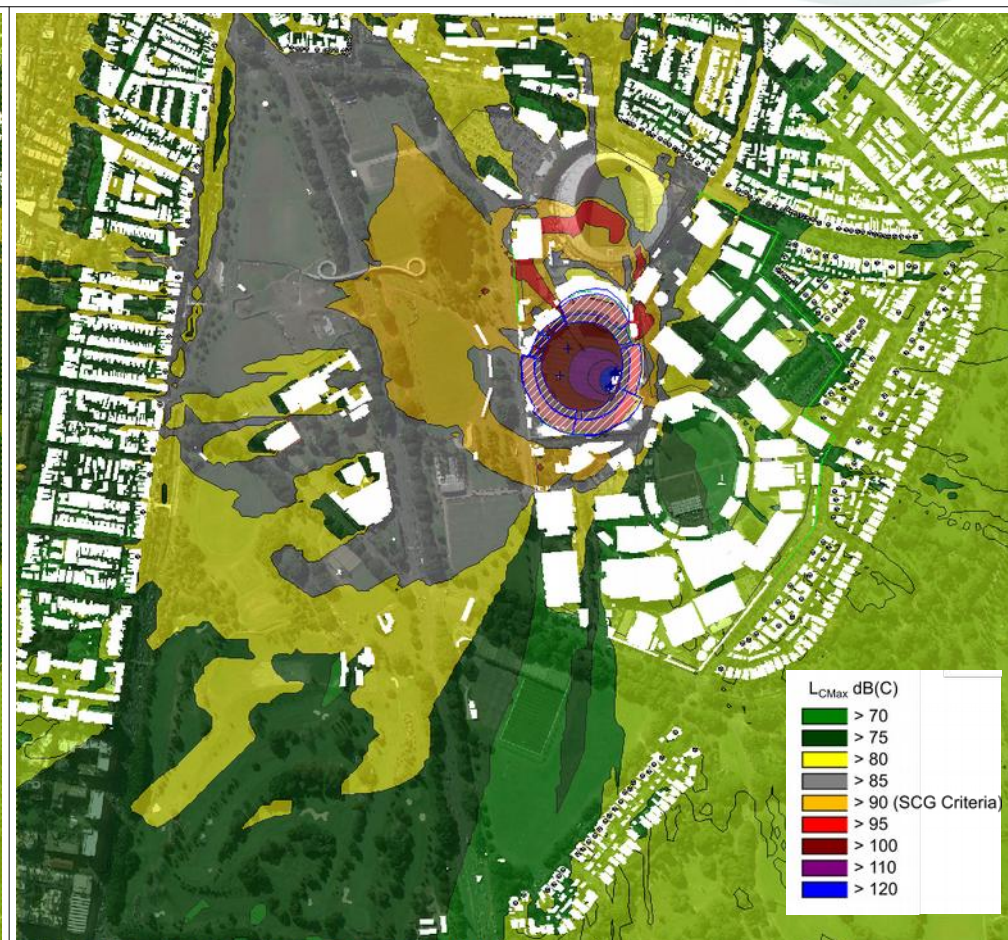


L_{CMMax} Predictions

Figure B6: Predicted Noise Contours – Stage Facing South

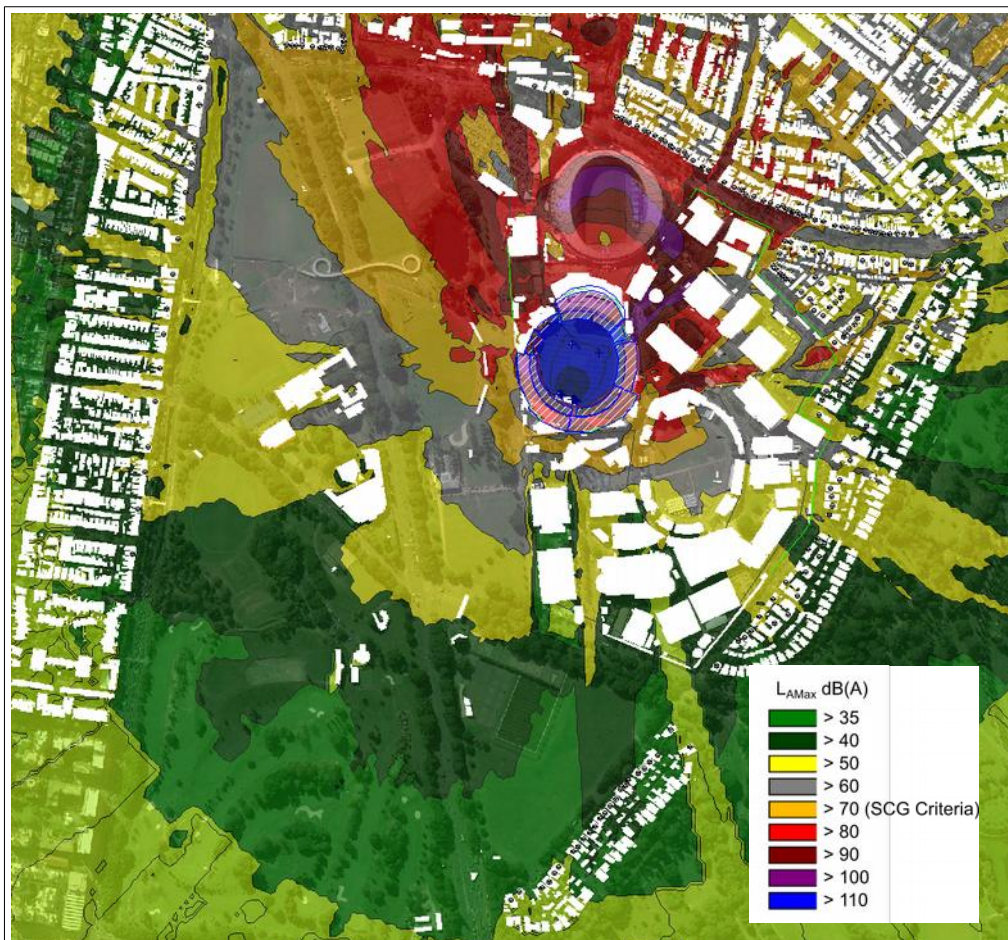


L_{AMax} Predictions

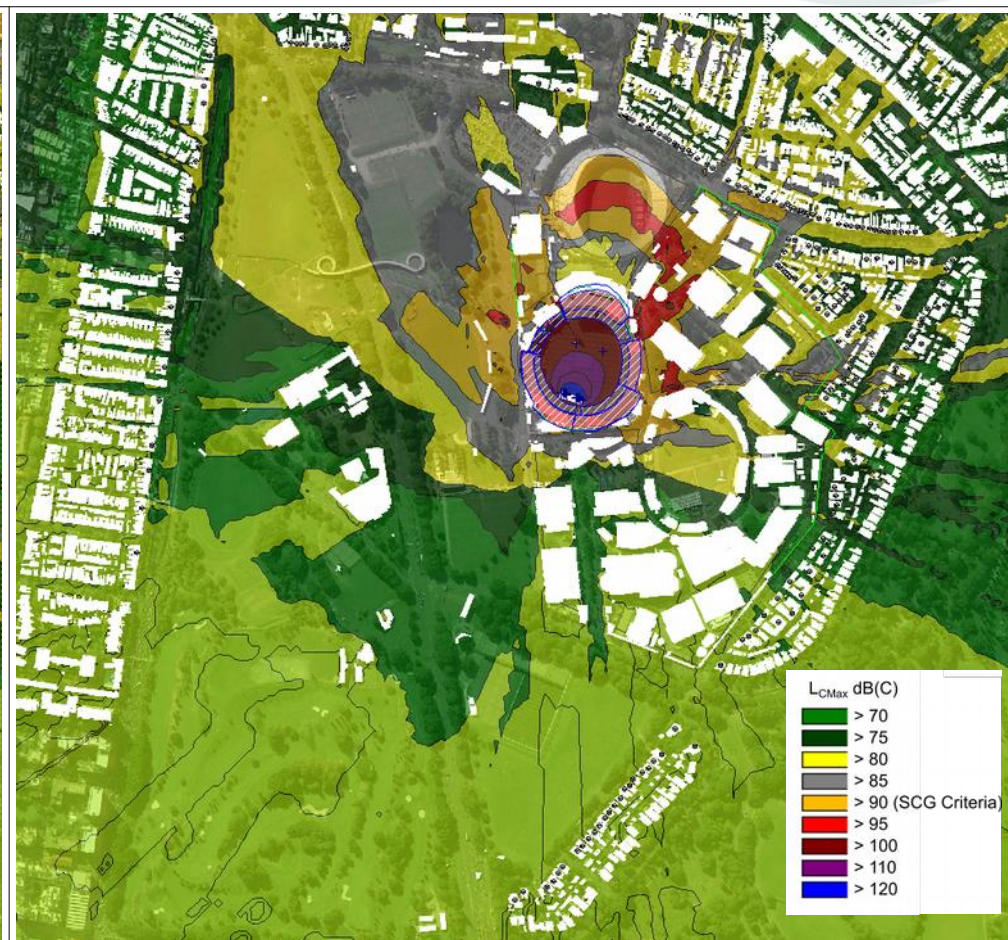


L_{CMMax} Predictions

Figure B7: Predicted Noise Contours – Stage Facing West



L_{AMax} Predictions



L_{CMax} Predictions

Figure B8: Predicted Noise Contours – Stage Facing North

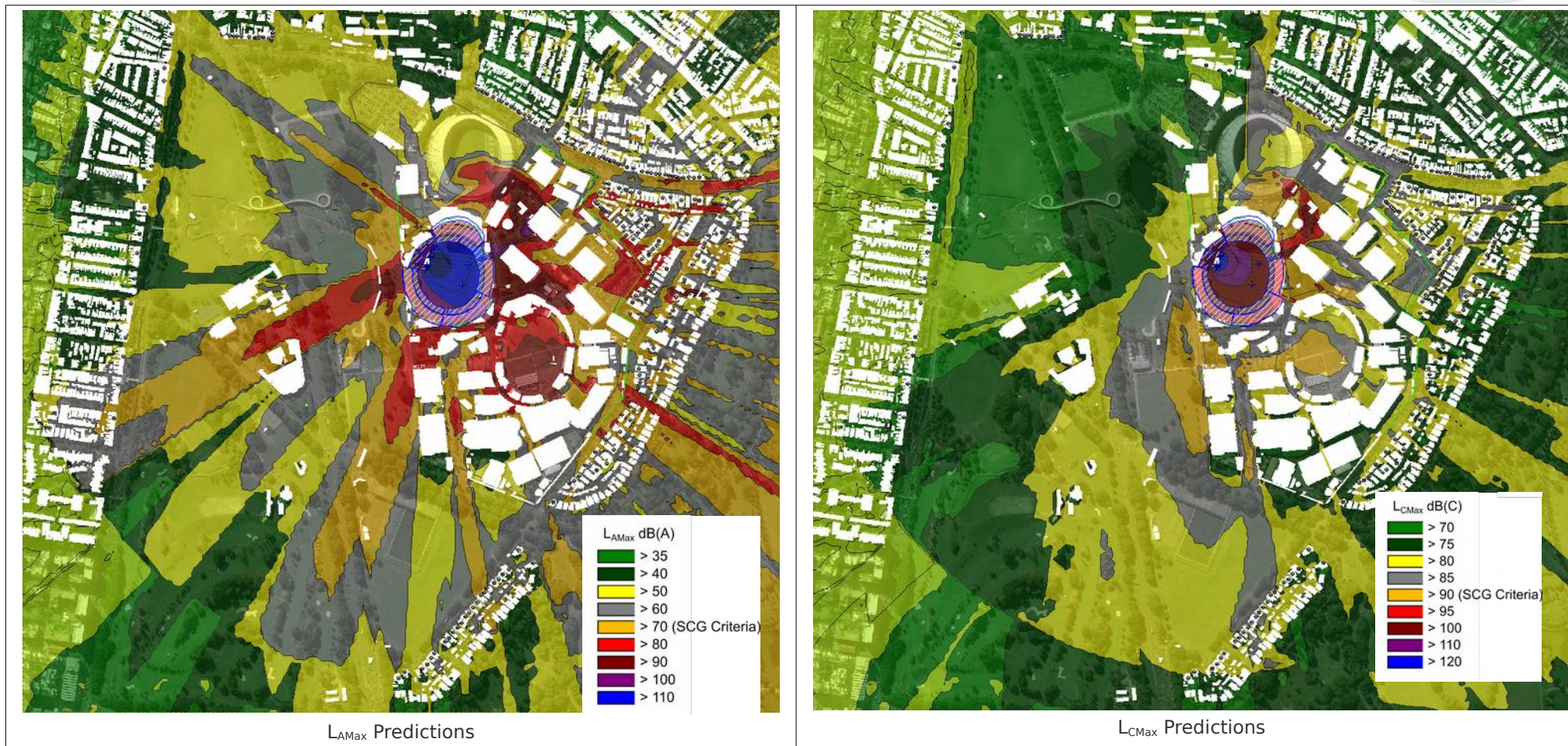


Figure B9: Predicted Noise Contours – Stage Facing East



Optimisation of FOH Levels

Based on the predicted noise levels, FOH noise levels in the noise model have been optimised to achieve predicted compliance at the nearest sensitive receptors. These optimised FOH levels are presented in Table B4.

Table B4 - Predicted FOH Levels

Stage Location/Orientation	L _{AMax} FOH Level	
	dB(A)	dB(C)
Facing South (Typical/Desired layout)	104	119
Facing West	101	114
Facing North	94	111
Facing East	97	115

As shown in Table B4, a concert stage facing south provides the highest FOH noise levels while still achieving predicted compliance at the nearest receptors. Higher FOH levels could be achieved under different meteorological conditions – the modelling accounts for light to moderate downwind conditions (1 to 5 m/s). The modelling suggests that, under source-to-receiver conditions and using a typical speaker arrangement, FOH limits could be restrictive. Therefore, while the south facing stage represents the best orientation for a concert, further consideration should be given to the type of speaker arrangement adopted, such that amplified sound is contained within the SCG as much as possible.

Summary of Modelling

Based on the modelling the typical / preferred stage orientation (facing south through the SCG) is predicted to provide the greatest opportunity for the desired elevated levels internally, however with some restrictions to achievable L_{AMax} volumes from those typically desired for events of international artists.

It is however noted that the predictions are based on achieving 100% compliance at all locations (including elevated receiver positions). Were the Allianz Stadium criteria applied for all receptors (including elevated) (80 dB(A) / 100 dB(C)) much higher dB(A) volumes would be allowed at FOH.

The Prevention Notice specifies that the venue criteria are applicable to the defined monitoring locations, which are at 1.5 – 1.8 m above ground. A more detailed review of the modelling indicates that the desired FOH levels are close to achievable where modelling predictions are restricted to predictions at ground level monitoring locations only.

